MID-CURRITUCK BRIDGE STUDY

PREFERRED ALTERNATIVE REPORT

WBS Element: 34470.1.TA1
STIP NO. R-2576
CURRITUCK COUNTY
DARE COUNTY

January 2011

Table of Contents

List of Tables

List of Figures

1.0 Project Description

1.1 Proposed Action

The North Carolina Turnpike Authority (NCTA), a division of the North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), is evaluating proposed transportation improvements in the Currituck Sound area. The proposed action is included in NCDOT's *2009 to 2015 State Transportation Improvement Program* (STIP), the North Carolina Intrastate System, the *North Carolina Strategic Highway Corridor Plan*, 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.

1.2 Project Purpose and Need

The proposed project 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.
- 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.

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 on NC 12 just south of Southern Shores and Duck and on US 158 east of the Wright Memorial Bridge.

- 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 62 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.

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.
- To reduce substantially hurricane clearance time for residents and visitors who use US 158 and NC 168 during a coastal evacuation.

1.3 Project Status

The Draft Environmental Impact Statement (DEIS) for the Mid-Currituck Bridge was signed on March 10, 2010 and made available for public and agency review on March 31, 2010 on NCTA's web site. A notice of availability was published in the Federal Register on April 9, 2010 (Volume 75, No. 68, page 18204). Copies of the document were

distributed to public review locations and agencies between April 1 and 6, 2010. The public comment period for the project ended on June 7, 2010. Next steps include:

- Selection of Preferred Alternative (underway).
- Publishing the Final EIS, including the response to comments.
- Publishing the Record of Decision (ROD).

1.4 Detailed Study Alternatives

Five detailed study alternatives are under consideration for implementation. They are named ER2, MCB2/C1, MCB2/C2, MCB4/C1, and MCB4/C2. The No-Build Alternative also is under consideration. The detailed study alternatives are shown on Figure 1. The alternatives screening process used to determine these detailed study alternatives is described in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009) that accompanied the DEIS.

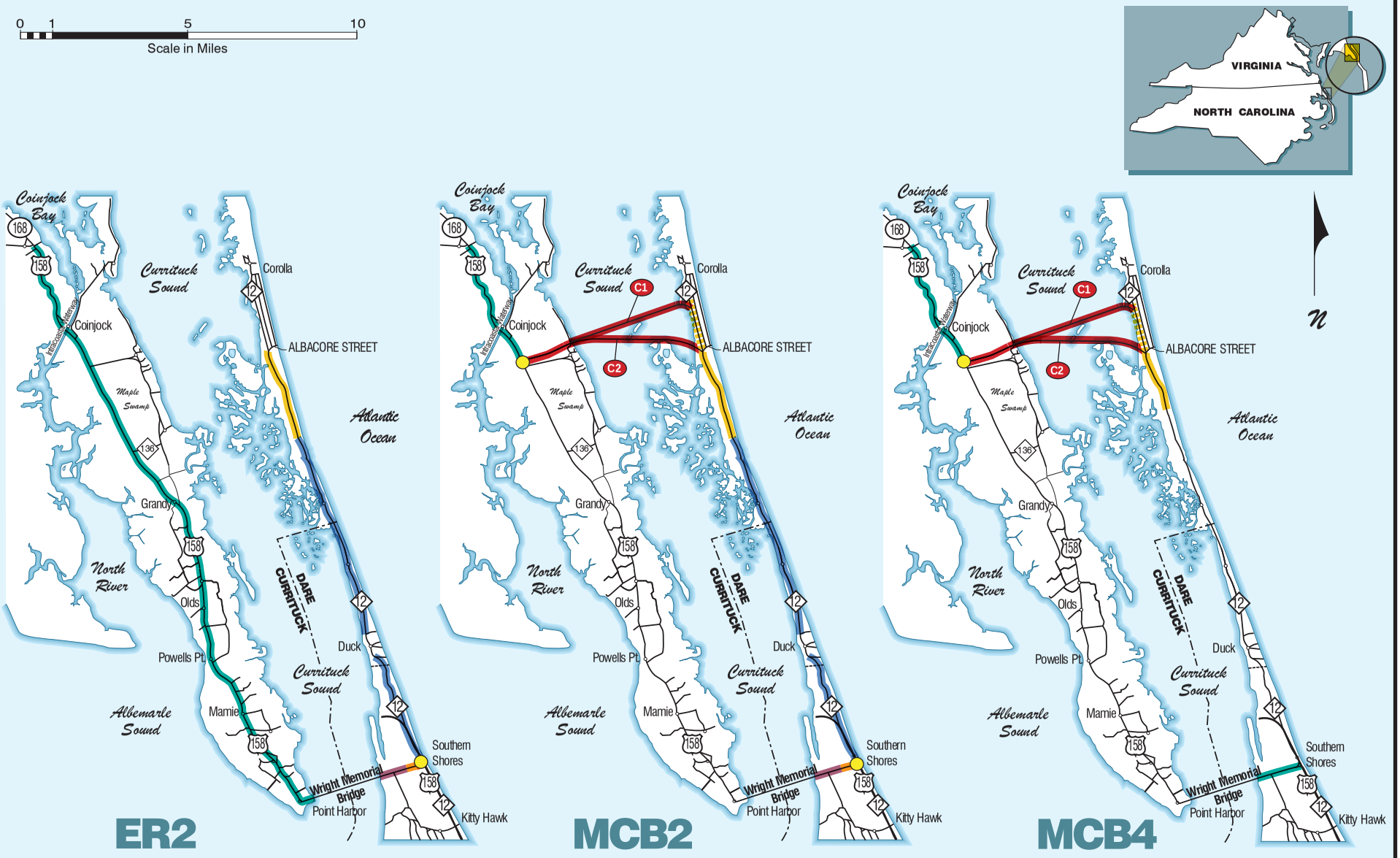
For all five corridor alternatives, two hurricane evacuation options were assessed in the DEIS. For the four MCB2 and MCB4 alternatives, two design options (Option A and Option B) were assessed in the DEIS for the mainland approach to the bridge over Currituck Sound (between US 158 and Currituck Sound). After further study and discussions with the agencies, a third design option (Option C) was proposed for the MCB4 alternative in the October 2010 *Preferred Alternative Report*. It was similar to Option A, but with a 2,640-foot-long bridge across Maple Swamp, with the balance of the swamp crossed on fill with wildlife passages. In response to agency concerns expressed at the November 2, 2010 TEAC meeting and in comments on the October 2010 report (see Handout 30 in Appendix B), Option C is no longer under consideration.

1.5 Summary of Impacts

The DEIS provides detailed discussions of the project's anticipated impacts to the human, physical, cultural, and natural environments. The key impact summary table from the DEIS is included in Appendix A. It has been revised to reflect corrections identified during the DEIS review process. It includes an additional column for the recommended Preferred Alternative that reflects refinements made in response to comments and to avoid and minimize environmental impacts.

1.6 Recommended Preferred Alternative

Based on information available (including the DEIS and agency comments), NCTA and FHWA identify MCB4/A/C1 as their recommended Preferred Alternative. This recommendation is made taking into account cost and design considerations; travel



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.

Detailed Study Alternatives

Figure 1

benefits; community, natural resource, and other impacts; agency comments and suggestions; and public involvement comments. The recommended Preferred Alternative is illustrated in Figure 2.

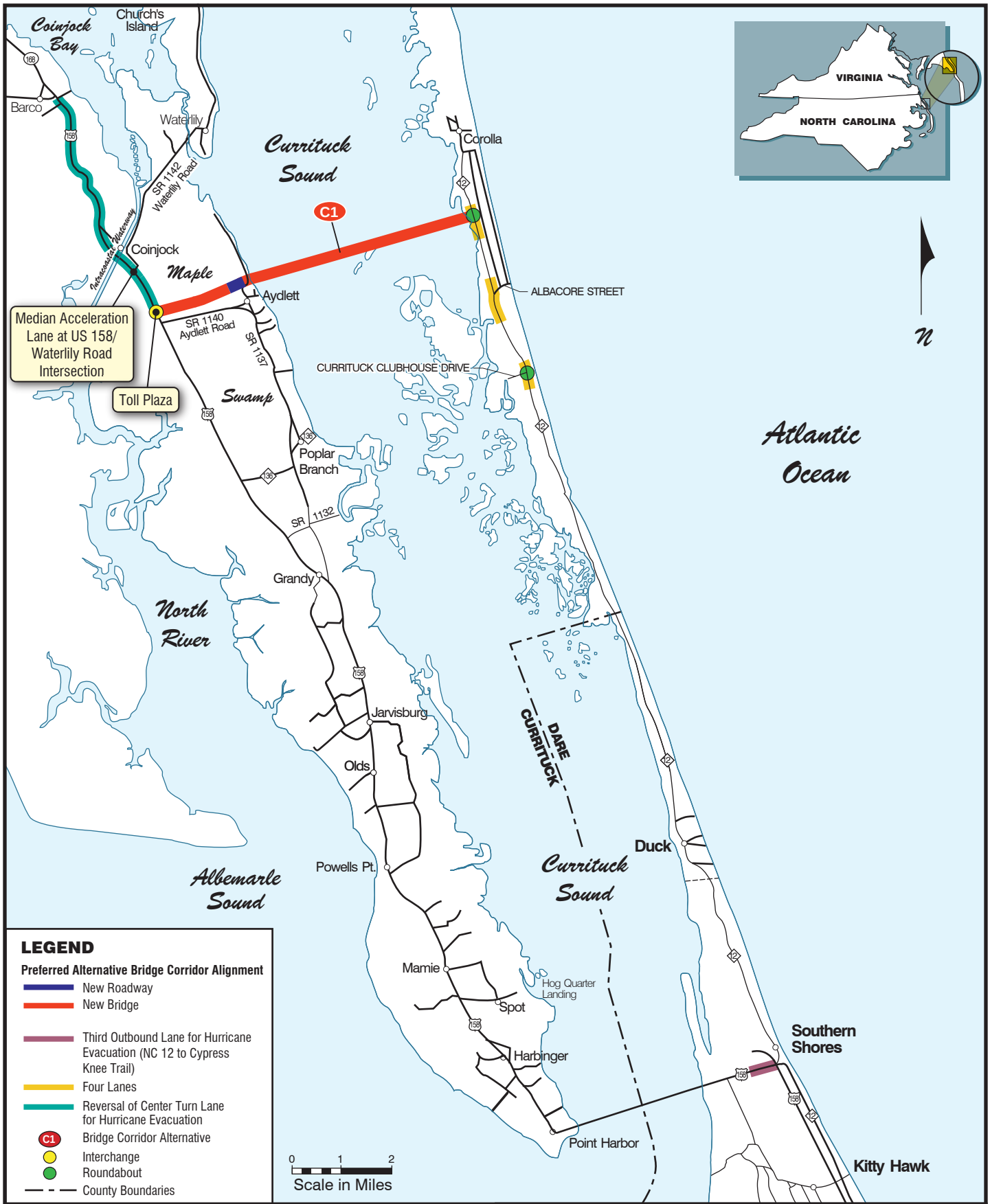
Further, the recommended Preferred Alternative includes the following features prescribed to avoid and minimize impacts in a cost-effective manner. They are:

- On the mainland, reversing the center turn lane on US 158 between the US 158/Mid-Currituck Bridge interchange and NC 168 to provide additional road capacity during a hurricane evacuation and reduce clearance times. On the Outer Banks, provide three westbound lanes on US 158 from the NC 12/US 158 intersection through the Duck Woods Drive intersection, and then merge back to two westbound lanes approximately 750 feet west of this intersection. This includes approximately 1,600 feet of new third outbound lane between Market Place/Cypress Knee Trail and a point approximately 450 feet west of the Duck Woods Drive intersection plus approximately 300 feet to taper back to two lanes. This is a primarily operational solution that includes no construction except for the length of third outbound lane noted.

- Provision of a median acceleration lane at Waterlily Road. This safety feature allows left turns to continue to be made at Waterlily Road and US 158. Waterlily Road is near the northbound exit ramp from the US 158/Mid-Currituck Bridge interchange to 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.

- Use of the Option A Maple Swamp crossing. Option A would place a toll plaza within the US 158 interchange (see Figure 2). The mainland approach road to the bridge over Currituck Sound would include an approximately 7,740-foot-long two-lane bridge over Maple Swamp between the US 158 interchange and the community of Aydlett. 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 (ranging from west to east approximately 3 to 23 feet high) and bridge Narrow Shore Road. The 7,740-foot length is less than the 7,913 feet presented in the October 2010 *Preferred Alternative Report* for Option A because an alignment adjustment on the mainland (that resulted from the straighter Mid-Currituck bridge) put approximately 173 feet of Maple Swamp bridge over upland, which allowed the bridge length to be reduced.

- Use of a combination of work trestle, barges, and dredging to build the Mid-Currituck Bridge over Currituck Sound. Dredging parameters have been reduced substantially. Dredging is now proposed only on the west side of Currituck Sound near non- submerged aquatic vegetation (SAV) shoreline confined areas. The dredging in this area also would occur only in shallow areas (less than 6 feet of water



Recommended Preferred Alternative

Figure 2

depth) where there is no SAV present, as identified at the start of construction. Dredging would occur for approximately 1,900 feet (48,900 cubic yards) along the Mid-Currituck Bridge. Approximately 11.6 acres of sound bottom would be dredged for the bridge.

- The use of the shorter C1 bridge corridor (as opposed to the C2 corridor) that would be located further from the marsh islands in Currituck Sound, would have lower SAV impacts, and would affect no Coastal Area Management Act (CAMA) wetlands. C1 also would avoid terminating the bridge and bringing its traffic onto NC 12 in an area with an existing concentration of traffic going to and from retail businesses. A refinement to the C1 bridge alignment across Currituck Sound reduced the length of the bridge and allowed for minimization of wetland impacts at the NC 12 terminus.

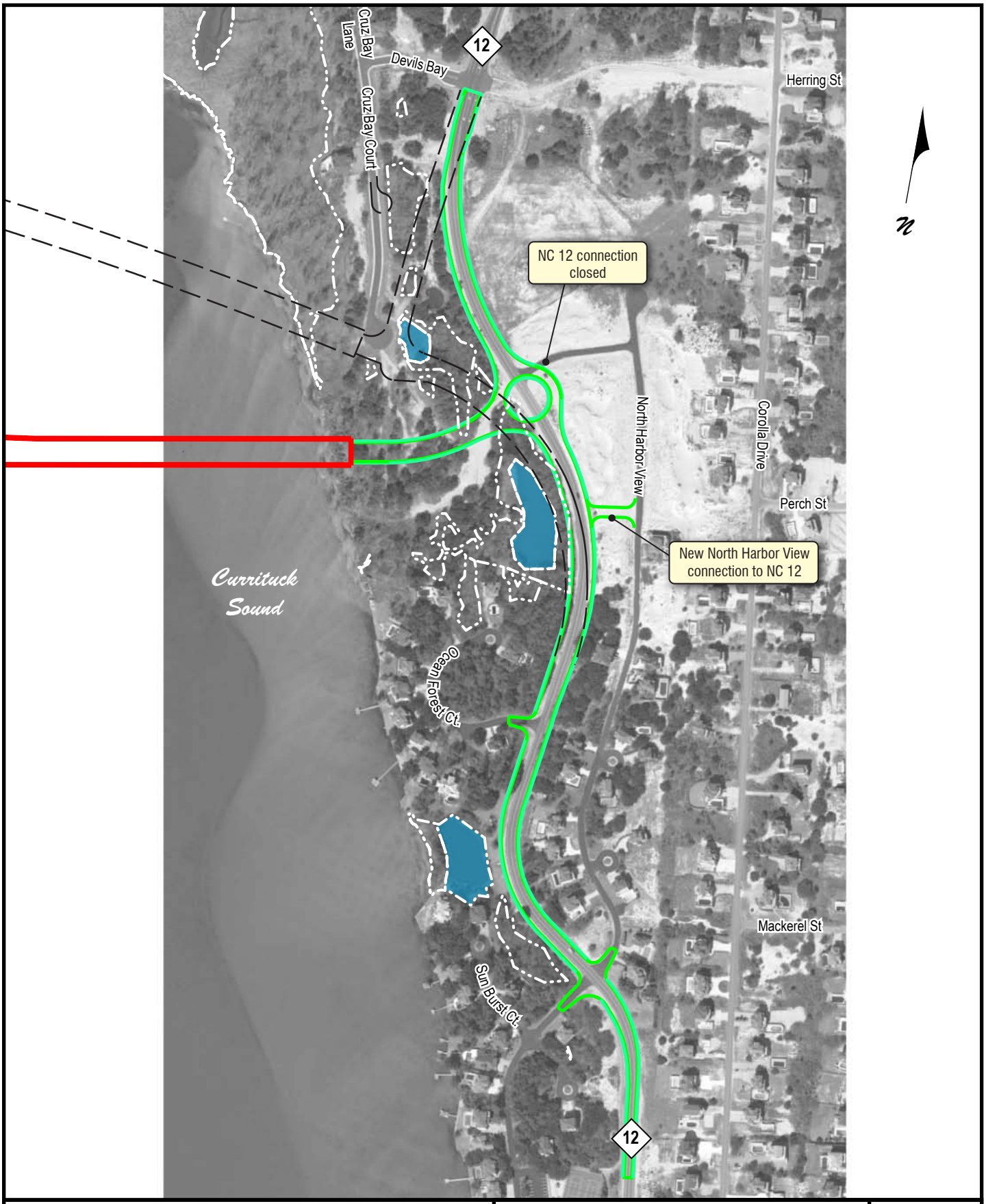
- Commitment to a stormwater management strategy that includes regular Mid-Currituck and Maple Swamp bridge deck cleaning and monitoring of water quality near the bridge to measure the effectiveness of the deck cleaning program so adjustments could be made as needed. Measures to dissipate the flow of stormwater coming from bridge scuppers over Currituck Sound and Maple Swamp will be incorporated into the project where needed to minimize potential disturbance of the sound bottom or erosion in the swamp potentially caused by any water free fall. Further refinements in this proposal developed in association with the North Carolina Department of Environment and Natural Resources–Division of Water Quality (NCDENR–DWQ) are expected. Capturing and treating runoff over wetlands adjacent to Currituck Sound was proposed in Handout 26; however, the refined C1 alignment for the Mid-Currituck Bridge over Currituck Sound does not cross any wetlands on either shoreline.

- Reducing the amount of four-lane widening along NC 12 by as much as 50 percent. The widening would be concentrated at three locations: the bridge terminus, the commercial area surrounding Albacore Street, and Currituck Clubhouse Drive. Roundabouts would be used at the bridge terminus and Currituck Clubhouse Drive. The use of a roundabout at the bridge terminus at NC 12, an adjustment in the alignment of the bridge, and the use of two lanes on NC 12 between the bridge and the Albacore Street commercial area provided the opportunity to reduce wetland impacts by approximately 4 acres on the Outer Banks in addition to reducing community impacts. The refined bridge terminus is shown in Figure 3.

- Terminating the bridge in a roundabout also allowed the bridge alignment to be adjusted to remove its curves and thereby reduced its length across Currituck Sound by about 250 feet (from approximately 24,950 feet to 24,700 feet).

- Provision of marked pedestrian crossings at locations identified by Currituck County along NC 12 where it would be widened, including at North Harbor View Drive.

The recommended Preferred Alternative also includes provisions for bicycles and pedestrians along the bridge.



LEGEND

- Proposed and Improved Existing Road
- Proposed Bridges and Other Structures
- Original C1 Bridge Terminus
- Wetland Boundary
- Pond

Refined C1 Bridge Terminus

Figure

3

MCB4/A/C1 with the features noted is identified as the recommended Preferred Alternative based on agency comments and the considerations that follow. This list is not in order of importance, but is organized by issues as they are presented in the DEIS. Also, this list does not represent all benefits or impacts of the recommended Preferred Alternative, just those elements that differentiated this alternative when compared to the other detailed study alternatives.

Cost and Design Considerations

- MCB4/C1 with the features noted could be financed as described in Handout 24 (see Appendix B). Handout 24 indicated the availability of the following funds:
  - Estimated State Appropriation Bonds Capacity Range: $475 to $506 million.
  - Estimated Toll Revenue Bonds Capacity Range: $87 to $122 million.
  - Estimated Net Private Equity Range: $36 to $79 million.
  - Total Funds Available to Finance the Project: $598 to $707 million.
- MCB4/C1 with the features noted would have the fewest changes in current access to residential and business properties.
- With MCB4, 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, instead of the 25 miles with ER2, reducing costs and environmental impacts.

Travel Benefit Considerations

- 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 NC 12 to the Wright Memorial Bridge, 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 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 MCB4, a future interchange at NC 12 and US 158 would not carry as much traffic (some 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).
- A Mid-Currituck Bridge is local governments' preferred means to meet the travel needs defined in the project's purpose and need. It also is in keeping with local land use and thoroughfare plans.

Community Impact Considerations

- With MCB4/C1 with the features noted, neighborhood and community cohesion impacts would be confined to the creation of a visual barrier in Aydlett. The use of the revised C1 corridor with MCB4 also would pass through the currently unimproved Phase II of the Corolla Bay subdivision.

- MCB4 is consistent with area land use plans in that it includes a Mid-Currituck Bridge and does not widen NC 12 in Dare County.

- Reducing the amount of NC 12 four-lane widening as described for MCB4/A/C1 addresses citizen concerns related to pedestrian crossing of NC 12 (including North Harbor View Drive) and greatly reduces the need for infiltration strips within a permanent drainage easement along a widened NC 12.

Cultural Resource Impact Considerations

- MCB4/C1 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

- MCB4 would have the least fill in natural upland communities.

- MCB4/C1 would have the least impact in upland and wetland maritime forest communities. Refinements described at the bridge terminus at NC 12 further reduced that impact.

- Use of the shorter C1 corridor (as opposed to the C2 corridor) would avoid impacts to CAMA wetlands. Also no wetlands on the shoreline of Currituck Sound would be affected.

- With MCB4/C1 with the features noted, the increase in impervious surface area (pavement and bridge deck) would be low in contrast to MCB2, and less than ER2.

- MCB4/A/C1 with the features noted 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 7.1 acres. This impact would be higher for all other detailed study alternatives, including ER2 at 8.6 acres.

- The construction approach described for MCB4/C1 seeks to minimize construction related impacts to Currituck Sound as practicable.

- The stormwater management strategy described above for MCB4/C1 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

- MCB4 would have the least number of homes that would experience an increase in traffic noise levels. The reduction in the amount of four-lane NC 12 would further reduce that impact.

- The Mid-Currituck Bridge with MCB4 would reduce the impact of accelerated sea level rise on travel on the Outer Banks north of the Currituck County/Dare County line.

- MCB4/A/C1 with the features noted would result in no impact on the surface water and groundwater hydrology in Maple Swamp or on storm surge elevations.

2.0 Overview of Open Houses and Public Hearings

Three Pre-Hearing Open Houses and three Public Hearings were held on May 18, May 19, and May 20, 2010, as indicated in Table 1.

Table 1. 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

Public Hearings were held immediately following each of the Pre-Hearing Open Houses.

The Pre-Hearing Open Houses and Public Hearings were announced via a flyer, newspaper advertisements, and web site postings. On March 31, 2010, NCTA released a formal statement announcing the upcoming Pre-Hearing Open Houses and Public Hearings.

A total of 13,131 project flyers were mailed. The mailing list included property owners, citizens who requested to be placed on the project mailing list, local officials, and resource agencies.

Advertisements for the Pre-Hearing Open Houses and Public Hearings were included in the Outer Banks Sentinel (April 28, May 5, and May 12), Virginian Pilot (May 2, May 9, and May 16), and The Coastland Times (April 25, April 29, May 2, May 6, May 9, May 12, and May 16).

A web site for the Mid-Currituck Bridge (https://www.ncdot.gov/projects/mid-currituck-bridge/) is hosted and maintained by NCTA. The schedule for the Pre-Hearing Open Houses and Public Hearings was posted on the web site. In addition, all materials displayed and distributed at the Pre-Hearing Open Houses and Public Hearings were made available for download on the project web site.

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.

2.1 Attendance

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.

Attendees were asked to sign in at a welcome table and to take a Citizens Summary, Public Hearing ground rules, and a comment sheet. Attendees also signed in prior to the start of each Public Hearing. Boxes for completed comment sheets were available. The Citizens Summary provided a project overview, brief explanation of the DEIS, and project schedule. Contact information was provided, including the project web site address. Attendees were encouraged to view the self-running slide show that provided background on toll roads and NCTA, a brief explanation of the project, and current project status. Following the slide show, attendees viewed the Public Hearing maps and other displays. Several representatives from NCTA, NCDOT, and private firms contracted by NCTA were present to assist with citizens' questions. Displays and handouts were the same for all three Open Houses.

2.2 Comments

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. Any comments postmarked after June 7 were not included or summarized below, but will be reviewed and considered throughout the ongoing public involvement process. The number of comments received by source is shown in Table 2.

Table 2. 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

2.3 Public Preferences

Table 3 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.

Table 3. Public Alternative Preferences

Stated Preferences	
No-Build	64
ER2	14
MCB	132
MCB2	27
MCB4	180
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

3.0 Summary of Previous Agency Coordination Meetings

NCTA conducted regularly scheduled agency coordination meetings throughout the project development process. These included NEPA/Section 404 Merger Team meetings prior to 2006 and Turnpike Environmental Agency Coordination (TEAC) meetings beginning in 2006. These meetings were held to review the status of current NCTA projects, to discuss and agree upon study methodologies, and to discuss and resolve environmental concerns and adherence to permitting requirements. Table 4 provides summaries of the agency coordination meetings held for the Mid-Currituck Bridge project.

Table 4. 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, 2008	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

Table 4 (concluded). Agency Coordination Meetings

Date	Topics of Discussion
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
March 9, 2010	Presentation of an overview of the DEIS format and findings; discussion of construction options in Currituck Sound, including construction dredging 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), 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 recommended Preferred Alternative

4.0 Impact Avoidance and Minimization

Based on agency and public comments on the DEIS, changes were made to the preliminary design for the Recommended Alternative in the DEIS (i.e., MCB4), as well as to other components of the detailed study alternatives (i.e., bridge corridor C1), to avoid and minimize impacts in a cost-effective manner. The recommended Preferred Alternative incorporates these design changes, as reflected in the design features discussed in Section 1.6. The features incorporated into the recommended Preferred Alternative to avoid and minimize impacts are discussed in more detail in the following sections. The recommended Preferred Alternative would not use Section 4(f) (of the Department of Transportation Act of 1966) resources.

4.1 Natural Resources Impact Avoidance and Minimization

4.1.1 Wetlands Impacts

The design and construction features described for the recommended Preferred Alternative seek to avoid and minimize, as practicable, impacts to wetlands and other Section 404 of the Clean Water Act (and the associated Section 401) jurisdictional waters on the Outer Banks and the mainland, as discussed in the following sections.

Outer Banks

The shorter C1 bridge corridor has the lowest natural resource impacts of the two bridge corridors. The use of the C1 corridor for the recommended Preferred Alternative affects no CAMA wetlands, as opposed to 1.4 acres of shading impact with the C2 corridor along the western shore of the Outer Banks. In addition, the C1 corridor is located further from the marsh islands in Currituck Sound than the C2 corridor.

With the recommended Preferred Alternative, the use of a roundabout at the bridge terminus at NC 12, an adjustment in the alignment of the bridge, and the use of two lanes on NC 12 between the bridge and the Albacore Street commercial area provided the opportunity to reduce further wetland impacts on the Outer Banks, including the elimination of a crossing of wetlands on the Outer Banks shoreline of Currituck Sound.

Mainland

Option A was selected as the Maple Swamp crossing component of the Preferred Alternative in part because it reduces the impact of fill in Maple Swamp from that with Option B. Option A includes an approximately 7,740-foot-long bridge over Maple Swamp between the US 158 interchange and the community of Aydlett. The 7,740-foot length is less than the 7,913 feet presented in the October 2010 *Preferred Alternative Report* for Option A for the reason noted above. 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 (ranging from west to east approximately 3 to 23 feet high) and bridge Narrow Shore Road.

In addition, the selection for the recommended Preferred Alternative of the operational solution (i.e., reversing the center turn lane on US 158 between the Mid-Currituck Bridge interchange and NC 168) rather than the construction solution (i.e., building a third northbound shoulder lane) for providing additional US 158 roadway capacity during a hurricane evacuation provided the opportunity to further reduce wetland impacts on the mainland. This decision 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 C), 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."

Wetland Fill Impact

With the recommended Preferred Alternative as described (i.e., MCB4/A/C1 with design revisions and reversing the center turn lane for hurricane evacuation improvements), approximately 7.1 acres of fill would be placed in wetlands (includes slope-stake line plus additional 25-foot buffer). Again, none of this impact is CAMA wetlands. These numbers are based on design concepts. New preliminary designs are underway from which final numbers will be prepared and presented in the Final Environmental Impact Statement (FEIS). A conceptual mitigation plan and opportunities for on-site mitigation will be presented in the FEIS. For comparison, the equivalent fill impact acreages (with reversing the center turn lane for hurricane evacuation improvements) as presented in the DEIS are 8.6 acres for ER2, 10.6 acres for MCB4/A/C1, and 36.6 acres for MCB4/B/C1.

4.1.2 Water Quality Impacts

4.1.2.1 Stormwater Management Strategy

The recommended Preferred Alternative includes commitment to a stormwater management strategy designed to minimize water quality impacts to Currituck Sound from bridge runoff, primarily by removing pollutants from the bridge before they can be suspended by rainwater and flushed off the bridge. The stormwater management strategy includes regular bridge deck cleaning and monitoring of water quality near the bridge to measure the effectiveness of the deck cleaning program so adjustments could be made as needed. Further details on the stormwater management strategy are described in Handout 26 and Handout 30 (see Appendix B). Capturing and treating runoff over wetlands adjacent to Currituck Sound also was proposed in Handout 26; however, the refined C1 alignment for the Mid-Currituck Bridge over Currituck Sound would not cross any wetlands on either shoreline.

The bridge deck cleaning equipment proposed for use on the Mid-Currituck Bridge would be designed for maximum pollutant removal through the use of a state of the art bridge deck cleaner that uses both mechanical sweeping and vacuum technology in conjunction with water and/or air for the most efficient surface cleaning possible. Tests have shown that greater than 90 percent of on-street pollutants can be removed with the more modern technologies and frequent use. The initial plan would be to clean the entire deck of the Mid-Currituck Bridge weekly following the peak summer weekend traffic period. Depending on the results of the cleaning process, the frequency of cleaning could be reduced or increased to achieve a reasonable performance result. Disposal of bridge debris would be in an approved landfill in accordance with local laws and regulations. A maintenance and monitoring plan will be prepared, which will include provisions for appropriate spare parts and equipment. Because NCTA would be entering into a legal concession agreement for operating and maintaining the Mid-Currituck Bridge, a condition of this agreement would be the satisfactory performance of the bridge deck cleaning in accordance with terms of the agreement.

Further refinements in this proposal are expected, developed in association with NCDENR–DWQ. NCDOT and NCTA will comply with NC Session Law 2008-11 (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. The merits of stormwater capture will be investigated for the ends of the bridges (approximately 600 feet) where geometrically feasible irrespective of the presence of wetlands. Infiltration strips or basins will be used for treatment of stormwater from paved surfaces. Pervious pavement will be investigated for parking areas and multi-use paths. Acquisition of land parcels identified in Currituck County as having a potential to improve water quality through land conservation and restoration will be investigated. Potential parcels are identified in the November 2006 report for Currituck County by the North Carolina Coastal Land Trust: *Countywide Land Parcel Prioritization Strategy for Water Quality Enhancement*.

On the Outer Banks, drainage from improvements to NC 12 would be handled through infiltration only. There would be no outfalls to any bodies of water. Customary BMPs would be used for runoff from new and improved mainland roads.

Maple Swamp bridge drainage would be placed directly into Maple Swamp, with considerations for minimizing the potential erosion and habitat disturbance from bridge water coming out of the bridge deck runoff outlets. NCTA anticipates using dissipaters at the ends of scuppers to provide a shower effect and reduce energy for stormwater directly discharged.

4.1.2.2 Construction Methodology

The recommended Preferred Alternative includes a commitment to the following construction methodologies for the Mid-Currituck Bridge to minimize construction-related water quality impacts to Currituck Sound and other jurisdictional waters as practicable:

- A combination of work trestle, barges, and potentially dredging to build the Mid-Currituck Bridge. The specific approach to construction recommended is described in Handout 27 (Appendix B) as "Non-SAV Dredging (East and West Side)/Trestle + Barge."

  The agencies have raised concerns about dredging. Concerns also were expressed related to the impact of pile driving. Responses to those concerns are included in Handout 30, including suggestions on how they might be addressed and modifications to the proposed dredging strategy presented in the October 2010 *Preferred Alternative Report*. Regarding dredging and other construction methods, NCTA would continue to work with the resource agencies as the project progresses to see if an acceptable approach to dredging that minimizes adverse impacts could be developed and to further minimize other construction impacts.

  NCTA's proposed construction strategy (taking into account the straighter bridge and the refined dredging plan presented at the November 2, 2010 TEAC meeting and in Handout 30) would include the following:

  - Construction from barges for approximately 20,000 feet or 3.8 miles (assuming the potential dredging indicated below).
  - Construction from land for approximately 400 feet.
  - Use of temporary construction trestle for approximately 4,300 feet or 0.8 mile (SAV = 3,000 feet and shallow water = 1,300 feet).
  - Construction duration of 52 months.

- Driving of bridge piles with no jetting.

- Potentially dredging to build the bridge in Currituck Sound for approximately 1,900 feet (48,900 cubic yards) on the west side of Currituck Sound. No dredging is proposed on the east side of Currituck Sound where it would be close to existing SAV beds. This dredging in areas with shallow water (less than 6-foot depth) along 8 percent of the bridge length would allow for barge-based construction for approximately 81 percent of the bridge length. No dredging would occur in areas containing SAV, as identified at the start of construction. Approximately 11.6 acres of sound bottom would be dredged for the bridge. For reducing dredging impacts, vacuum (hydraulic/suction) dredging is the most likely dredging method with the use of turbidity curtains and/or shrouds. Vacuum dredging can be more precise and less disturbing to adjacent bottom soil areas, resulting in minimal turbidity. No mechanical excavation is used, as the process is a suction line head that is moved along the surface bottom to collect the removed soils. Any turbidity created would loom around the dredge head and be captured by the suction process. Additionally, a sediment shroud could be used to limit turbidity as well as turbidity curtains. No dredging would occur from February 15 to September 30. The supply dock discussed at the November 2, 2010 TEAC meeting and the October 2010 *Preferred Alternative Report* and its associated dredging has been dropped from consideration as a construction technique.

- Temporary trestle construction would be used in SAV and areas not mentioned above that are too shallow to be reached by barge without dredging.

- Options for disposal or use of hydraulically dredged materials could include:

  - Removal and Disposal. Removal of dredged materials from Currituck Sound and placement of it in an upland area could be considered. The existing borrow pit east of US 158 and north of Aydlett Road in Coinjock could be a suitable site for placement of the dredged material, as this would help to restore this site to an elevation that could make it suitable for wetland creation along the west edge of Maple Swamp. Material placed initially in an upland location also could be placed back in dredged areas at the end of construction, restoring those areas to their original depth.

  - SAV Habitat Creation. SAV habitat creation on the east side of Currituck Sound or other locations could be a potential use for some of the dredged materials. The intent is to raise areas with a bottom depth of more than four feet deep to a more shallow condition for better SAV habitat.

  - Sidecasting or Temporary Storage for Restoration. Another option is sidecasting of the dredged materials in Currituck Sound or temporary storage of dredged materials in the water for use later in restoring dredged areas. This would, however, create additional temporary impacts in the water.

4.1.3 Other Natural Resource Impacts

The design and construction features described for the recommended Preferred Alternative would avoid and minimize the following additional natural resource impacts:

- MCB4 had the least fill in natural upland communities of the DEIS detailed study alternatives. The refinements made to MCB4, such as reducing the amount of four-lane widening on NC 12, further reduced this impact. The amount will be calculated based on a revised preliminary design and included in the FEIS.

- MCB4/C1 had the least impact of the DEIS detailed study alternatives in upland and wetland maritime forest communities. The refinements made to the C1 bridge terminus on the Outer Banks further reduced this impact. The amount of the upland reduction will be calculated based on a revised preliminary design and included in the FEIS.

- As a result of the reduction in four-lane widening along NC 12 and the straighter C1 bridge corridor across the sound, the project's overall increase in impervious surface area (pavement and bridge deck) with the recommended Preferred Alternative also was reduced. The increase in the amount of impervious surface area presented in the DEIS was 89.0 acres with ER2 and 79.6 to 80.0 acres with MCB4/C1 with no third outbound hurricane evacuation lane. The amount of reduction with the recommended Preferred Alternative will be calculated based on a revised preliminary design and included in the FEIS.

- The design features described for the recommended Preferred Alternative would result in no impact on the surface water and groundwater hydrology in Maple Swamp or on storm surge elevations.

4.2 Community Impacts Avoidance and Minimization

4.2.1 Aydlett and Other Currituck County Mainland Community Impacts

Use of design Option A would reduce impacts to the Aydlett community. Per the strong preference of Currituck County and the Aydlett community, Aydlett Road would not be removed with Option A, whereas it would be removed with Option B. Secondly, the residential relocation on Narrow Shore Road in Aydlett associated with Option B would not occur with Option A. Finally, the toll plaza would be constructed at the US 158/Mid-Currituck Bridge interchange rather than in Aydlett, thereby avoiding the substantial community impacts related to the presence of the toll plaza in the community. For example, Narrow Shore Road (the only road between the northern and southern parts of the Aydlett community) would not have to be relocated as with Option B, but rather would be bridged by the western end of the Mid-Currituck Bridge. As a result, access between the two parts of the community would not be affected, so the community cohesion impacts in Aydlett would be confined to a visual barrier as the bridge passes

through the community. The visual impacts to the Aydlett community would consist of the presence of the earthen berm that the Mid-Currituck Bridge would transition to as it enters Aydlett from Maple Swamp. The berm would be noticeable from homes south of the berm, and it would replace existing woods. However, 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.

A median acceleration lane was added at the US 158/Waterlily Road intersection. This safety feature would allow left turns to continue to be made at this intersection. Waterlily Road is near the northbound exit ramp from the US 158/Mid-Currituck Bridge interchange to 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.

4.2.2 NC 12 Community Impacts

Design revisions have been made to NC 12 with the recommended Preferred Alternative to decrease costs and to minimize community impacts. The design revisions include: reducing the amount of four-lane widening along NC 12 by approximately 50 percent; the use of a roundabout at the bridge terminus at NC 12; and an adjustment in the alignment of the bridge as it approaches the Outer Banks. The NC 12 four-lane widening with the recommended Preferred Alternative would be concentrated at three locations: the bridge terminus, the commercial area surrounding Albacore Street, and Currituck Clubhouse Drive. A roundabout also would be used instead of a traffic signal at the NC 12/Currituck Clubhouse Drive intersection.

MCB4/C1 was the only DEIS detailed study alternative that had no business or residential relocations along NC 12. Other than MCB4/C2, MCB4/C1 also had the fewest changes in current access to residential and business properties along NC 12 of the DEIS detailed study alternatives, and these impacts were reduced further with the design changes (i.e., reduced four-lane NC 12 widening) made to the recommended Preferred Alternative. The revised C1 terminus would minimize the division of the Corolla Bay subdivision by placing the project to the south of the subdivision's Phase I and entirely within the currently unimproved Phase II.

Reducing the amount of NC 12 four-lane widening, as described above, also helps address citizen concerns related to pedestrian crossing of NC 12. Currituck County has identified the need for formal pedestrian crossing at several locations along NC 12 in a draft of a transportation plan update. At the pedestrian crossing locations where NC 12 improvements are planned with the recommended Preferred Alternative, formal crossings would be provided by the project. The project also would include one pedestrian crossing at North Harbor View Drive, which is not proposed in the draft plan. The recommended Preferred Alternative also includes provisions for bicycles and pedestrians along the full length of the bridge.

The NC 12 design change also would reduce the need for infiltration strips within a permanent drainage easement along a widened NC 12.

MCB4 had the least number of homes of the detailed study alternatives analyzed in the DEIS that would experience an increase in traffic noise levels. The DEIS noise impacts for MCB4/C1 consisted of increased noise levels (up to 10 dBA) on NC 12 from Seashell Lane to the Mid-Currituck Bridge terminus as a result of the four-lane NC 12 widening causing pavement to be closer to homes and because more motor vehicles could travel the speed limit. The nature of the impacts would be similar for the recommended Preferred Alternative, but the number of homes affected could be reduced as a result of the reduction in the amount of four-lane NC 12. The increased traffic noise levels would be limited to the homes along three sections of NC 12: the bridge terminus area, the Albacore Street area, and the Currituck Clubhouse Drive area.

4.2.3 Boating Impacts in Currituck Sound

As stated in the Project Commitments section of the DEIS, NCTA is coordinating with the US Coast Guard to determine appropriate horizontal and vertical navigation clearances for the Mid-Currituck Bridge. NCTA is proposing a minimum vertical clearance of 16 feet for the entire length of the bridge over Currituck Sound. A single navigation span would have a vertical clearance of 35 feet. The proposed clearances could change during the bridge permitting process if the US Coast Guard determines it necessary to meet reasonable needs for navigation.

4.3 Cultural Resource Impact Avoidance and Minimization

Using the operational solution to provide additional US 158 roadway capacity during a hurricane evacuation, the recommended Preferred Alternative would have No Adverse Effect on one property (the Daniel Saunders House) on or eligible for inclusion in the NRHP and No Effect at all other properties in the project area.

5.0 Comments Received on the DEIS that Relate to Selection of the Preferred Alternative and Responses

Based on agency and public comments received, NCTA foresees working with the participating and cooperating agencies on the following decisions associated with the selection of a Preferred Alternative and its design features:

- Selection of the Least Environmentally Damaging Practicable Alternative (LEDPA).
- Selection of practicable design and construction avoidance, minimization, and mitigation strategies for the LEDPA.

Comments and responses that relate to the selection of the Preferred Alternative are summarized in the sections below.

5.1 Selection of the Least Environmentally Damaging Practicable Alternative

Decisions involved in the identification of the LEDPA are:

- ER2 versus MCB2 versus MCB4.
- With the selection of MCB2 or MCB4, C1 versus C2.
- Selection of a hurricane evacuation strategy.

5.1.1 ER2 versus MCB2 versus MCB4

Substantive public and agency comments related to the practicability of these alternatives relate to:

- **Availability of funding.**

  The US Army Corps of Engineers indicated that the funding aspect for this project as it relates to practicability weighs heavily in the decision process for the LEDPA.

  Response: *The only programmed and reasonably foreseeable source of funding for improvements that would meet the purpose and need for the project includes toll financing. The recommended Preferred Alternative can be funded in this manner through a combination of revenue bonds and private financing. Tolls and annual appropriations by the General Assembly of $15 million (as appropriated starting in 2008, increasing to $28 million on July 1, 2013) could be used to fund bridge construction,*

operation and maintenance costs, interest and other financing costs, and repayment of debt. Handout 24 (see Appendix B) indicated the availability of the following funds:

- *Estimated State Appropriation Bonds Capacity Range: $475 to $506 million.*
- *Estimated Toll Revenue Bonds Capacity Range: $87 to $122 million.*
- *Estimated Net Private Equity Range: $36 to $79 million.*
- *Total Funds Available to Finance the Project: $598 to $707 million.*

Components of MCB2 that are common with MCB4 could be financed in the same manner. It is not practicable from NCTA's perspective to finance ER2 with tolls since tolls cannot be applied to surface streets with unlimited access. The General Assembly also has passed legislation that prohibits the tolling of existing facilities. NCTA's enabling legislation states: "The Authority Board is prohibited from converting any segment of the nontolled State highway system to a toll facility." (G.S. § 136-89.187). It also is important to note that toll funding, although substantial, is limited and that NCTA is confident the recommended Preferred Alternative is financially viable, however, changes to the Preferred Alternative could render the project financially infeasible. Toll revenue and General Assembly appropriations are not sufficient to fund the additional street improvements associated with MCB2.

- **Alternative preferences.**

In the agency comments, there is a general preference for ER2, which is viewed as having lower natural resource impact and less potential for induced development. However, several agencies acknowledged that lack of funding for ER2 makes it financially infeasible. Local governments, including Currituck County, the Towns of Nags Head, Kitty Hawk, Southern Shores, and Duck, and the Albemarle Rural Planning Organization (RPO) all support building the Mid-Currituck Bridge and/or oppose widening existing roads.

With the public, preferences are predominantly divided between the No-Build Alternative and MCB4. There is general opposition to widening NC 12, particularly in Dare County. Few supported ER2 or MCB2. Those who favor the No-Build Alternative are concerned a bridge would bring additional development, additional day visitors (particularly beach drivers), and crime to the Currituck County Outer Banks. They are concerned that the unique character afforded by the relative isolation of the Currituck County Outer Banks would be lost. They feel it is worth dealing with congestion in order to retain that character. Other reasons given for favoring the No-Build Alternative include cost, the perceived unreasonableness of making an improvement that is needed today only on summer weekends, and natural resource impacts. Those who favor MCB4 feel the bridge would be the best way to address traffic congestion and hurricane evacuation and that both needs are important to address. Many of those who favor the bridge live or own homes along NC 12 in Southern Shores and Duck. Many of those who oppose the bridge appear

to be permanent residents of the Currituck County Outer Banks or live in Aydlett (through which the mainland bridge approach would pass).

Response: *It is NCTA's opinion that ER2 would not be practicable because it would not achieve the transportation system and traffic movement pattern change objectives of local and state governments. This is reflected in the lack of support of ER2 by local governments, as well as support for the bridge and/or opposition to widening NC 12 in the CAMA land use plans of Currituck County, Southern Shores, and Duck. As documented in the DEIS, a Mid-Currituck Bridge is included in the NCDOT's 2009 to 2015 State Transportation Improvement Program (STIP), the North Carolina Intrastate System, the North Carolina Strategic Highway Corridor Plan, and the Thoroughfare Plan for Currituck County.*

In Handout 25 (see Appendix B), NCTA indicated that it was their opinion that ER2 is not logistically available and capable of being implemented (and therefore not practicable) for four reasons:

1. *It cannot be financed and no traditional funding is available.*

   The funding sources listed earlier in this document are only available for a project that includes a tolled Mid-Currituck Bridge. They are not available for ER2 for the following three reasons:

   - *Tolls cannot be used on local roads logistically or according to state law.*
   - *State appropriations can only be spent by NCTA for a Mid-Currituck Bridge.*
   - *NCTA projects must be in locally adopted comprehensive transportation plans and in the current STIP; only the NC 12/US 158 interchange component of ER2 is in the current STIP.*

   In addition, traditional highway funds are not available to build ER2. The STIP includes no traditional highway funds for Project No. R-2576 that could be used to build ER2. In addition, the reallocation of Division 1 funds to pay for ER2 is not a realistic proposal. In the current STIP, Division 1 is anticipated to get approximately $569 million in equity funds over a 7-year period. With an estimated cost in the neighborhood of $500 million, funding ER2 would require delaying or deleting most other projects in Division 1. The replacement of the Bonner Bridge at an anticipated cost of $300 million also is scheduled within this 7-year window. Thus, generating funding from the STIP for ER2 also would require the delay of the Bonner Bridge replacement.

2. *Widening NC 12 contradicts local and state plans.*

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

- *The NCDENR, Division of Coastal Management (DCM), in their DEIS response letter, made a provisional consistency determination that ER2 is <u>not</u> consistent with the Town of Duck 2004 Land Use Plan.*

- *The CAMA land use plan for Currituck County assumes that the bridge will be built, as opposed to widening existing roads, and indicates that the bridge is needed to alleviate traffic congestion and to assist in hurricane evacuations.*

3. *Local community opposition to widening NC 12 is strong.*

   - *A tabulation of comments received from unique individuals during the public review of the DEIS yielded 379 commenters either opposing ER2 or favoring an alternative that included a bridge.*

   - *Local governments are unanimous in statements either opposing ER2 or favoring MCB4.*

4. *Meeting the purpose and need of the project, as defined in the DEIS, is problematic.*

   - *MCB4 generally achieves more than twice the travel benefits of ER2.*

   - *With ER2, reversing the center turn lane for 27 miles to reduce hurricane evacuation clearance time (as included in the recommended Preferred Alternative for 5 miles) would be logistically unrealistic.*

   - *ER2 could not meet the project's stated purpose and need because it could not be implemented in the foreseeable future, making its selection as the LEDPA equivalent to selecting the No-Build Alternative in terms of the travel service it could provide.*

The basis for these reasons is described further in Handout 25. USACE responded to NCTA's position in an October 29, 2010 letter. Further clarifications are included in Handout 30 in response to USACE comments. USACE's comments included the statement, "We believe a state law which so severely restricts funding sources to a defined project at a defined location is not a valid constraint to the building of one alternative over another pursuant to the [404(b)(1)] Guidelines." In the same letter, USACE indicated that they believe that either ER2 or MCB4/A/C1 (with modifications and coupled with the significant reductions in the proposed dredging impacts proposed by NCTA at the November 2, 2010 TEAC meeting) could be the LEDPA.

Given these factors, NCTA recommends MCB4/A/C1 for selection as the Preferred Alternative and LEDPA. Despite NCTA's position that ER2 is not practicable and its preference for MCB4, NCTA also recognizes that it must make every effort to avoid and minimize the impact of MCB4 on wetlands and other natural and community resources. This effort is reflected in the features of the recommended Preferred Alternative.

At the August 10, 2010, TEAC meeting participants agreed to eliminate MCB2 from further consideration. MCB2 has the most impacts, has little public support, and cannot be funded at this time. It was agreed that ER2 be retained for additional comparison with MCB4.

5.1.2 C1 versus C2

Substantive agency comments related to the selection of C1 versus C2 indicate a general preference for Outer Banks terminus C1 because of less potential Currituck Sound and coastal marsh impact. With the public, preferences are divided between the two Outer Banks termini alternatives. Those who favor C1 generally do so because the C2 bridge terminus is in a commercial area and NC 12 in that area already carries substantial traffic. Those who favor C2 are concerned about community impacts associated with C1 and feel that a commercial area is the best place to add bridge traffic.

Response: *NCDOT met with Currituck County representatives on July 16, 2010, to discuss issues raised by the agencies and the public related to C1 and C2. Items of discussion associated with public comment on C1 and C2 included:*

- *C1—U-turn opportunities for Ocean Forest Court, providing access to a public street for the development at the north end of North Harbor View Drive, and provisions for pedestrians crossing NC 12 at North Harbor View Drive.*
- *C2—Commercial displacement and eliminating left turns from the secondary driveway at the TimBuck II commercial center.*

One objective of meeting with Currituck County was to discuss how to avoid, minimize, or mitigate these concerns to the satisfaction of county representatives. The preference of the agencies for C1 and the reasons were relayed to Currituck County representatives. The county manager indicated that the county would like to see the concerns raised about C1 and C2 addressed, but did not object to either corridor.

NCTA recommends C1 for selection as a part of the LEDPA for the following reasons:

- *It is the shorter of the two corridors.*
- *It would be the furthest from the marsh islands in Currituck Sound.*
- *It would have lower impacts to SAVs and potential SAV areas.*
- *It would affect no CAMA wetlands.*
- *It would avoid terminating the bridge and bringing its traffic onto NC 12 in an area with an existing concentration of traffic going to and from retail businesses.*

This recommendation for a Preferred Alternative that included a Mid-Currituck Bridge was affirmed by participants at the August 10, 2010, TEAC meeting. At that time, C2 was eliminated from further consideration.

5.1.3 Hurricane Evacuation Strategy

The agencies indicated no particular preference regarding hurricane evacuation. The US Environmental Protection Agency (USEPA) indicated that reducing hurricane evacuation clearance times in general is a desirable goal, but should be reasonably weighed against other costs, benefits, and adverse environmental effects. Public commenters either favor making no hurricane evacuation-related improvements (generally because of a belief that contemporary forecasting techniques would allow for evacuations to be ordered several days in advance) or reversing the center turn lane on US 158 to function as a third outbound lane (as opposed to building a new outbound lane). The latter is favored by the public because of perceived lower cost and lower environmental impact.

Response: *A recommendation on a preferred hurricane evacuation strategy was primarily dependent on three items:*

- *The desires of state and local emergency management officials who did not comment on the DEIS.*
- *The decision between ER2, MCB2, and MCB4 in that emergency management officials already have taken the position that reversing the center turn lane for 27 miles, as required by ER2, would not be logistically possible. This is because of numerous opportunities to enter and exit US 158 and the volume of staff and equipment required to attempt to manage such movements so that the center turn lane could make an effective contribution to northbound evacuation capacity.*
- *Public and agency comment.*

NCTA held a meeting with emergency management officials on August 19, 2010, to discuss their preferences. The outcome was as follows:

- *ER2 – It was agreed that the reversible center lane is not a feasible solution. It was suggested that if ER2 is pursued as the Preferred Alternative that the third outbound lane not be implemented immediately. Rather at such time as local emergency management representatives feel an improvement is needed, that a new alternatives study be conducted that could consider additional demand management solutions, such as forcing some evacuees that would prefer to evacuate via US 158 to use US 64, in addition to a physical improvement to US 158.*
- *MCB2 and MCB4 North of a Mid-Currituck Bridge – Reverse the center turn lane from the US 158/Mid-Currituck Bridge interchange to US 158/NC 168 in Barco.*

– *MCB4 East of Wright Memorial Bridge – Provide three westbound lanes on US 158 from the NC 12/US 158 intersection through the Duck Woods Drive intersection, and then merge back to two westbound lanes approximately 750 feet west of this intersection. This includes approximately 1,600 feet of new third outbound lane between Market Place/Cypress Knee Trail and a point approximately 450 feet west of the Duck Woods Drive intersection plus approximately 300 feet to taper back to two lanes. The DEIS evaluated for MCB4 a third outbound lane east of the Wright Memorial Bridge that was 5,782 feet long and bridged Jean Guite Creek, a Primary Nursery Area.*

This solution as it relates to MCB4 is in keeping with the USEPA comment and public preference and is recommended as a part of the Preferred Alternative.

5.2 Selection of Practicable Design and Construction Avoidance and Minimization Strategies

Key issues involved in the development and selection of practicable design and construction avoidance and minimization strategies are:

- Crossing Maple Swamp on bridge or fill.
- Construction methods.
- Stormwater management for a Mid-Currituck Bridge.

These issues relate to the implementation of MCB4. NCTA conducted the additional studies presented in Handouts 26 to 29 (see Appendix B). The findings of this effort are noted in the responses to the comments below and will be included in the FEIS. This effort will be one part of NCTA's response to comments made by the public, local government, and environmental resource and regulatory agencies.

5.2.1 Crossing Maple Swamp on Bridge or Fill

Substantive agency comments related to crossing Maple Swamp on bridge versus fill are:

- A strong preference was expressed for bridging Maple Swamp (as included in Option A), with the exception of the Natural Heritage Program, which prefers Option B. Option A is viewed as having lower natural resource and hydrologic impacts.
- A suggestion to both bridge Maple Swamp and remove existing Aydlett Road, combining features of Option A and Option B, respectively.
- A request for additional assessment of hydrologic impacts on groundwater and the storm surge (100-year floodplain) when crossing Maple Swamp on fill. This assessment would include taking into account changes in swamp hydrology resulting from recent clear cutting in the swamp, any removal of muck and its

replacement with compatible soil, and the effect of seasonal groundwater inundation on proposed wildlife crossings.

- Continued interest in the purchase of the landlocked parcels for wetland preservation credits, as well as wetland restoration or enhancement because of the effect of logging operations (rutting, log landings, compaction, and hydrology alteration) on the landscape.

- A request for a revised habitat impact assessment that takes into account recent additional logging within and adjacent to the bridge corridor.

- A request for additional information on how the restoration of Aydlett Road would be accomplished with Option B.

- A provisional CAMA consistency determination by NCDENR–DCM that Option B is not consistent with the Currituck County 2006 Land Use Plan certified by the Coastal Resources Commission (CRC) on May 18, 2007 and amended on September 25, 2008 and June 24, 2009.

The focus of the public related to crossing Maple Swamp on bridge or fill related primarily to the closure of Aydlett Road, which accompanied the use of fill in Maple Swamp with mainland approach Option B. Almost all commenters favor mainland approach design Option A because it would have less impact on the mainland community of Aydlett, place the toll plaza in an interchange at US 158 and retain Aydlett Road. Community impact concerns expressed at the DEIS Public Hearings were reflected in the community impact assessment of the DEIS in Sections 3.1.2, 3.1.3, and 3.1.8. The option of fill in Maple Swamp (to reduce project cost) and retaining Aydlett Road (to minimize community affects) was raised by the public as an option important to consider.

Currituck County commissioners also passed a resolution opposing a toll plaza in Aydlett and placing Aydlett traffic on the bridge approach road. The resolution was included in Section 3.3 of the *Stakeholder Involvement for Draft Environmental Impact Statement Technical Report* included on the CD that was a part of the DEIS. The county also is concerned about the impact of fill in Maple Swamp on flooding.

Response: *In giving additional consideration to this design issue NCTA took into account the following considerations:*

- *Agency and public preferences for Option A.*

- *Avoiding and minimizing wetland fill impacts is important, as is avoiding impacts to the groundwater and surface water hydrology of Maple Swamp, including increases in storm surge elevation. Handouts 28 and 29 (see Appendix B) present findings of new efforts to understand the potential for a crossing of Maple Swamp to affect the groundwater of Maple Swamp and the storm surge, respectively.*

As discussed in Handout 28, professional groundwater hydrologists reviewed available data regarding the groundwater system of Maple Swamp. They found that because of the very flat topography within the swamp, existing groundwater levels likely show only minimal elevation changes, and groundwater flows consequently are quite small. They concluded that assuming that the crossing of Maple Swamp is designed and constructed with appropriately sized culverts and/or bridges to adequately maintain surface water hydrology in Maple Swamp, existing groundwater flows and levels in the swamp essentially should be unaffected by fill in Maple Swamp.

As discussed in Handout 29, the floodplain impact studies presented in the DEIS were revised. This included modeling impacts on storm surge elevations of design Option A and various combinations of bridge and fill across the swamp using a more detailed August 2010 location survey of the terrain in Maple Swamp and taking into account recent logging in the swamp. Hydraulic modeling results affirmed no impacts to 100-year maximum water surface elevations as a result of Option A. Several additional combinations of bridge and fill also were modeled to determine the minimum length of bridge that must be built across Maple Swamp in order to have no impacts to 100-year maximum water surface elevations. Hydraulic modeling results show that a minimum 2,500-foot wide bridge opening across the central and eastern portion of the swamp (i.e., the portion of the swamp with the lowest elevation) is required to have no effect on 100-year maximum water surface elevations.

– *The closing of Aydlett Road is unacceptable to the Aydlett community and Currituck County.*

Based on the above, NCTA recommends Option A (as defined in the DEIS) as a part of the Preferred Alternative.

5.2.2 Construction Methods

Substantive agency comments on construction methods that relate to decisions on the details of the recommended Preferred Alternative include:

- Construction techniques to be used in Currituck Sound need to be resolved, particularly as it relates to the need for and extent of dredging in Currituck Sound and an overall priority for minimizing disturbances to the bottom of the sound. SAV disturbance was a particular concern.

- Top down construction or an approach that does not require dredging should be used.

- Waiting until the permitting process to select final construction methods could result in substantial delay or denial of a permit.

- February 15 to September 30 moratorium on dredging activities. These dates encompass fish spawning and peak migration periods.

The public generally did not comment on construction aspects of the project. Concerns raised related to community disturbance by equipment activity (including noise) and debris removal during construction. Information on community disturbance during construction also was requested by USEPA.

Response: *Handout 27 (see Appendix B) presented a description of various construction options (and combinations of options) and their characteristics. Methods considered were: 1) conventional bridge construction through the use of barges in the water with cranes mounted on the barges; 2) a temporary construction trestle adjacent to the new bridge for use by the contractor in building the bridge; and 3) top down construction where the bridge would be built from itself as it progresses. No one method would likely be used for the entire crossing of Currituck Sound because of site conditions and duration of construction. Instead, a combination of two or all three methods could be used in the building of the bridge. The most economically feasible construction approach is a combination of barge-based and trestle construction with limited dredging along portions of the bridge alignment.*

Seven possible combinations of construction methods were discussed in Handout 27. The first two methods involve dredging along the bridge alignment on both the east and west sides of Currituck Sound in non-SAV areas. The third method only includes dredging on the west side of Currituck Sound. The remaining four methods involve no dredging.

Handout 27 concluded that:

- *Barge-based construction should be used as practicable because of pile setup issues and to reduce overall construction costs and duration.*

- *Jetting of piles for installation should not be needed on the project based on currently available geotechnical information.*

- *Dredging in non-SAV shallow water areas to maximize barge-based construction would substantially reduce construction duration and construction costs. Dredging should be part of the construction approach for this bridge and would likely be subject to a time of year dredging moratorium (February 15 to September 30).*

- *In SAV and wetland areas, temporary trestle construction should be used to reduce construction costs rather than top down construction.*

- *If dredging is not an acceptable approach for this project, then trestle (shallow water) and barge based (deep water) construction methods should be used to balance impacts, mitigation, duration, and costs.*

NCTA recommends as the most cost-effective approach to construction of a Mid-Currituck Bridge what is defined in Handout 27 (Appendix B) as "Non-SAV Dredging (East and West Side)/Trestle + Barge." It would include (taking into account the straighter bridge and the

refined dredging plan presented at the November 2, 2010 TEAC meeting and in Handout 30) the following:

- *Construction from barges for approximately 20,000 feet or 3.8 miles.*
- *Construction from land for approximately 400 feet.*
- *Use of temporary construction trestle for approximately 4,300 feet or 0.8 mile (SAV = 3,000 feet and shallow water = 1,300 feet)*
- *Construction duration of 52 months.*

For reducing dredging impacts, vacuum (hydraulic/suction) dredging is the most likely dredging method with the use of turbidity curtains and/or shrouds. Also, no dredging would occur from February 15 to September 30. Bridge piles would be driven and not jetted.

At the November 2, 2010 TEAC meeting and in the comments on the October 2010 Preferred Alternative Report, agencies continued to express concern about the potential environmental impacts of dredging. Concerns also were expressed related to the impact of pile driving. Responses to those concerns are included in Handout 30, including suggestions on how they might be addressed and modifications to the proposed dredging strategy presented in the October 2010 Preferred Alternative Report. Regarding dredging and other construction methods, NCTA would continue to work with the agencies as the project progresses to see if an acceptable approach to dredging that minimizes adverse impacts could be developed and to further minimize other construction impacts.

5.2.3 Stormwater Management for a Mid-Currituck Bridge

Concerns related to the impact on Currituck Sound of automotive pollutants contained in bridge runoff were expressed by both the public and the agencies. Agency comments included:

- A concerted effort to address runoff from a new bridge should be initiated.
- The impacts to water quality are expected to be very significant. Water quality in Currituck Sound has declined substantially in the last several decades primarily because of an increase in turbidity and nutrient loading from non-point source runoff. The effect on water quality of untreated stormwater runoff from the bridge is a concern.
- Provide discussion of the NCDOT report prepared in accordance with NC Session Law 2008-107, Section 25.18, Stormwater Runoff from Bridges.

  Response: *The FEIS will include a conceptual stormwater management plan for the Mid-Currituck Bridge. It will be developed with input from participating and cooperating*

agencies. The strategy will take into consideration:

- *Applicable state stormwater law and regulation, including NC Session Law 2008-211.*
- *The findings of Section 2.1.7 of the DEIS.*
- *The findings of the NCDOT/NCDENR–DWQ/US Geological Survey report prepared in accordance with NC Session Law 2008-107, Section 25.18, Stormwater Runoff from Bridges entitled: Stormwater Runoff from Bridges, Final Report to Joint Legislation Transportation Oversight Committee In Fulfillment of Session Law 2008-107.*
- *Findings currently available from the US Army Corps of Engineers(USACE) on-going study of water quality in Currituck Sound, including the report released in February 2010 entitled Currituck Sound, North Carolina Ecosystem Restoration Feasibility Study: Feasibility Scoping Meeting Report and available on-line at: http://www.saw.usace .army.mil/Currituck/FSM/Currituck%20Sound%20FSM%20Report_February% 202010_FINAL.pdf.*
- *Agency DEIS comments related to bridge runoff and the resources that could be affected.*

A stormwater management strategy was presented in Handout 26 (see Appendix B) at the September 8, 2010 TEAC meeting. It was discussed further with NCDENR–DWQ at a meeting on October 1, 2010 and in the response to agency comments on the October 2010 Preferred Alternative Report (Handout 30 in Appendix B). As indicated above, NCTA recommends a stormwater management strategy that includes:

- *Regular bridge deck cleaning (the initial plan would be to clean the entire deck of the Mid-Currituck Bridge and the Maple Swamp bridge weekly following the peak summer weekend traffic period).*
- *Monitoring of water quality near the bridge to measure the effectiveness of the deck cleaning program so adjustments could be made as needed.*
- *Measures to dissipate the flow of stormwater coming from bridge scuppers over Currituck Sound and Maple Swamp where needed to minimize potential disturbance of the sound bottom or erosion in the swamp potentially caused by any water free fall.*

Further refinements in this proposal are expected by NCTA, developed in association with NCDENR–DWQ as indicated in Section 4.1.2.1.

6.0 Traffic Forecasts

Future 2035 traffic forecasts for the alternatives analysis were developed for the roadway network with (applicable to MCB2 and MCB4) and without (applicable to the No-Build Alternative and ER2) a Mid-Currituck Bridge. Daily forecasts were completed for 15 roadway links on US 158, NC 12, and the proposed Mid-Currituck Bridge. For each link, traffic forecasts were developed for the Average Annual Daily Traffic (AADT), Non-Summer Weekday, Non-Summer Weekend, Summer Weekday, and Summer Weekend time periods to reflect the impact of tourist traffic in the summer and on weekends. These forecasts are shown by link in Table 5. The forecasts assume full build-out on the part of the project area accessible to NC 12, state and county population forecasts in 2030 projected to 2035 on the mainland, and the continuation of recent building trends in the part of the Currituck County Outer Banks not accessible to NC 12. The effect of tolls on bridge traffic demand was considered in the roadway network with bridge forecasts.

Table 5. Future (2035) Daily Traffic Volumes without and with a Mid-Currituck Bridge

Link #	Roadway Link	Without a Mid-Currituck Bridge (No-Build and ER2)					With a Mid-Currituck Bridge (MCB2 and MCB4)				
		AADT	Non-Summer Weekday	Non-Summer Weekend	Summer Weekday	Summer Weekend	AADT	Non-Summer Weekday	Non-Summer Weekend	Summer Weekday	Summer Weekend
1	US 158 south of Barco	45,400	37,400	35,800	54,300	92,600	45,400	37,400	35,800	54,300	92,600
2	US 158 near Bertha	42,000	35,200	32,600	47,400	89,900	33,700	28,000	25,800	37,800	74,200
3	US 158 near Jarvisburg	44,900	38,600	34,800	50,800	90,300	34,800	29,800	26,700	39,300	72,000
4	US 158 near Mamie	47,700	42,100	37,300	53,300	91,400	36,800	32,400	28,600	40,900	71,800
5	US 158 at Wright Memorial Bridge.	48,700	43,100	37,000	58,900	84,600	37,400	33,100	28,100	46,000	64,500
6	US 158 between Wright Memorial Bridge and NC 12	64,000	55,700	47,300	82,500	108,200	52,700	45,700	38,600	69,500	88,000
7	US 158 just west of NC 12 intersection	78,700	68,200	58,500	102,800	131,700	67,700	58,400	49,900	90,100	112,000
8	US 158 just south of NC 12 intersection	66,500	57,200	47,100	93,600	104,500	66,500	57,200	47,100	93,600	104,500
9	NC 12 just north of US 158 intersection	31,900	28,800	22,300	43,100	47,400	23,000	20,800	15,700	30,200	31,300
10	NC 12 in Duck business area	29,000	26,500	21,300	36,500	44,100	21,700	20,000	16,000	27,900	30,600
11	NC 12 in Sanderling Inn area	23,700	21,900	16,900	29,700	36,200	19,000	17,600	13,900	23,800	27,800
14	NC 12 at Dare/ Currituck County Line	23,400	21,500	17,700	28,900	35,700	20,000	18,400	15,400	24,800	29,400
12	NC 12 at Corolla south	20,100	18,200	14,800	25,300	31,400	21,700	19,900	15,600	26,800	34,600
13	NC 12 at Corolla north	9,400	8,600	7,200	11,600	13,900	9,400	8,600	7,200	11,600	13,900
15	Mid-Currituck Bridge	Not Applicable – Proposed Bridge					12,600	11,200	9,200	14,500	22,500

Appendix A

Comparison of Key Impacts

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		Is in the currently unimproved Phase II of Corolla Bay subdivision and does not divide Phase I.
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	
• Homes	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)	5
• Businesses	5 (2 with no third outbound lane for hurricane evacuation)	7 (5 with no third outbound lane for hurricane evacuation)		8 (6 with no third outbound lane for hurricane evacuation)		5 (3 with no third outbound lane for hurricane evacuation)		6 (4 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 clearance times is accomplished by reversing the existing center turn lane.

Comparison of Key Impacts (continued)

	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	66 (none with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	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					Compatible	Incompatible because of access to bridge approach in Aydlett	Compatible	Incompatible because of access to bridge approach in Aydlett	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.		No left turns from side streets at NC 12/Orion's Way/Shopping Center Driveway intersection on the Outer Banks with opportunity for U-turns.

Comparison of Key Impacts (continued)

	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 in the Albacore Street area in Currituck County Outer Banks. With Option B, direct access from US 158 would be lost for customers of 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 customers of a gas station near the end of a frontage road.	Substantial changes in business access in the Albacore Street area in Currituck County. With Option B, direct access from US 158 would be lost for customers of a gas station near the end of a frontage road.	Minor except with Option B, direct access from US 158 would be lost for customers of a gas station near the end of a frontage road.	Substantial changes in business access in the Albacore Street area in Currituck County.
Natural Resource Impacts						
Water Quality Impact	Increased levels of highway runoff with 89.0 acres of increased impervious surface (53.4 acres without construction of a third outbound lane for hurricane evacuation).	Increased turbidity levels during Currituck Sound 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).		Increased turbidity levels during Currituck Sound 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).		Increased turbidity levels during Currituck Sound bridge construction; increased levels of bridge and highway runoff with increased impervious surface.
Natural Upland Biotic Communities Impact for Option A and Option B						
• Fill in Natural and Naturalized Upland Communities[2]	85.3 acres	Option A: 113.4 acres; Option B: 121.7 acres	Option A: 110.0 acres; Option B: 118.4 acres	Option A: 44.1 acres; Option B: 52.4 acres	Option A: 40.8 acres; Option B: 49.1 acres	Less than 44.1 acres
• Clearing Natural and Naturalized Upland Communities[2]	0.0 acre	2.7 acres	0.5 acres	2.5 acres	0.4 acres	2.7 acres	0.5 acres	2.5 acres	0.4 acres	Less than 2.7 acres
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	14.5 acres	17.8 acres	14.5 acres	17.8 acres	Less than 14.5 acres because of straighter bridge
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.				

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

Comparison of Key Impacts (continued)

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2		Preferred Alternative
Submerged Aquatic Vegetation (SAV) Impact										
• Existing SAV Shaded	0.0 acre	4.3 acres		5.5 acres		4.3 acres		5.5 acres		Less than 4.3 acres because of straighter bridge
• Existing and Potential (water depths < 6 feet) SAV Shaded	0.1 acre	14.5 acres		17.8 acres		14.5 acres		17.8 acres		Less than 14.5 acres because of straighter bridge
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	Option A	Option B	Option A	Option B	Option A	Option B	7.1 acres
		21.1 (17.1) acres	47.1 (43.1) acres	16.5 (12.5) acres	42.5 (38.5) acres	15.4 (10.6) acres	41.4 (36.6) acres	10.9 (6.0) acres	36.9 (32.0) 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 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
• Shading (water depths < 6 feet)	0.1 acre	14.5 acres		17.8 acres		14.5 acres		17.8 acres		Less than 14.5 acres because of straighter bridge
• Clearing	0.0 acre	0.0 acre		3.2 acres		0.0 acre		3.2 acres		0.0 acre

[3] The first number or numbers indicate the impact assuming the construction of a third outbound lane for hurricane evacuation. The number or numbers in parentheses is the impact if improving hurricane clearance times is accomplished by reversing the existing center turn lane.

Comparison of Key Impacts (continued)

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2	Preferred Alternative
Threatened and Endangered Species Habitat Affected	ER2 would have no effect on the eight threatened and endangered species whose habitat is present in the project area and for whom a biological conclusion is required.	May affect but is not likely to affect adversely six of the eight threatened and endangered species whose habitat is present in the project area and for whom a biological conclusion is required. They are the piping plover under US Fish and Wildlife Service (USFWS) jurisdiction and the West Indian manatee, green sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, and shortnose sturgeon under National Marine Fisheries Service (NMFS) jurisdiction. There would be no effect on the turtles on land under USFWS jurisdiction.				
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 affected by sea level rise.	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 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.				

Comparison of Key Impacts (concluded)

	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 the Corolla Bay subdivision; changes in views along NC 12 at three locations - bridge terminus, 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.	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. However, the extent of development on the Outer Banks by 2035 would be the same with or without the bridge. 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.				

Appendix B

Preferred Alternative
Agency Meeting Handouts

Table of Contents

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties
STIP No. R-2576

Preferred Alternative Identification Information Package
Handout 23—August 10, 2010

As per the requirements of Section 10.2 of the Section 6002 Coordination Plan for the Mid-Currituck Bridge Project, this information package includes the following sections:

- An impacts comparison matrix (introduction on page 1 and the matrix beginning on page 2);
- Responses to substantive comments on the Draft Environmental Impact Statement (DEIS) that relate to selection of the preferred alternative (beginning on page 8); and
- Other pertinent information (beginning on page 17).

Impacts Comparison Matrix

The table on the following pages presents a comparison of key impacts for the five detailed study alternatives, ER2, MCB2/C1, MCB2/C2, MCB4/C1, and MCB4/C2. It is identical to Table S-1 of the DEIS except for changes to the threatened and endangered species material so it matches what is presented in DEIS Section 3.3.8. As responses to agency and public comments are developed, it is expected that the findings of this table will change. The No-Build Alternative would not involve construction of the proposed project and, therefore, would have no direct impacts to the environment.

Figure 2-1 from the DEIS follows the table and shows the location and features of the five detailed study alternatives.

Comparison of Key Impacts

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2	
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	
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
• Homes	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)
• Businesses	5 (2 with no third outbound lane for hurricane evacuation)	7 (5 with no third outbound lane for hurricane evacuation)		8 (6 with no third outbound lane for hurricane evacuation)		5 (3 with no third outbound lane for hurricane evacuation)		6 (4 with no third outbound lane for hurricane evacuation)	
• 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)
• Gravesites	66 (none with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)	36 (20 with no third outbound lane for hurricane evacuation)	35 (19 with no third outbound lane for hurricane evacuation)
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					Compatible		Compatible	

[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 clearance times is accomplished by reversing the existing center turn lane.

Comparison of Key Impacts (continued)

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2
Access Changes					
• Neighborhoods	Super-street would reduce number of 4-way intersections and limit direct access across US 158 in Dare County. Along NC 12, four street intersections would be closed to through traffic but not emergency vehicles (Widgeon Drive, Wood Duck Drive, Canvas Back Drive, and Old Squaw Road). 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 Harbor View 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 Harbor View 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.
• 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 in the Albacore Street area in Currituck County Outer Banks. With Option B, direct access from US 158 would be lost for customers of 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 customers of a gas station near the end of a frontage road.	Substantial changes in business access in the Albacore Street area in Currituck County. With Option B, direct access from US 158 would be lost for customers of a gas station near the end of a frontage road.	Minor except with Option B, direct access from US 158 would be lost for customers of a gas station near the end of a frontage road.

Comparison of Key Impacts (continued)

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2	
Natural Resource Impacts									
Water Quality Impact	Increased levels of highway runoff with 89.0 acres of increased impervious surface (53.4 acres without construction of a third outbound lane for hurricane evacuation).	Increased turbidity levels during Currituck Sound 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).				Increased turbidity levels during Currituck Sound 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).			
Natural Upland Biotic Communities Impact for Option A and Option B									
		Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B
• Fill in Natural and Naturalized Upland Communities[2]	85.3 acres	113.4 acres	121.7 acres	110.0 acres	118.4 acres	44.1 acres	52.4 acres	40.8 acres	49.1 acres
• Clearing Natural and Naturalized Upland Communities[2]	0.0 acre	2.7 acres	0.5 acres	2.5 acres	0.4 acres	2.7 acres	0.5 acres	2.5 acres	0.4 acres
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	14.5 acres		17.8 acres		14.5 acres		17.8 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							

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

Comparison of Key Impacts (continued)

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2	
Submerged Aquatic Vegetation (SAV) Impact									
• Existing SAV Shaded	0.0 acre	4.3 acres		5.5 acres		4.3 acres		5.5 acres	
• Existing and Potential (water depths < 6 feet) SAV Shaded	0.1 acre	14.5 acres		17.8 acres		14.5 acres		17.8 acres	
Permanent Wetland Impacts for Option A and Option B with and (without) a third outbound lane for hurricane evacuation[3]									
		Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B
• Fill	5.1 (4.6) acres	12.8 (12.4) acres	42.9 (42.4) acres	10.2 (9.8) acres	40.3 (39.9) acres	8.5 (8.1) acres	38.6 (38.2) acres	5.9 (5.5) acres	36.0 (35.6) acres
• Pilings	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre
• Clearing	0.0 acre	25.7 acres	0.3 acres	30.6 acres	5.1 acres	25.8 acres	0.3 acres	30.6 acres	5.1 acres
Total Permanent Impacts	5.1 (4.6) acres	38.6 (38.2) acres	43.2 (42.8) acres	40.7 (40.3) acres	45.3 (44.9) acres	34.4 (34.0) acres	38.9 (38.5) acres	36.5 (36.1) acres	41.0 (40.6) acres
Temporary Wetland Impacts	2.1 acres	1.7 (0.0) acres	1.7 (0.0) acres	1.7 (0.0) acres	1.7 (0.0) acres	2.1 (0.0) acres	2.1 (0.0) acres	2.1 (0.0) acres	2.1 (0.0) acres
Total Wetland Impacts	7.2 (4.6) acres	40.3 (38.2) acres	44.9 (42.8) acres	42.4 (40.3) acres	47.0 (44.9) acres	36.6 (34.0) acres	41.1 (38.5) acres	38.7 (36.1) acres	43.2 (40.6) acres
Total Coastal Area Management Act (CAMA) Wetland Impacts	0.7 acre	0.7 acre		2.2 acres		0.0 acre		0.0 acres	
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	0.9acre		0.9 acre		0.0 acre		0.0 acre	
• Pilings	0.0 acre	0.1 acre		0.2 acre		0.1 acre		0.2 acre	
• Clearing	0.0 acre	0.0 acre		1.5 acres		0.0 acre		1.5 acres	
Essential Fish Habitat Affected									
• Fill	1.8 acres	1.8 acres		1.8 acres		0.0 acre		0.0 acre	
• Pilings	0.0 acre	0.1 acre		0.2 acre		0.1acre		0.2 acre	
• Shading (water depths < 6 feet)	0.1 acre	14.5 acres		17.8 acres		14.5 acres		17.8 acres	
• Clearing	0.0 acre	0.0 acre		3.2 acres		0.0 acre		3.2 acres	

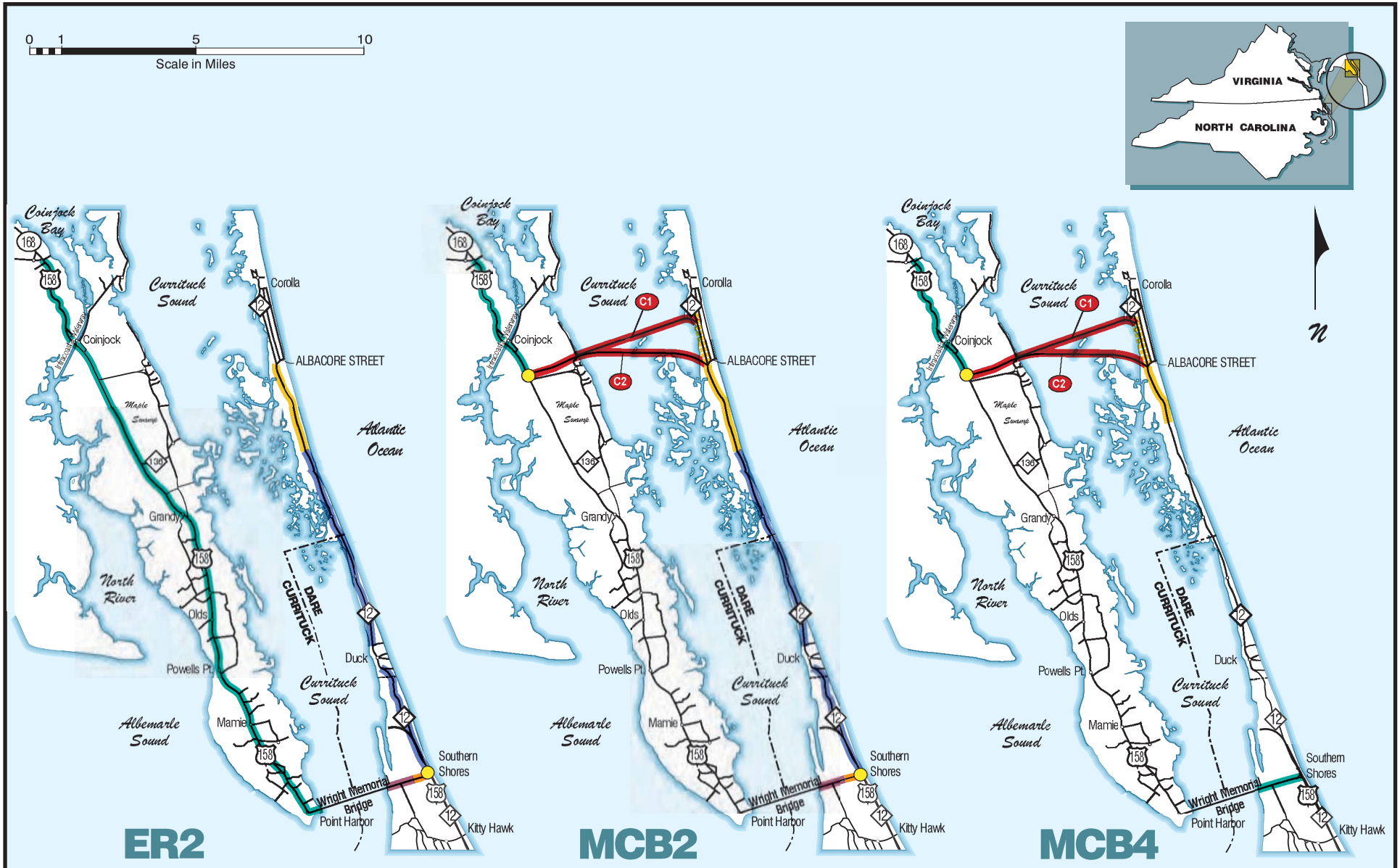
[3] The first number or numbers indicate the impact assuming the construction of a third outbound lane for hurricane evacuation. The number or numbers in parentheses is the impact if improving hurricane clearance times is accomplished by reversing the existing center turn lane.

Comparison of Key Impacts (continued)

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2
Threatened and Endangered Species Habitat Affected	ER2 would have no effect on the eight threatened and endangered species whose habitat is present in the project area and for whom a biological conclusion is required.	May affect but is not likely to affect adversely six of the eight threatened and endangered species whose habitat is present in the project area and for whom a biological conclusion is required. They are the piping plover under USFWS jurisdiction and the West Indian manatee, green sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, and shortnose sturgeon under National Marine Fisheries Service (NMFS) jurisdiction. There would be no effect on the turtles on land under US Fish and Wildlife Service (USFWS) jurisdiction.			
Other Physical Features					
Noise Impact	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.	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.		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.	
Accelerated Sea Level Rise	Existing roads affected by sea level rise.	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 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.			

Comparison of Key Impacts (concluded)

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2
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.
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.			
Indirect and Cumulative Effects	Forecast development would be the predominant contributor to cumulative impacts, irrespective of whether a detailed study alternative is implemented.	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. However, the extent of development on the Outer Banks by 2035 would be the same with or without the bridge. 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.			



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.

Detailed Study Alternatives

Figure

2-1

Responses to Substantive Comments on the DEIS that Relate to the Selection of the Preferred Alternative

Based on agency and public comments received, the NCTA foresees working with the participating and cooperating agencies on the following decisions associated with the selection of a preferred alternative and its design features:

1. Selection of the Least Environmentally Damaging Practicable Alternative (LEDPA); and

2. Selection of practicable design and construction avoidance, minimization, and mitigation strategies for the LEDPA.

In addition to the material in this handout, NCTA has distributed four additional handouts related to public and agency comments and NCTA's response:

1. Handout 20—Summary of Agency Comments on the Draft Environmental Impact Statement (includes copies of all agency and local government comments received related to the DEIS);

2. Handout 21—Summary of Public Participation and Comment;

3. Handout 22—Summary of Positions and Additional Needs; and

4. Handout 24—Financial Feasibility Assessment of the Mid-Currituck Bridge.

Selection of the Least Environmentally Damaging Practicable Alternative

Decisions involved in the identification of the LEDPA are:

- ER2 versus MCB2 versus MCB4;
- With the selection of MCB2 or MCB4, C1 versus C2; and
- Selection of a hurricane evacuation strategy.

ER2 versus MCB2 versus MCB4

Substantive public and agency comments related to the practicability of these alternatives relate to:

- Availability of funding.

  The US Army Corps of Engineers indicated that the funding aspect for this project as it relates to practicability weighs heavily in the decision process for the LEDPA.

Response: *The only programmed and reasonably foreseeable source of funding for improvements that would meet the purpose and need for the project includes toll financing. MCB4 can be funded in this manner through a combination of revenue bonds and private financing. Tolls and annual appropriations by the General Assembly of $15 million (as appropriated starting in 2008, increasing to $28 million on July 1, 2013) could be used to fund bridge construction, operation and maintenance costs, interest and other financing costs, and repayment of debt. Components of MCB2 that are common with MCB4 could be financed in the same manner. It is not practicable to finance ER2 with tolls since tolls cannot be applied to surface streets with unlimited access. The General Assembly also has passed legislation that prohibits the tolling of existing facilities. Toll revenue and General Assembly appropriations are not sufficient to fund the additional street improvements associated with MCB2. Handout 24 is also provided to demonstrate this financial feasibility finding.*

- Alternative preferences.

  In the agency comments, there is a general preference for ER2, which is viewed as having lower natural resource impact and less potential for induced development. Several agencies acknowledged the lack of funding with ER2 may not make it financially feasible. Local governments, including Currituck County, the Towns of Nags Head, Kitty Hawk, Southern Shores, and Duck, and the Albemarle Rural Planning Organization (RPO) all support building the Mid-Currituck Bridge and/or oppose widening existing roads.

  With the public, preferences are divided between the No-Build Alternative and MCB4. There is general opposition to widening NC 12, particularly in Dare County. Few supported ER2 or MCB2. Those who favor the No-Build Alternative are concerned a bridge will bring additional development, additional day visitors (particularly beach drivers), and crime to the Currituck County Outer Banks. They are concerned that the unique character afforded by the relative isolation of the Currituck County Outer Banks will be lost. They feel it is worth dealing with congestion in order to retain that character. Other reasons given for favoring the No-Build Alternative include cost, the perceived unreasonableness of making an improvement that is needed today only on summer weekends, and natural resource impacts. Those who favor MCB4 feel the bridge is the best way to address traffic congestion and hurricane evacuation and that both needs are important to address. Many of those who favor the bridge live or own homes along NC 12 in Southern Shores and Duck. Many of those who oppose the bridge appear to be permanent residents of the Currituck County Outer Banks or live in Aydlett (through which the mainland bridge approach would pass).

  Response: *Although ER2 may meet certain aspects of the project's purpose and need (although not as well as MCB2 or MCB4, as documented in Section 2.2 of the DEIS), it also would not be practicable because it would not achieve the transportation system and*

traffic movement pattern objectives of local and state governments. This is reflected in the lack of support of ER2 by local governments, as well as support for the bridge and/or opposition to widening NC 12 in the Coastal Area Management Act (CAMA) land use plans of Currituck County, Southern Shores, and Duck. The CAMA land use plan for Currituck County assumes that the bridge will be built and indicates that the bridge is needed to alleviate traffic congestion and to assist in hurricane evacuations. CAMA in their DEIS response letter made a provisional consistency determination that ER2 and MCB2 are not consistent with the Town of Duck 2004 Land Use Plan certified by the Coastal Resources Commission (CRC) on April 8, 2005. As documented in the DEIS, a Mid-Currituck Bridge is included in the North Carolina Department of Transportation's (NCDOT) 2009 to 2015 State Transportation Improvement Program (STIP), the North Carolina Intrastate System, the North Carolina Strategic Highway Corridor Plan, and the Thoroughfare Plan for Currituck County.

Given the above financial and preference factors, NCTA recommends MCB4 for selection as a part of the LEDPA.

C1 versus C2

Substantive agency comments related to the selection of C1 versus C2 indicate a general preference for Outer Banks terminus C1 because of less potential Currituck Sound and coastal marsh impact. With the public, preferences are divided between the two Outer Banks termini alternatives. Those who favor C1 generally do so because the C2 bridge terminus is in a commercial area and NC 12 in that area already carries substantial traffic. Those who favor C2 are concerned about community impacts associated with C1 and feel that a commercial area is the best place to add bridge traffic.

Response: *NCDOT met with Currituck County representatives on July 16, 2010 to discuss issues raised by the agencies and the public related to C1 and C2. Items of discussion associated with public comment on C1 and C2 included:*

- *C1—U-turn opportunities for Ocean Forest Court, providing access to a public street for the development at the north end of Harbor View, and provisions for pedestrians crossing NC 12 at North Harbor View.*

- *C2—Commercial displacement and eliminating left turns from the secondary driveway at the TimBuck II commercial center.*

One objective of meeting with Currituck County was to discuss how to avoid, minimize, or mitigate these concerns to the satisfaction of county representatives. The preference of the agencies for C1 and the reasons were relayed to Currituck County representatives. The county manager indicated that the county would like to see the concerns raised about C1 and C2 addressed, but did not object to either corridor.

Given the above factors, NCTA recommends C1 for selection as a part of the LEDPA.

Hurricane Evacuation Strategy

The agencies indicated no particular preference regarding hurricane evacuation. The US Environmental Protection Agency (USEPA) indicated that reducing hurricane evacuation clearance times in general is a desirable goal, but should be reasonably weighed against other costs, benefits, and adverse environmental effects. Public commenters either favor making no hurricane evacuation-related improvements (generally because of a belief that contemporary forecasting techniques would allow for evacuations to be ordered several days in advance) or reversing the center turn lane on US 158 to function as a third outbound lane (as opposed to building a new outbound lane). The latter is favored because of perceived lower cost and lower environmental impact.

Response: *A recommendation on a preferred hurricane evacuation strategy appears to be primarily dependent on three items:*

- *The desires of state and local emergency management officials who did not comment on the DEIS;*
- *The decision between ER2, MCB2, and MCB4 in that emergency management officials already have taken the position that reversing the center turn lane for 25 miles, as required by ER2, would not be logistically possible. This is because of numerous opportunities to enter and exit US 158 and the volume of staff and equipment required to attempt to manage such movements so that the center turn lane could make an effective contribution to northbound evacuation capacity.*
- *Public and agency comment.*

NCTA has scheduled a meeting with state and local emergency management officials for August 19 to discuss their preferences and will provide participating and cooperating agencies with the outcome of that meeting when NCTA proposes a recommended hurricane evacuation strategy. At this time, NCTA prefers reversing the center turn lane for selection as a part of the LEDPA.

Selection of Practicable Design and Construction Avoidance, Minimization, and Mitigation Strategies

Key issues involved in the development and selection of practicable design and construction avoidance, minimization, and mitigation strategies are:

- Crossing Maple Swamp on bridge or fill;
- Construction methods; and
- Stormwater management for a Mid-Currituck Bridge.

These issues relate to the implementation of MCB4. The NCTA plans to conduct additional impact assessment and work with participating and cooperating agencies to develop conceptual avoidance, minimization, and mitigation strategies for these three issues. The findings of this effort will be included in the Final Environmental Impact Statement (FEIS). This effort will be one part of NCTA's response to comments made by the public, local government, and environmental resource and regulatory agencies.

Crossing Maple Swamp on Bridge or Fill

Substantive agency comments related to crossing Maple Swamp on bridge versus fill are:

- A strong preference was expressed for bridging Maple Swamp (as included in Option A), with the exception of the Natural Heritage Program, which prefers Option B. Option A is viewed as having lower natural resource and hydrologic impacts.

- A suggestion to both bridge Maple Swamp and remove existing Aydlett Road, combining features of Option A and Option B, respectively.

- A request for additional assessment of hydrologic impacts on groundwater and the storm surge (100-year floodplain) when crossing Maple Swamp on fill. This assessment would include taking into account changes in swamp hydrology resulting from recent clear cutting in the swamp, any removal of muck and its replacement with compatible soil, and the effect of seasonal groundwater inundation on proposed wildlife crossings.

- Continued interest in the purchase of the landlocked parcels for wetland preservation credits, as well as wetland restoration or enhancement because of the effect of logging operations (rutting, log landings, compaction, and hydrology alteration) on the landscape.

- A request for a revised habitat impact assessment that takes into account recent additional logging within and adjacent to the bridge corridor.

- A request for additional information on how the restoration of Aydlett Road would be accomplished with Option B.

- A provisional CAMA consistency determination by the NC Division of Coastal Management that Option B is <u>not</u> consistent with the Currituck County 2006 Land Use Plan certified by the CRC on May 18, 2007 and amended on September 25, 2008 and June 24, 2009.

The focus of the public related to crossing Maple Swamp on bridge or fill related primarily to the closure of Aydlett Road, which accompanied the use of fill in Maple

Swamp with mainland approach Option B. Almost all commenters favor mainland approach design Option A because it would have less impact on the mainland community of Aydlett, place the toll plaza in an interchange at US 158 and retain Aydlett Road. Community impact concerns expressed at the hearing were reflected in the community impact assessment of the DEIS in Sections 3.1.2, 3.1.3, and 3.1.8. The option of fill in Maple Swamp (to reduce project cost) and retaining Aydlett Road (to minimize community impacts) was raised by the public as an option important to consider.

Currituck County commissioners also passed a resolution opposing a toll plaza in Aydlett and placing Aydlett traffic on the bridge approach road. It was included in Section 3.3 of the *Stakeholder Involvement for Draft Environmental Impact Statement Technical Report* included on the CD that was a part of the DEIS. The county also is concerned about the impact of fill in Maple Swamp on flooding.

Response: *In giving additional consideration to this design issue the NCTA plans to take into account the following considerations:*

- *The closing of Aydlett Road is unacceptable to the Aydlett community and Currituck County.*

- *Using fill in Maple Swamp would reduce the project cost by over $80 million dollars as indicated in Table 2-4 of the DEIS. The amount of funding available for the project and the cost-effective use of funds are important considerations. For example, the use of funds for a bridge across Maple Swamp could preclude other mitigation investments that might better serve the long-term preservation of the value and function of Maple Swamp. Clearly the value and function of Maple Swamp is at risk from further logging by its owners.*

- *A decision on how to cross Maple Swamp and related conceptual mitigation strategies will be made in association with participating and cooperating agencies and included in the FEIS. As a part of that discussion and for the FEIS, additional stormwater and groundwater hydraulic studies will be conducted by NCTA and the habitat impact assessment will be updated to reflect recent logging. This work will be completed in conjunction with decisions on how to cross Maple Swamp*

- *Avoidance, minimization, and mitigation strategies related to crossing Maple Swamp will be discussed with the participating and cooperating agencies in the context of available funding, decisions on construction techniques, a bridge stormwater management plan, and recreational features advocated to be part of the bridge and described in Section 2.1.11 of the DEIS. The goal would be the most cost-effective use of available funds to minimize environmental impacts project-wide.*

Construction Methods

Substantive agency comments on construction methods that relate to decisions on the details of the Preferred Alternative include:

- Construction techniques to be used in Currituck Sound need to be resolved, particularly as it relates to the need for and extent of dredging in Currituck Sound and an overall priority for minimizing disturbances to the bottom of the sound. SAV disturbance was a particular concern.

- Top down construction or an approach that does not require dredging should be used.

- Waiting until the permitting process to select final construction methods could result in substantial delay or denial of a permit.

- February 15 to September 30 moratorium on dredging activities.

The public generally did not comment on construction aspects of the project. Concerns raised related to community disturbance by equipment activity (including noise) and debris removal during construction. Information on community disturbance during construction also was requested by USEPA.

> ***Response:*** *NCTA understands the impacts resulting from dredging, but it was proposed in the DEIS and continues to be considered as a cost saving measure. Like Maple Swamp, impact avoidance, minimization, and mitigation strategies related to bridge construction will be discussed further with participating and cooperating agencies in the context of available funding, a bridge stormwater management plan, and recreational features advocated for the bridge and described in Section 2.1.11 of the DEIS, as well as the approach to crossing Maple Swamp. The goal is to identify the most cost-effective use of available funds while avoiding and minimizing environmental impacts project-wide.*
>
> *A decision on what construction technique or combination of techniques will be made for inclusion in the FEIS with associated impacts and conceptual mitigation strategies and commitments. Potential techniques were presented in Section 2.4 of the DEIS. Additional information related to construction techniques, including more information on the extent of dredging and comparative costs, will be presented for consideration by participating and cooperating agencies and in conjunction with decisions on construction techniques.*

Stormwater Management for a Mid-Currituck Bridge

Concerns related to the impact on Currituck Sound of automotive pollutants contained in bridge runoff were expressed by both the public and the agencies. Agency comments included:

- A concerted effort to address runoff from a new bridge should be initiated.

- The impacts to water quality are expected to be very significant. Water quality in Currituck Sound has declined substantially in the last several decades primarily because of an increase in turbidity and nutrient loading from non-point source runoff. The effect on water quality of untreated stormwater runoff from the bridge is a concern.

- Provide discussion of the NCDOT report prepared in accordance with Session Law 2008-107, Section 25.18, Stormwater Runoff from Bridges.

  Response: *The FEIS will include a conceptual stormwater management plan for the Mid-Currituck Bridge. It will be developed with input from participating and cooperating agencies. The strategy will take into consideration:*

  – *The findings of Section 2.1.7 of the DEIS.*

  – *The findings of the recently or soon-to-be released NCDOT report prepared in accordance with Session Law 2008-107, Section 25.18, Stormwater Runoff from Bridges entitled: Stormwater Runoff from Bridges, Final Report to Joint Legislation Transportation Oversight Committee In Fulfillment of Session Law 2008-107. Its findings include those of other bridge runoff characterization studies, stormwater control measures used in North Carolina and other states, the results of a bridge monitoring program to support the evaluation of bridge runoff effects, the effect of stormwater runoff from bridges, stormwater control measures (their effectiveness and cost and including a broader range of potential mitigation options than was presented in Section 2.1.7 of the DEIS).*

  – *Findings currently available from the US Army Corps of Engineers(USACE) on-going study of water quality in Currituck Sound, including the report released in February 2010 entitled Currituck Sound, North Carolina Ecosystem Restoration Feasibility Study: Feasibility Scoping Meeting Report and available on-line at: http://www.saw.usace .army.mil/Currituck/FSM/Currituck%20Sound%20FSM%20Report_February% 202010_FINAL.pdf.*

  – *Agency DEIS comments related to bridge runoff and the resources that could be affected.*

  Discussions related to bridge runoff mitigation will be a part of our September TEAC meeting. Matt Lauffer of NCDOT, who led the effort that produced the NCDOT report prepared in accordance with Session Law 2008-107, Section 25.18, will be invited to participate. Participating and cooperating agencies are encouraged to review the NCDOT and USACE reports before the September meeting. NCTA will post the NCDOT report on the TEAC web site. Additional material for this meeting will be provided in August, two weeks prior to the meeting.

Other Pertinent Information

The responses to comments above include descriptions of additional financial analyses and development of conceptual avoidance, minimization, and mitigation strategies that will be developed for substantive comments on the DEIS that relate to the selection of the Preferred Alternative. The responses include commitments to participating and cooperating agency involvement. Other public and agency comments made that are not presented above as substantive comments related to the selection of the Preferred Alternative are described in Handouts 20 and 21. Handout 22 lists additional design refinements requested or identified as appropriate based on comments, as well as additional impact assessment requested or identified as appropriate based on comments. These comments will be addressed in the FEIS, including additional analyses and commitments to conceptual mitigation strategies as appropriate.

Following the release of the FEIS and Record of Decision, NCTA expects that it will regularly coordinate with participating and cooperating agencies to finalize avoidance, minimization, and mitigation strategies for construction and operation as a part of final design and permitting for the project.

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties

STIP No. R-2576

Financial Feasibility Assessment of the Mid-Currituck Bridge Project Handout 24—August 10, 2010

In order to determine the financial feasibility of the Mid-Currituck Bridge project as a toll facility, the NCTA has estimated all costs related to the project. The expected term of the concession contract is 50 years, which will allow a private partner to participate in the financing and operations of a Mid-Currituck Bridge Project.

Project Construction Cost

As described in the Mid-Currituck Bridge DEIS (Section 2.3), the total cost range to construct each alternative was estimated. These costs including construction, environmental mitigation, right-of-way, and utility relocation:

ER2	**$416.1 to $523.4 million**
MCB2/C1	**$800.1 to $1,062.4 million**
MCB2/C2	**$802.4 to 1,065.1 million**
MCB4/C1	**$600.7 to $816.2 million**
MCB4/C2	**$595.5 to $808.6 million**

A probabilistic range was developed for each alternative considering the inherent variability in the estimating process. The following drivers will determine the final project construction cost:

- Inflation rates for materials
- Unit cost and quantities of materials
- Right of way costs
- Mitigation costs
- Utility relocation costs
- Engineering, design, and construction inspection costs
- Preliminary design level contingencies
- Toll collection methodology
- Hurricane evacuation treatment
- Interchange configuration
- Pavement design
- Bridge substructure
- Stormwater treatment
- Geometric improvements on NC 12 and US 158
- Construction methodology
- Recreational accommodations
- Others

Operations and Maintenance Costs

In order to finance the project a detailed operations and maintenance plan was developed. As described below the operations and maintenance costs will be paid using the toll revenues. Following is a listing of some of the major O&M items:

- Management of the concession
- Routine and Preventive Maintenance
- Bridge Inspection
- Bridge maintenance and repair
- Pavement maintenance and repair
- Bridge deck replacement
- Toll Operations management
- Toll Operations equipment maintenance and replacement
- Debris removal
- Drainage maintenance and replacement
- Traffic signals & ITS maintenance and replacement
- Roadway cleaning
- Cost of equipment
- Insurance
- Traffic incident Management

The estimated average annual O&M cost range: $8.7 to $10.4 million

The Net Present Value of all O&M cost during the project life has been estimated in a range of $140 to $160 Million.

Sources of Funds

The NCTA has identified two funding sources available for the alternatives considered in the Mid-Currituck Bridge Study Draft Environmental Impact Statement. The two funding sources identified are state appropriations and net toll revenues. Based on these two funding sources three financing techniques were analyzed. The three financing techniques are state appropriation bonds, toll revenue bonds, and private equity. The range of funds, available for project construction that could be obtained from these three financing techniques was calculated and presented below. A range was used because the exact amount cannot be calculated due to fluctuations in interest rates and other factors driven by the financial market. It is important to note that these funding sources are only available for a project that includes a tolled Mid-Currituck Bridge.

1. State Appropriation Bonds.

Based on the North Carolina "Current Operations and Capital Improvements Appropriations Act of 2010" as ratified by the NC General Assembly and signed by the Governor on June 30, 2010, the state will appropriate $15,000,000 annually **to be used to pay debt service or related financing expenses on revenue bonds or notes issued for the construction of the Mid-Currituck Bridge**. Therefore, this source of funds cannot be used to finance the option ER2. Effective July 1, 2013 the state appropriation amount will be raised to $28,000,000 annually. The amount of funds that could be obtained from this funding stream has been calculated assuming a forty year debt term. Forty years is typically the longest debt term that can be supported by this type of funding. After accounting for the bond financing costs and potential proceeds from the ability to invest the bond proceeds during the construction period a net bonding capacity range was calculated.

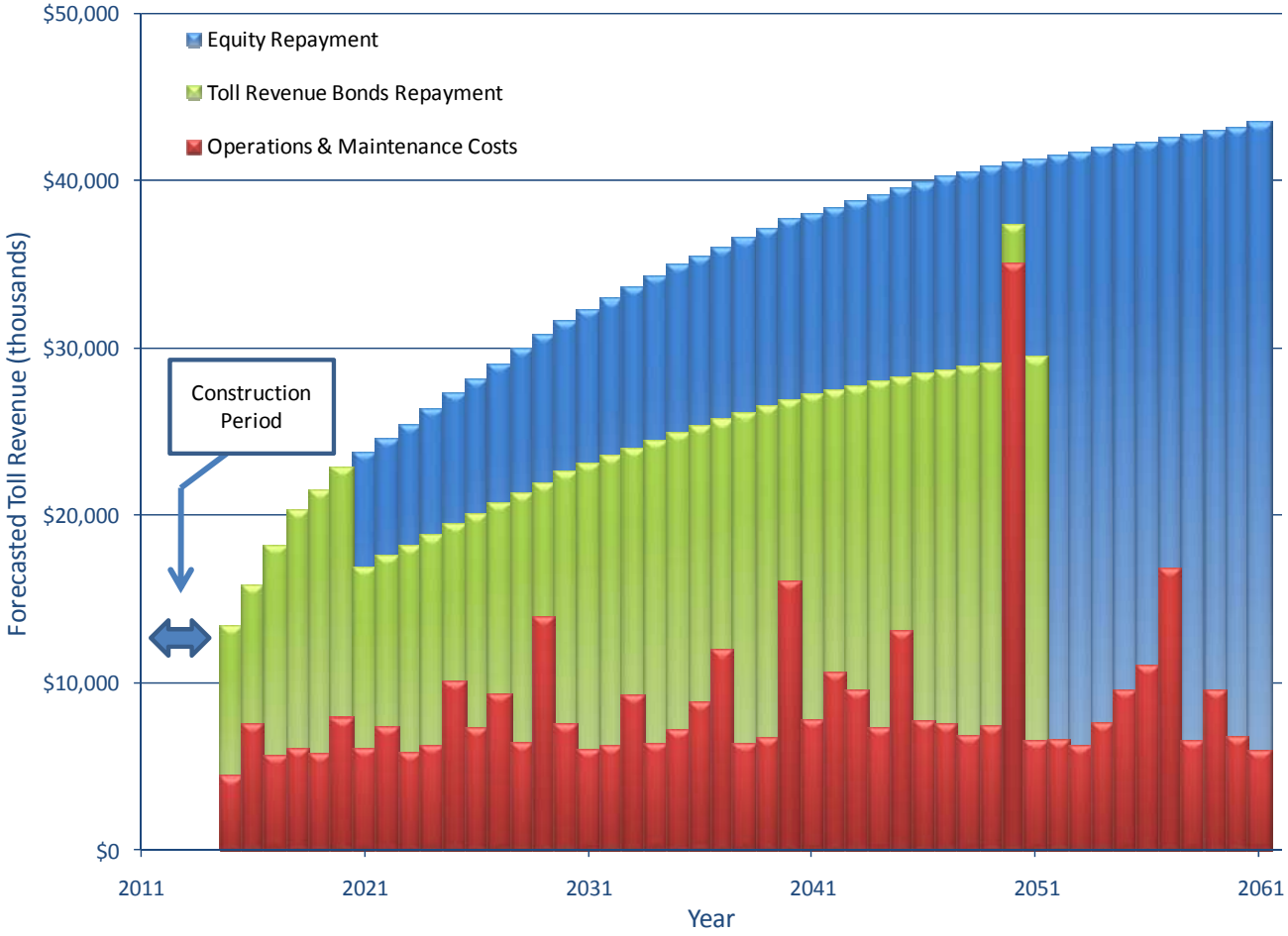
Estimated State Appropriation Bonds Capacity Range: $475 to $506 million.

2. Toll Revenue Bonds.

The "Mid-Currituck Bridge Traffic and Revenue Study, 2008 Update" completed by Wilbur Smith Associates and dated October 17, 2008 has been used to quantify the forecasted toll revenue of the Mid-Currituck Bridge project. The amount of debt that could be issued by the revenue bonds is calculated considering the cash flow to pay the yearly debt service (principal plus interest) that remains after the payment of the Operations costs. The revenue forecast considers 2015 as the project opening year to traffic, and it has been estimated through 2061. The estimated average revenues in dollars 2010 for the first ten years is $21 million per year; the revenues increase until reaching an average toll revenues of $34 million per year during the entire concession period. All the project operation and maintenance (O&M) costs during the concession period will be paid using toll revenues. An average of 30% of the revenues will be used to pay the O&M costs each year. The remaining toll revenue during the concession period will be used for debt repayment and payment of the equity return. The toll revenue bonds will be repaid during the first forty years and the majority of the private equity will be repaid during the last years of the concession period. (See the Uses of Toll Revenue graph below that explains the concept described in this paragraph.)

Estimated Toll Revenue Bonds Capacity Range: $87 to $122 million.

Uses of Toll Revenue

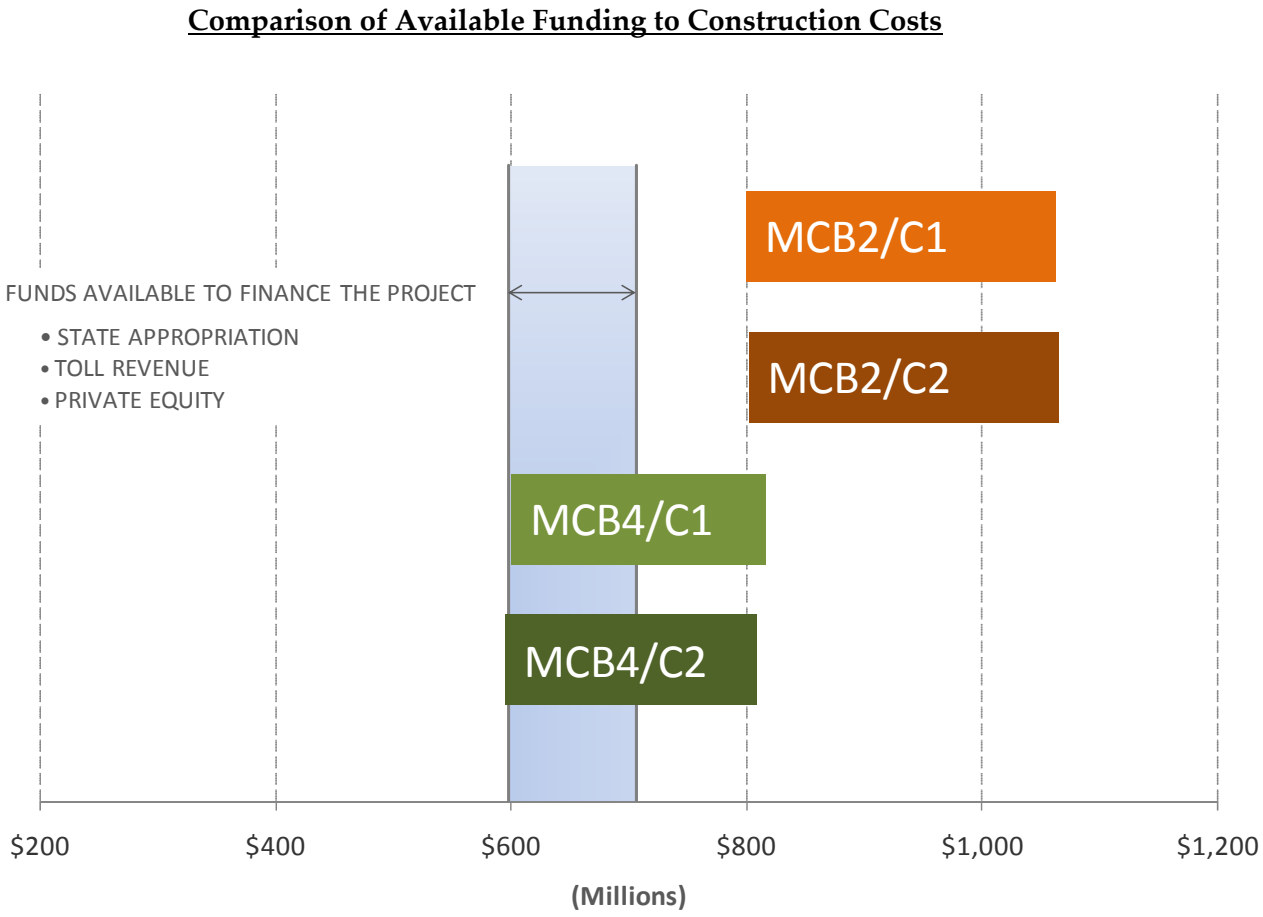


3. Private Equity.

The NCTA is considering a PPP (public private partnership) approach to finance, design, construct, operate, and maintain the project. The PPP approach assumes that a private partner will make a private equity investment to provide additional financing for the project. The amount of this investment will be based on the potential rate of return to the investor over the concession period. The private equity investment will be repaid using the toll revenue stream available after the payment of the O&M costs and the debt service of the revenue bonds. The first payment to the equity will begin 7 years after the project is open to traffic but the majority of the equity return will be paid during the final years of the concession period. (See the Uses of Toll revenue Graph above.) Based on the toll revenue funding stream and the assumed concession period of 50 years the net private equity range was calculated.

Estimated Net Private Equity Range: ***$36 to $79 million.***

Comparison of Available Funding to Construction Costs



Note: ER2 is not included in this graph because no funding is available for that alternative.

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties
STIP No. R-2576

Reasons for a Determination that ER2 is Not a Practicable Alternative to a Bridge across Currituck Sound
Handout 25—September 8, 2010

Criteria for Practicability and Applicability

From the perspective of relevant US Environmental Protection Agency (USEPA) regulations related to practicability:

- "No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." (40 CFR § 230.10(a))

- "An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." (40 CFR. § 230.10(a)(2)).

- "Where the activity is associated with a discharge which is proposed for a special aquatic site (i.e., wetlands) does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not water dependent), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise." (40 CFR § 230.10(a)(3)).

The key considerations associated with applying these regulations to the practicability of ER2 in contrast with MCB4 are:

- Will the project affect a special aquatic site (i.e., wetlands)? – **YES.**

- Is the basic project purpose (i.e., highway) water-dependent? In other words, does the project require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose? This criterion is based on the project's basic purpose, i.e., transportation, as opposed to the purpose defined in the Statement of

Purpose and Need. – **NO**. Highways are not considered water dependent because it is presumed that non-water dependent alternatives exist. (Northwest Bypass Group versus the US Army Corps of Engineers, 552 F. Supp. 2d 97 [D.N.H. 2008]; and Hoosier Environmental Council versus the US Department of Transportation, 2007 LEXIS 90840 [S.D. Ind. 2007]).

- Has the project proponent demonstrated that there are no practicable alternatives in light of overall project purposes? The overall purpose, based on the three purposes presented in the Draft Environmental Impact Statement (DEIS) of the Mid-Currituck Bridge project is to move traffic efficiently between mainland Currituck County and the Currituck County Outer Banks. Efficiency is defined in the DEIS's Statement of Purpose and Need as substantially reducing congestion, travel time, and hurricane evacuation clearance time. In terms of the practicability of ER2, this question asks whether, in light of the overall project purposes, is ER2 available and capable of being implemented in terms of cost, technology, and logistics? – The position of the North Carolina Turnpike Authority (NCTA) is **NO**.

  NCTA's "no" is based on ER2's lack of availability and capability of being built in terms of logistics. Cost is not a factor in this response since ER2 would cost less than MCB4, $416.1 to $523.4 million for ER2 versus $595.5 to $816.2 million for MCB4 as documented in Table 2-4 of the DEIS. Technology is not a factor since road building uses commonly applied technologies.

  ER2 is not logistically available and capable of being implemented for four reasons:

  1. It cannot be financed and no traditional funding is available;
  2. Widening NC 12 contradicts local and state plans;
  3. Local community opposition to widening NC 12 is strong; and
  4. Meeting the purpose and need of the project, as defined in the DEIS, is problematic.

  The remainder of this handout addresses the basis for these four reasons.

Reasons Why ER2 is Not Logistically Available and Capable of Being Implemented

It Cannot Be Financed and No Traditional Funding is Available

The NCTA has identified two funding sources available for the alternatives considered in the DEIS, state appropriations and net toll revenues. Based on these two funding sources, three financing techniques are planned, state appropriation bonds, toll revenue bonds, and private equity. The range of funds available for project construction that could be obtained from these three financing techniques was calculated and presented in

Handout 24. These funding sources are only available for a project that includes a tolled Mid-Currituck Bridge. They are not available for ER2 for the following three reasons:

1. Tolls cannot be used on local roads logistically or according to state law:

   Logistically, one cannot toll a road with driveways and connecting local streets because tolls can be evaded by using other streets. This reason would apply to ER2 in Southern Shores, where local residential streets could be used by NC 12 travelers to evade collection of tolls in Southern Shores. Also, NC 12 and US 158 serve numerous daily local trips and toll collection on these roads would result in persons paying tolls multiple times a day in the course of their daily routine. The only location on the road network where tolls logistically could be conceivably charged would be for trips across the Wright Memorial Bridge.

   However, the NCTA's enabling legislation says:

   – "The Department shall maintain an existing, alternate, comparable nontoll route corresponding to each Turnpike Project constructed pursuant to this Article." (G.S. § 136-89.197)

     There is no direct alternate route to US 158 and NC 12 for nontolled travel. One could say that US 64 might be representative of a free alternative route to the Outer Banks, but the circuitous route around Albemarle Sound would represent a substantial increase in travel time for most Wright Memorial Bridge users and is not in keeping with the intent of this requirement.

   – "The Authority Board is prohibited from converting any segment of the nontolled State highway system to a toll facility." (G.S. § 136-89.187)

     An exception to this rule has been contemplated to fund the reconstruction of I-95 in North Carolina. Also a short section of NC 540 in Wake County between NC 54 and NC 55 is currently free, but will be tolled as a part of the longer 18.8-mile Triangle Expressway. However, in both cases these are a fully access controlled roads that can be readily tolled and alternate highway routes exist (multiple alternatives in Wake County and US 301 parallels I-95).

2. State appropriations can only be spent by NCTA for a Mid-Currituck Bridge.

   Gap funding is authorized by the North Carolina Current Operations and Capital Improvements Appropriations Act of 2010 (Session Law 2010-31, "SL2010-31"). Pursuant to SL2010-31, an annual appropriation will be allocated from the Highway Trust Fund to the North Carolina Turnpike Authority to be "used to pay debt service or related financing expenses on revenue bonds or notes issued for the construction of the Mid-Currituck Bridge."

Based on SL2010-31, gap funding cannot be used to fund ER2 for the following reasons. First, the "gap funding" is allocated to NCTA. Pursuant to G.S. § 136-89.183, the 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 cannot 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 the 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. Even if NCDOT received the same amount as the gap funding, the additional funds would be subject to the equity formula in G.S. § 136-17.2A. Being subject to the equity formula would dilute the effectiveness of the funding.

3. Only the NC 12/US 158 interchange component of ER2 is in the *2009 to 2015 State Transportation Improvement Plan* (STIP).

   The enabling legislation for NCTA (G.S. § 136-89.183(a)2) says "A Turnpike Project selected for construction by the Turnpike Authority shall be included in any applicable locally adopted comprehensive transportation plans and shall be shown in the current State Transportation Improvement Plan prior to the letting of a contract for the Turnpike Project." As discussed below, the NC 12 widening component of ER2 contradicts local plans and local official and public opposition to widening NC 12 is strong.

Further, traditional highway funds are not available to build ER2. The STIP includes no traditional highway funds for R-2576 that could be used to build ER2. In addition, the reallocation of Division 1 funds to pay for ER2 is not a realistic proposal. In the current STIP, Division 1 is anticipated to get approximately $569 million in equity funds over a 7-year period. With an estimated cost in the neighborhood of $500 million, funding ER2 would require delaying or deleting most other projects in Division 1. The replacement of the Bonner Bridge at an anticipated cost of $300 million also is scheduled within this 7-year window. Thus, generating funding from the STIP for ER2 also would require the delay of the Bonner Bridge replacement.

Widening NC 12 Contradicts Local Plans

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 the NCDENR-DCM will not permit a planned development to be implemented.

ER2 would not be consistent with local CAMA plans as follows:

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

- The Division of Coastal Management, in their DEIS response letter, made a provisional consistency determination that ER2 is not consistent with the Town of Duck 2004 Land Use Plan certified by the Coastal Resources Commission (CRC) on April 8, 2005 because that plan calls for NC 12 to remain two lanes except in the downtown area where it is presently three lanes.

- The CAMA land use plan for Currituck County assumes that the bridge will be built as opposed to widening existing roads and indicates that the bridge is needed to alleviate traffic congestion and to assist in hurricane evacuations.

As noted above, only the NC 12/US 158 interchange component of ER2 is in the STIP. The *Dare County Thoroughfare Plan* (NCDOT, 1988) recommended widening the Wright Memorial Bridge to four lanes and improving US 158 from the bridge east to the US 158/NC 12 intersection. These two projects were completed during the 1990s. ER2 therefore represents a further improvement of US 158 beyond the work already completed. From the US 158/NC 12 intersection north to the Currituck County line, the 1988 plan originally recommended widening NC 12 from two lanes to three lanes, with paved shoulders for pedestrians and bicycles. This aspect of the 1988 plan was later dropped except in downtown Duck at the request of local officials.

Local Community Opposition to Widening NC 12 is Strong

A tabulation of comments received from unique individuals during the public review of the DEIS yielded 379 commenters either opposing ER2 or favoring an alternative that included a bridge. (See Handout 21.) Fourteen people favored ER2. While 88 stated that they opposed the Mid-Currituck Bridge, they tended to favor the No-Build Alternative over ER2. Overall in the comments, the stated preferences were more numerous than stated opposition in part because the comment sheet questionnaire emphasized preferences.

Local governments are unanimous in statements either opposing ER2 or favoring MCB4:

- During the DEIS comment period, the Town of Duck indicated they favor MCB4, and believes that ER2 would not meet the purpose and need for the project and would have a negative impact on the town.

- The Town of Nags Head passed a resolution during the DEIS comment period supporting MCB4. One reason given was that it would not require widening of NC 12 in Duck.

- The Town of Southern Shores board of commissioners passed a resolution during the DEIS comment period supporting MCB4 and rejecting the drainage improvements associated with ER2.

- On April 2, 2008, the Albemarle Commission adopted a resolution in support of a Mid-Currituck Bridge.

- In a March 19, 2008 letter, the Town of Duck supported a Mid-Currituck Bridge and indicated that widening of NC 12 through Duck "would be contrary to the efforts we have made to establish and maintain our Town's vision."

- On March 4, 2008, the Town of Southern Shores board of commissioners passed a resolution supporting a Mid-Currituck Bridge, financing the bridge through tolls, and opposing the widening of NC 12 in Southern Shores.

- On March 3, 2008, the Currituck County Commissioners adopted a resolution indicating their strong support of the construction of a Mid-Currituck Bridge.

- On April 9, 2008, the Town of Nags Head Board of Commissioners formed a Board consensus to support the recommendation of the NCTA on the proposed Mid-Currituck Bridge. The letter sent also included opposition to widening NC 12 north of US 158 and strongly encouraged NCTA to study bridge alternatives only.

Meeting the Purpose and Need of the Project is Problematic

All of the detailed study alternatives would meet the project purpose and need to varying degrees. Differences between the alternatives exist in terms of meeting the need for substantially improving traffic flow and substantially reducing travel time presented in Section 1.2 of the DEIS. Table 1 presents those differences for the detailed study alternatives. The percent in parentheses is the percent reduction from that with the No-Build Alternative. For all but two line items in the table, MCB4 achieves more than twice the reduction from the No-Build Alternative as ER2. As also shown in Table 1, MCB2 achieves further reductions but is the alternative with the greatest total environmental impact. It was agreed at the August 2010 TEAC meeting that it is not the Least Environmentally Damaging Practicable Alternative (LEDPA).

In terms of the need for reducing hurricane clearance times, all of the detailed study alternatives would meet this need equally well. ER2 is limited, however, in the approaches available for reducing clearance times. At a meeting of emergency management officials on August 19, 2010, participants indicated that reversing the center turn lane for 27 miles would be logistically unrealistic it terms of the personnel and equipment required to enforce the reversal so that it would operate safely. This also

was stated at earlier meetings with emergency management officials, as noted on page 2-32 of the DEIS. Emergency management officials also had concerns with the option of adding a third outbound lane, including its potential misuse when not needed for hurricane evacuation and its visual impact. ER2 would involve 25 miles of third outbound lane versus 7 miles with MCB4.

Finally, without funding for any of the ER2 components in the foreseeable future (see "It Cannot Be Financed and No Traditional Funding is Available" above), the lack of interest reflected in local plans for widening NC 12 (see "Widening NC 12 Contradicts Local Plans" above), and strong opposition from the community to widening NC 12, particularly in Dare County (see "Local Community Opposition to Widening NC 12 is Strong" above), ER2 could not meet the project's stated purpose and need because it could not be implemented in the foreseeable future, making its selection as the LEDPA equivalent to selecting the No-Build Alternative in terms of the travel service it could provide.

Table 1. Travel Benefits of Detailed Study Alternatives

	No- Build	ER2	MCB2	MCB4
2035 Traffic Flow Benefits				
Congested Annual Millions of Vehicle-Miles Traveled (VMT)				
• Total Congested VMT (millions)	66.1	51.4 (-22%)	31.4 (-52%)	40.2 (-39%)
• VMT with Traffic Demand at or Above Road Capacity (millions)	60.6	44.4 (-27%)	5.3 (-91%)	17.7 (-71%)
• VMT with Traffic Demand 30 Percent or Above Road Capacity (millions)	15.8	8.9 (-44%)	0.0 (-100%)	4.9 (-69%)
Miles of Road Operating with Traffic Demand at or Above Road Capacity				
• Summer Weekday (SWD)	14.7	5.9 (-60%)	0.0 (-100%)	5.7 (-61%)
• Summer Weekend (SWE)	43.5	39.0 (-10%)	4.8 (-89%)	11.7 (-73%)
• Weighted Average of SWD & SWE	22.9	15.4 (-33%)	1.4 (-94%)	7.4 (-68%)
Miles of Road with Traffic Demand 30 Percent or Above Road Capacity				
• Summer Weekday (SWD)	5.7	3.7 (-35%)	0.0 (-100%)	0.8 (-86%)
• Summer Weekend (SWE)	7.9	5.9 (-25%)	0.0 (-100%)	2.0 (-75%)
• Weighted Average of SWD & SWE	6.3	4.3 (-32%)	0.0 (-100%)	1.1 (-83%)
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 (-19%)	86 (-44%)	107 (-31%)
Summer Travel Time via Mid-Currituck Bridge (weighted average of SWD & SWE)	N/A	N/A	11	11

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties

STIP No. R-2576

Mid-Currituck Bridge Stormwater Management
Handout 26—September 8, 2010

Key Findings in NCDOT's "Stormwater Runoff from Bridges" Report Related to the Environmental Impact of Stormwater Runoff

In response to Section 25.18 of House Bill 2436, NCDOT established the Bridge Stormwater Project (BSP) multidisciplinary team to assess the effect of runoff from 15 North Carolina bridge decks over waterways on receiving streams. The BSP results were compared to available literature on bridge deck runoff and to the more extensive available literature on highway runoff to determine if, and under what conditions, bridge deck runoff may affect water quality. Upstream and downstream sediment of 30 bridge sites was evaluated for streambed chemistry to identify solids that could potentially enter receiving streams through bridge deck runoff. Bridge decks were also swept to determine the concentrations of various target organic and inorganic constituents that accumulate on bridges. In addition, bioassay samples were collected at 13 bridge sites and biosurveys were conducted at 15 bridge sites to determine the toxicity of bridge deck runoff and the biological health of the receiving waters. Median unit loads and annual loading rates for the 15 BSP bridge deck runoff monitoring sites were also measured and compared to roadway annual pollutant loading rates. A weight-of-evidence (WOE) approach was used to integrate the diverse, complicated, and variable interactions associated with episodic stormwater events and the water quality of receiving streams. The WOE approach uses best professional judgment to determine if the collective results from multiple monitoring methods support or do not support a conclusion of effect.

Study Findings

The bioassay, biosurvey water chemistry, and sediment chemistry data provide multiple lines of evidence that there is no conclusive specific cause of toxicity from bridge deck runoff. However the same data indicate the following:

- Periodic toxicity does occur and may result from ambient rainwater characteristics, the storm-related application of anti-icing or de-icing materials for safety concerns, or other unmeasured toxicants.

- Occasionally, the exceedance of water quality thresholds was not consistently correlated with the expression of toxicity in samples. The identification of several pollutants (dissolved and total copper, zinc, cadmium, lead, iron, manganese, aluminum, and mercury; total suspended solids; bis (2-ethylhexyl) phthalate; and nutrients) with concentrations above established thresholds from human health and aquatic criteria in a few samples indicate a potential for toxic effects from bridge deck runoff.

- As might be expected, the data collected for the BSP do not indicate that bridge deck runoff contributes to organic or nutrient enrichment stresses.

- Biosurveys of benthic communities do not indicate any significant statistical difference upstream and downstream of the bridges; however, downstream benthic habitats often were better quality and more diverse than those found upstream due to hydromodification from concentrated flow.

- Bridge sweeping solids were not found to affect streambed sediment quality, as evidenced by the similarities in sediment chemistry upstream and downstream of bridges. Both inorganic and organic constituents were found to exceed sediment quality benchmarks, including either one or both of threshold effect concentrations (TECs) and probably effect concentrations (PECs). It is difficult to ascribe an effect or no effect concentration to a specific chemical when present in a mixture, and variations in chemical speciation, bioavailability, or the mixture of chemicals present can influence the efficiency of the derived values from these studies.

- The BSP loading study found no compelling evidence that bridge deck runoff loads (event mean concentrations or annual loading rates) in North Carolina are higher in parameters typically associated with stormwater runoff as compared to stormwater runoff loads from other roadways.

In summary, the BSP team concluded that while several parameters-of-concern (POC) from bridge deck runoff did exceed site-specific surface water quality thresholds, the additional analyses and multiple lines of evidence associated with aquatic toxicity, biological assessments, and sediment chemistry data did not indicate long-term adverse impacts from untreated bridge deck discharges.

Linking Bridge Deck Runoff Results to the Mid-Currituck Bridge

While the BSP study results indicate that effects of bridge deck runoff are comparable to highway runoff, application of the BSP study results to the Mid-Currituck Bridge must keep in mind that none of the 15 monitored bridges were over estuarine waters.

Additionally, the species used for bioassays, *Ceriodaphnia dubia*, is a freshwater species common in lakes and larger rivers and is not likely to be found in the often brackish and sometimes seawater strength salinities of Currituck Sound (the species cannot survive salinities greater than 4 parts per thousand). Of the 30 bridges evaluated for streambed chemistry, two were in the Coastal Plain but neither of the two is over estuarine waters. None of the bridges used for biosurveys are in the Coastal Plain. The AADT (average annual daily traffic) volumes on the BSP and Mid-Currituck Bridge are comparable, with an average of 16,117 vehicles per day (vpd) for the BSP study and 12,600 vpd to 22,500 vpd (summer weekend daily traffic) projected for the Mid-Currituck Bridge in 2035. Long bridges in general, and long bridges over estuarine waters in particular, were not included in the main aspects of the study.

The BSP study is comprehensive and provides strong evidence that bridge deck runoff in freshwater systems is less of actual concern than it may be perceived to be. This may also be true of bridges over estuarine waters. However, many characteristics of estuarine aquatic environments are substantially different from freshwater environments. NCDOT is currently conducting additional research associated with bridges in estuarine conditions to supplement the BSP study (personal communication with Kathy Herring, NCDOT PDEA Biological Surveys Group, August 20, 2010).

Currituck Sound Bridge Stormwater Management Strategy

All waters in the project area are designated as "SC" under North Carolina's water quality classifications by the NC Department of Environment and Natural Resources – Division of Water Quality (NCDENR-DWQ). SC waters are defined by DWQ as all tidal salt waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; fish and noncommercial shellfish consumption; aquatic life propagation and survival; and wildlife. This is the minimal quality standard for saltwaters.

Currituck Sound in the project area is 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 one mile downstream of the Currituck Sound crossing. There are no Primary Nursery Areas (PNA) along the MCB4/C1 crossing of Currituck Sound. No Anadromous Fish Spawning Areas (AFSA) are crossed by the project.

The nearest coastal bridge to the proposed MCB4/C1 crossing of Currituck Sound is the four-lane Wright Memorial Bridge that carries US 158 across the southern end of Currituck Sound as it flows into Albemarle Sound. This bridge has direct discharge of bridge runoff into the receiving waters. Further to the south are the four-lane US 64 bridges over Croatan Sound and Roanoke Sound. These structures also have direct discharge of bridge runoff into receiving waters except over coastal marsh where waters are collected and piped off the bridge instead of direct discharge into these specific

receiving areas. The AADT volumes on the Wright Memorial Bridge in 2008 were approximately 26,000 vpd and on the US 64 bridges were about 18,000 vpd. Summer weekend traffic volumes on the Wright Memorial Bridge increase to around 50,000 vpd. The AADT for the Mid-Currituck Bridge in 2035 is 12,600 vpd. This volume increases to 22,500 vpd in 2035 under summer weekend conditions. The daily traffic volumes for the Mid-Currituck Bridge in the future are substantially lower than the volumes that currently use other coastal bridges in the area. These structures do not have any stormwater management provisions beyond the areas of coastal marsh.

For the proposed two-lane Mid-Currituck Bridge, the preferred stormwater management strategy will generally follow the same approach as other coastal bridges in the area that have higher volumes of traffic and additional travel lanes. Stormwater would be directly discharged into Currituck Sound except over coastal wetlands adjacent to the sound (these are not Coastal Area Management Act wetlands) on the east end of the MCB4/C1 alignment where runoff would be captured and piped off the bridge to an appropriate BMP (Best Management Practice) for treatment rather than being directly discharged into these wetlands. This capture of runoff would apply to the eastern most end of the bridge for approximately 590 feet.

Since this project is being developed as a toll facility and a public-private partnership, there is additional opportunity for bridge stormwater management. The NC Turnpike Authority (NCTA) and the private developer (Currituck Development Group – CDG) have agreed to provide equipment and personnel to clean the bridge deck surface more frequently than routinely done for other coastal bridges. NCDOT cleans bridge decks between two to four times a year. The US 64 Virginia Dare Bridge is cleaned four times a year. NCTA and CDG are strongly committed to a more frequent deck cleaning approach and this commitment would be included into the performance requirements that CDG would be required to meet during the operations period of the public private partnership (estimated to be 50 years). This aggressive cleaning program would include state of the art equipment for pollutant removal and frequency of use to ensure low pollutant discharge levels into Currituck Sound. One of the values of this approach is the collection of potential pollutants before they are suspended in water and can enter the water system.

The bridge deck cleaning equipment proposed for use on the Mid-Currituck Bridge is designed for maximum pollutant removal through the use of a state of the art bridge deck cleaner that uses both mechanical sweeping and vacuum technology in conjunction with water and/or air for the most efficient surface cleaning possible.

Advancement in street cleaning equipment in recent years has vastly improved the efficiency and effectiveness of this stormwater management strategy. Mechanical units are effective at removing large debris but less effective at smaller particles and pollutants. Vacuum units improved the removal of smaller particles and pollutants. Regenerative-air devices combine the mechanical sweeper with air pressure and a vacuum process to further the ability to collect materials and pollutants. Scrubbers and captive hydrology units use water and vacuum technology to further the efficiency of the process. The intent for the Mid-Currituck Bridge is to find the best and most effective technology that meets the needs of the project in removing pollutants from the bridge deck surface.

Research on pavement cleaning has shown that use of modern equipment with technology geared towards removal of a broad spectrum of pollutants has been effective if used frequently. Research has been focused in reducing the stormwater pollutants from roadway surfaces as part of the overall mix of runoff in urban settings. There is little specific research on bridge deck cleaning. Studies have shown urban roadway cleaning frequencies of monthly to bi-weekly as being most effective for pollutant removal. Tests have shown that greater than 90% of on-street pollutants can be removed with the more modern technologies and frequent use. Effectiveness of pavement cleaning on overall pollutant loadings in urban settings is limited because much of the pollutant runoff comes from outside the roadway. This however is not the case for the Mid-Currituck Bridge. Frequent use of appropriate bridge deck cleaning technology could be an effective stormwater management practice for this bridge as all pollutants are associated with the bridge deck and traffic alone. The initial plan is to clean the Mid-Currituck Bridge weekly following the peak summer weekend traffic period. Depending on the results of the cleaning process, the frequency of cleaning may be reduced or increased to achieve a reasonable performance result.

The estimated cost for providing this stormwater management strategy is approximately $1 million for purchase of the deck cleaning equipment and provision of the piping system over the coastal wetlands adjacent to the sound with appropriate BMP. Pipe maintenance on the east end of the bridge would be done adjacent to traffic for maintenance crews. Deck cleaning would be done from the motorized cleaning equipment. Periodic replacement of the deck cleaning equipment would be required approximately every 10 years, depending on the frequency of the cleaning activity.

Replacement equipment would be equivalent or better than the current cleaning unit. Annual operating costs would cover operator salary, fuel, and equipment upkeep/ repairs as well as routine maintenance on the piping system. Disposal of bridge debris would be in an approved landfill in accordance with local laws and regulations. Most manufacturers have alternative fuel vehicles using compressed natural gas, liquid natural gas, or liquid propane gas for the deck cleaning equipment.

Because NCTA would be entering into a legal concession agreement with CDG for operating and maintaining the Mid-Currituck Bridge, a condition of this agreement would be the satisfactory performance of the bridge deck cleaning in accordance with terms of the agreement. CDG would maintain the bridge deck cleaning equipment on-site near the toll facility. Appropriately trained personnel would be on-site to operate the equipment, as required. With the equipment and trained personnel on-site, additional deck cleaning could be done if necessary.

The Mid-Currituck Bridge and this aggressive bridge deck cleaning stormwater management approach would be an excellent opportunity for additional research on the effectiveness of bridge deck cleaning. NCTA, NCDENR-DWQ, and local universities should team to undertake a definitive study of this stormwater management approach for use on other long bridge toll projects.

Other stormwater management considerations were examined for use on the Mid-Currituck Bridge. Section 2.1.7 of the DEIS discusses three such options. The above preferred stormwater management strategy is one of the options (Option 3) but has been enhanced with the addition of frequent bridge deck cleaning. The proposed stormwater management strategy is the preferred option for the following reasons: 1) it is consistent with the findings of the NCDOT/USGS/NCDENR-DWQ study on stormwater runoff from bridges; 2) it complies with environmental requirements; and 3) it is the most cost effective solution. Neither of the other two options (discussed below) is included in this stormwater management strategy because they are not cost effective or practicable in comparison to the proposed wetland stormwater capture and deck cleaning strategy.

The first option considers establishing a central high point over Currituck Sound and draining the first inch of stormwater from the bridge to on-shore treatment facilities on both sides of the bridge. This approach would require an almost 80 foot high bridge, an extensive inlet and piping system, large on-shore treatment facilities, and additional bridge supports to carry the weight of the stormwater system. The construction and operating/maintenance cost for this system makes this approach impracticable and not worth consideration as a stormwater management strategy. Subsurface conditions and water depths in Currituck Sound make it unrealistic to consider constructing a bridge of this magnitude in this location. The cost to build this bridge would be more than double the current planned crossing of Currituck Sound. The practicality and cost of land adjacent to the bridge to accommodate the stormwater treatment facilities is another factor in the unreasonableness of this option. Maintenance activities would either be

through the inlets from the deck surface or through cleanouts under the bridge that would be accessed via a bridge snooper. Either way, maintenance crews would need to be adjacent to traffic to perform maintenance activities. Specialized maintenance equipment would be required for this cleanout process.

The second option considers using inlet based filtering devices on the bridge itself to capture and treat the first inch of runoff from each storm event. There would need to be approximately 275 units on the bridge. Based on the most current construction cost estimate, this approach costs approximately $12 million. The inlets must be cleaned out periodically and filtering devices replaced. Maintenance crews would be working adjacent to traffic to maintain these devices. Again, specialized equipment would be required. Current annual maintenance costs are estimated to be substantially more for this option than the preferred strategy at approximately $1.4 million per year. Additionally, the NCDOT/USGS/NCDENR-DWQ study of bridge runoff indicates that the benefits derived from this option do not justify its implementation and on-going maintenance costs.

Sources:

"Stormwater Runoff from Bridges: Final Report to Joint Legislation Transportation Oversight Committee", URS Corporation; NC Department of Transportation, US Geological Society, and NC Department of Environment and Natural Resources – Division of Water Quality; 2010

"The Role of Street Cleaning in Stormwater Management", Robert Pitt, Roger Bannerman, and Roger Sutherland; Environmental and Water Resources Institute of the American Society of Civil Engineers; Water World and Environmental Resources Conference, 2004

"Street Sweeping – State of the Practice", J.G. Schilling; Ramsey-Washington Metro Watershed District; June, 2005

"Residential Street-Dirt Accumulation Rates and Chemical Composition, and Removal Efficiencies by Mechanical- and Vacuum-Type Sweepers, New Bedford, Massachusetts", Robert F. Breault, Kirk P. Smith, and James R. Sorenson; Scientific Investigations Report 2005-5184; US Department of the Interior, US Geological Survey, 2005

"New Developments in Street Sweeper Technology"; Article 121, Technical Note #103 from Watershed Protection Techniques

"Sweeper Test Results Highlight Positive Impact of Sweeping on Reducing Storm Water Pollution"; Elgin Sweeper; January, 2008

"Clean Air, Clean Water: The Elgin Sweeper Guide to High Efficiency Sweeper"; Elgin Sweeper, 2010

"Parking Lot and Street Cleaning"; US Environmental Protection Agency Stormwater Menu of BMP's

"Storm Surface Water Plan 2003, Appendix M: Street Cleaner Evaluation"; City of Olympia Washington Public Works Department, July, 2002

"Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Basin", Neely L. Law, Katie DiBlasi, and Upal Ghosh; Center for Watershed Protection, September, 2008

"Draft Environmental Impact Statement: Mid-Currituck Bridge Study"; US Department of Transportation, Federal Highway Administration and the North Carolina Turnpike Authority; March, 2010

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties
STIP No. R-2576

Construction Methodologies for Mid-Currituck Bridge
Handout 27—September 8, 2010

Three basic bridge construction methods are under consideration for the Mid-Currituck Bridge across Currituck Sound. Methods under consideration include: 1) conventional bridge construction through the use of barges in the water with cranes mounted on the barges; 2) a temporary construction trestle adjacent to the new bridge for use by the contractor in building the bridge; and 3) top down construction where the bridge would be built from itself as it progresses. In reality, no one method would likely be used for the entire crossing of Currituck Sound because of site conditions and duration of construction. Instead, a combination of two or all three methods may be used in the building of the bridge. The extent of the use of the various methods depends on the relationship between construction methods, possible environmental effects, and potential permitting implications. The most economically feasible construction approach is a combination of barge-based and trestle construction with limited dredging along portions of the bridge alignment.

Barge-Based Construction

Conventional bridge construction methods over open water would include the use of barge mounted cranes to install the various bridge elements such as piles, caps, and beams. Given the shallow water depths in Currituck Sound, the use of heavy marine equipment would not be practical. However, lighter weight barges and cranes are a potential solution that could be effective for areas of deeper water (6 feet or greater) in Currituck Sound. Construction from the water allows multiple bridge activities to be progressing at the same time and generally is the fastest means of constructing the bridge.

Barge-based construction would provide the fastest and most economical bridge building solution of the three being considered. Dredging of shallow areas of Currituck

Sound along the bridge alignment is under consideration where submerged aquatic vegetation (SAV) is not present. Should dredging be permitted in Currituck Sound, this construction method could be used for a substantial length of the bridge crossing thereby maximizing the use of this effective bridge construction methodology.

Temporary Construction Trestle

Temporary trestle construction would involve the use of a work bridge that would be constructed parallel to the main bridge being built. This would be an efficient and proven construction method that would allow for multiple construction activities to be conducted concurrently or sequentially along the length of the work trestle. This method of construction would have additional temporary pile and shading impacts compared to top down construction. Temporary trestle construction would be slower than barge-based construction, faster than top down construction, and would eliminate the construction risk of single operations associated with top down construction (as explained on the following page).

Trestle-based construction could be used with either a narrow-width material supply trestle or a full-width construction trestle. The narrow-width material supply trestle would be approximately 16 feet wide. Because of site conditions, shorter spans along the main bridge would result (similar to those with top down construction). A full-width construction trestle would be approximately 34 feet wide. Because of the wider trestle, longer bridge spans would be possible for the main bridge (similar to those with barge-based construction).

Top Down Construction

Top down construction would involve construction of the bridge from itself as it advances across the open water. This is a sequential or assembly line approach to bridge building. Top down construction would reduce the amount of work to be performed from the water and would reduce construction effects in environmentally sensitive (wetlands and submerged aquatic vegetation) and shallow water areas.

This method would be slower and less flexible than more traditional construction methods as the bridge is built from one shore to the other or from the two sides and progresses to the middle. The opportunity for multiple construction activities would be

limited and the bridge elements (piles, caps, beams, deck) would be constructed in a set sequence, a single span at a time, prior to advancing construction operations to the next span. Typically this method would result in shorter spans with more piles in the water than the other methods.

Construction Methods Matrix

Seven possible combinations of construction methods have been considered for the 4.7 mile crossing of Currituck Sound along bridge corridor MCB4/C1. These seven possibilities are described on the matrix following this document and are depicted on the graphics that follow the matrix. The first two methods involve dredging along the bridge alignment on both the east and west sides of Currituck Sound in non-SAV areas. The third method only includes dredging on the west side of Currituck Sound. The remaining four methods involve no dredging. The matrix presents permanent and temporary impacts for each construction method along with the range of total project costs, bridge construction costs, project duration, and potential mitigation costs. A potential construction moratorium period for dredging has been factored into the construction schedule for the methods using dredging.

The first construction method is the most financially feasible, least costly, and fastest to construct. This method involves dredging along portions of the bridge alignment in conjunction with the use of trestle and barge construction. This method has the most construction related impacts (permanent and temporary) and highest mitigation costs of the seven methods evaluated. In contrast, the seventh construction method that uses top down construction for the entire length of the bridge is the most economically infeasible method, has the greatest project/construction costs, and the longest construction duration. The impacts and mitigation costs are nearly the same for construction methods 5, 6, and 7.

Pile Setup

Based on preliminary geotechnical investigations in Currituck Sound along the alignment of the proposed Mid-Currituck Bridge, it appears that pile installation would be relatively easy to achieve with minimal disturbance using steel pipe piles. Direct driving of the piles should be achievable without the aid of mechanisms such as jetting.

The bigger issue for construction (particularly top down construction) would be the time needed for the pile to “setup” before being

placed into use. The subsurface materials under Currituck Sound are such that once the pile is driven, the soils would need to rest to allow for sufficient resistance to develop between the pile and the soil (skin friction). It is this soil/pile resistance that gives the pile the strength to support the weight of the bridge and traffic.

The time for pile setup would vary depending on the location in Currituck Sound and more information will be learned on this matter as additional geotechnical tests are performed and analyzed. However, there are some homogenous characteristics in the nearly five miles across Currituck Sound such that pile setup time will be a substantial factor in the construction process.

In general, a larger pile would ultimately develop greater strength than a smaller pile of equal length in Currituck Sound because of the greater pile surface area for development of skin friction. However, the larger pile would have a longer setup time than a smaller pile because of greater soil resting time. The length of the pile and the soil characteristics surrounding the pile also affect the load carrying capacity of the pile. With additional geotechnical information and engineering analysis in conjunction with construction methodologies, an optimal balance between pile size/length, bridge characteristics such as span-length, and construction duration could be determined.

In areas of Currituck Sound where top down or temporary trestle construction methods might be appropriate (shallow water, SAV areas, and wetland areas), the use of several smaller piles with shorter bridge span lengths would be needed to optimize the construction schedule and economics of the bridge. In areas of Currituck Sound where traditional barge construction methods could be used (deeper water), fewer larger piles in conjunction with longer bridge spans would seem appropriate.

Pile setup times would vary from perhaps as little as two days to as long as 30 days to reach near ultimate pile capacity depending on pile size, type, shape, and location in Currituck Sound. No loads would be added to the pile while this setup process is taking place and testing would be required to analyze the pile load capacity before applying additional loads during construction.

Barge-based construction would be best relative to pile setup times. Pile installation/driving could proceed independently from other bridge construction activities and no temporary piles would be involved.

With temporary trestle construction, pile setup time would have some impact on the schedule primarily associated with the temporary piles for the trestle. However, with the trestle in place, pile driving for the main bridge could proceed while previously driven piles are developing strength. The use of the trestle would allow pile driving to be disconnected from other bridge building tasks. This is particularly true with the full-width construction trestle.

Pile setup times would have the greatest impact on the construction schedule for top down construction. The setup time would cause a delay in this assembly line construction process. Progress on placing bridge elements on the piles would be delayed and construction would be halted while piles develop needed skin friction and undergo testing.

Conclusions

The following conclusions and recommendations have been made based on this data relative to construction methods for building the Mid-Currituck Bridge across Currituck Sound:

- Barge-based construction should be used to the maximum extent practicable because of pile setup issues and to reduce overall construction costs and duration.
- Jetting of piles for installation should not be needed on the project based on currently available geotechnical information.
- Dredging in non-SAV shallow water areas would substantially reduce construction duration and construction costs. Dredging should be part of the construction approach for this bridge and would likely be subject to a time of year moratorium (February 15 to September 30).
- In SAV and wetland areas, temporary trestle construction should be used to reduce construction costs rather than top down construction.
- If dredging is not an acceptable approach for this project, then trestle (shallow water) and barge based (deep water) construction methods should be used (Method 4) to balance impacts, mitigation, duration, and costs.

Construction Methods Matrix – Currituck Sound Bridge along MCB4 – Option C1

Construction Method(s)	Non-SAV Dredging (East and West Side)		Partial Dredging (West Side Only)	No Dredging			
	Trestle + Barge	Top Down + Barge	Trestle + Barge	Trestle + Barge	Top Down (East Side) + Trestle (West Side) + Barge	Top Down + Barge	Top Down Only
Figure Number (next sheets)	Figure #1	Figure #2	Figure #3	Figure #4	Figure #5	Figure #6	Figure #7
Conventional Barge Construction Method (bridge length and number of spans)	21,300 feet / 4.03 miles 213 spans (100 feet per span)	21,300 feet / 4.03 miles 213 spans (100 feet per span)	14,700 feet / 2.78 miles 147 spans (100 feet per span)	12,300 feet / 2.33 miles 123 spans (100 feet per span)	12,300 feet / 2.33 miles 123 spans (100 feet per span)	12,300 feet / 2.33 miles 123 spans (100 feet per span)	0 miles
Temporary Trestle Construction Method (bridge length and number of spans)	**East Side:** 3,500 feet / 0.67 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Shallow water = 550 feet) 71 spans (50 feet per span)	0 miles	**East Side**: 10,150 LF / 1.92 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Shallow water = 7,200 feet) 203 spans (50 feet per span)	**West Side**: 2,400 feet / 0.45 miles in Shallow water 48 spans (50 feet per span) **East Side**: 10,150 feet / 1.92 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Shallow water = 7,200 feet) 203 spans (50 feet per span)	**West Side**: 2,400 feet / 0.45 miles in Shallow water 48 spans (50 feet per span)	0 miles	0 miles
Top Down Construction Method (bridge length and number of spans)	0 miles	**East Side:** 3,500 feet / 0.67 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Shallow water = 550 feet) 71 spans (50 feet per span)	0 miles	0 miles	**East Side**: 10,150 feet / 1.92 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Shallow water = 7,200 feet) 203 spans (50 feet per span)	**West Side**: 2,400 feet / 0.45 miles in Shallow water 48 spans (50 feet per span) **East Side**: 10,150 feet / 1.92 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Shallow water = 7,200 feet) 203 spans (50 feet per span)	24,850 feet / 4.7 miles (SAV = 2,800 feet) (Wetlands = 150 feet) (Open water = 21,900 feet) 497 spans (50 feet per span)
SAV Impacts Permanent (piles + shading)	# of piles: 280 / 0.03 acres Shading: 3.05 acres	# of piles: 280 / 0.03 acres Shading: 3.05 acres	# of piles: 280 / 0.03 acres Shading: 3.05 acres	# of piles: 280 / 0.03 acres Shading: 3.05 acres	# of piles: 280 / 0.03 acres Shading: 3.05 acres	# of piles: 280 / 0.03 acres Shading: 3.05 acres	# of piles: 280 / 0.03 acres Shading: 3.05 acres
SAV Impacts Temporary (piles + shading)	# of piles: 336 / 0.04 acres Shading: 2.19 acres / 5-8 months	0 acres	# of piles: 336 / 0.04 acres Shading: 2.19 acres / 5-8 months	# of piles: 336 / 0.04 acres Shading: 2.19 acres / 5-8 months	0 acres	0 acres	0 acres
Wetland Impacts Permanent (piles + shading)	# of piles: 15 / 0.002 acres Shading: 0.16 acres	# of piles: 15 / 0.002 acres Shading: 0.16 acres	# of piles: 15 / 0.002 acres Shading: 0.16 acres	# of piles: 15 / 0.002 acres Shading: 0.16 acres	# of piles: 15 / 0.002 acres Shading: 0.16 acres	# of piles: 15 / 0.002 acres Shading: 0.16 acres	# of piles: 15 / 0.002 acres Shading: 0.16 acres
Wetland Impacts Temporary (piles + shading)	# of piles: 18 / 0.002 acres Shading: 0.12 acres	0 acres	# of piles: 18 / 0.002 acres Shading: 0.12 acres	# of piles: 18 / 0.002 acres Shading: 0.12 acres	0 acres	0 acres	0 acres
Non Wetland and Non SAV Impacts (piles only)	# of piles: 907 / 0.25 acres	# of piles: 907 / 0.25 acres	# of piles: 1,308 / 0.25 acres	# of piles: 1,452 / 0.25 acres	# of piles: 1,452 / 0.25 acres	# of piles: 1,452 / 0.25 acres	# of piles: 2,190/ 0.25 acres
Non Wetland and Non SAV Impacts (dredging)	7,100 feet 29 acres 53,000 cubic yards	7,100 feet 29 acres 53,000 cubic yards	2,000 feet 11 acres 30,000 cubic yards	0	0	0	0
Total Project Cost Range for MCB4/C1 (millions)[1]	$611 to $754	$641 to $784	$651 to $794	$651 to $794	$691 to $834	$691 to $834	$741 to $884
Cost of the bridge over Currituck Sound (millions)	~$290	~$320	~$330	~$330	~$370	~$370	~$420
Potential Currituck Sound Mitigation Costs (millions)	$16.0	$15.0	$9.0	$3.5	$2.5	$2.5	$2.5
Project Duration	50 months	52 months[2] (assumes <2 days per pile for setup)	61 months	64 months	79 months	78 months	84 months
Potential Dredging Moratorium (February 15 to September 30)	Included	Included	Included	Not Applicable	Not Applicable	Not Applicable	Not Applicable

1 – Available project funding is between $600 and $700 million (Black). Project options that combine to more than the available resources are financially infeasible (Red). For most construction methods there are project options that are financially feasible (Black).

2 – Project duration and cost are directly related to the length of time required for pile setup. The assumed two days is likely the shortest setup time. Longer pile setup times will extend the project duration and increase the project cost.

NON-SAV DREDGING (EAST & WEST SIDE)

Figure # 1

TRESTLE + BARGE

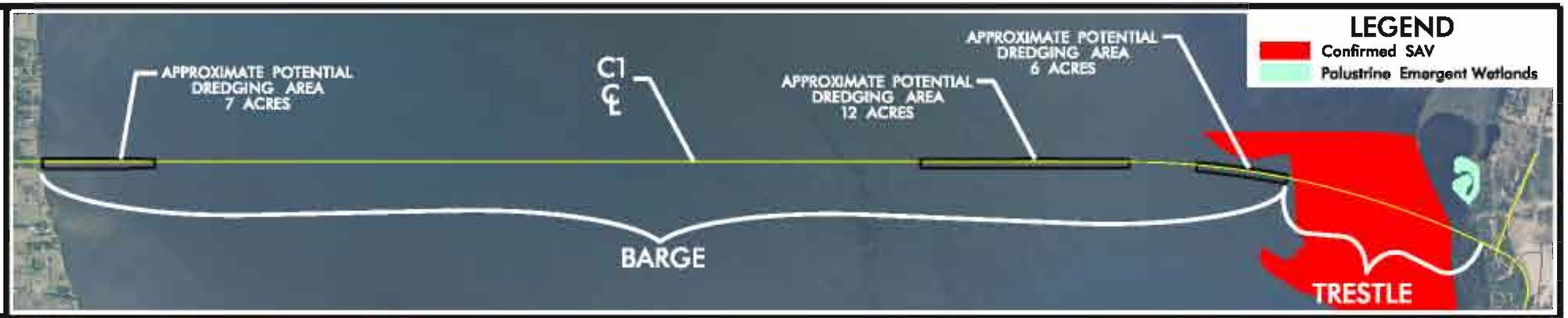
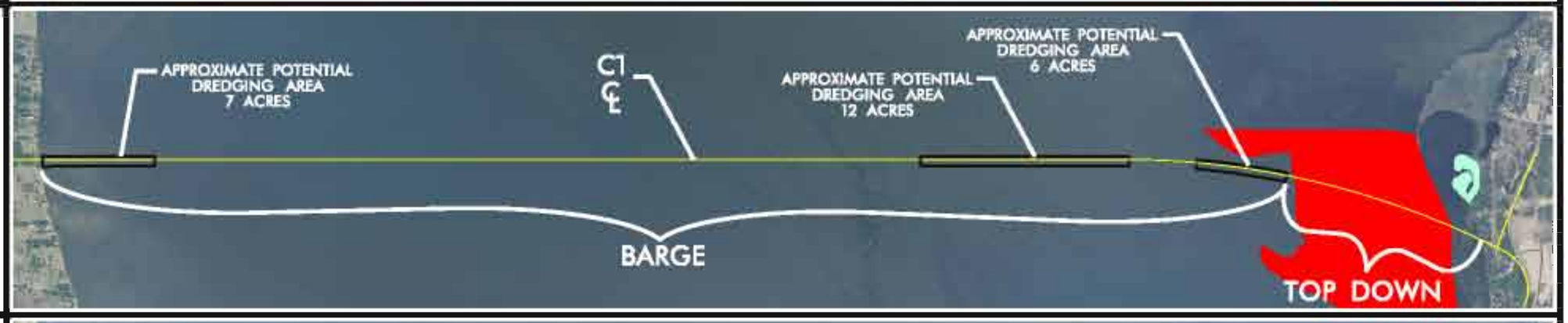


Figure # 2

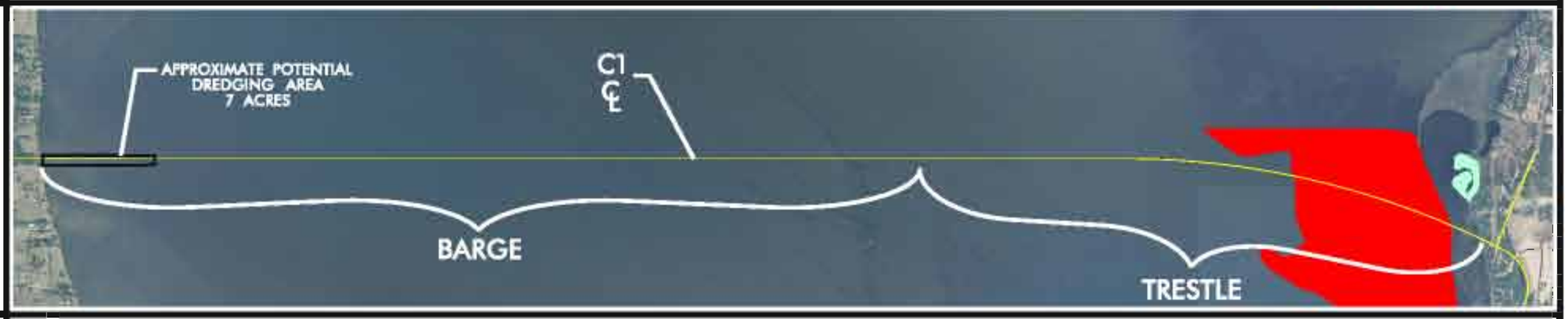
TOP DOWN + BARGE



PARTIAL DREDGING

Figure # 3

TRESTLE + BARGE



NO DREDGING

Figure # 4

TRESTLE + BARGE

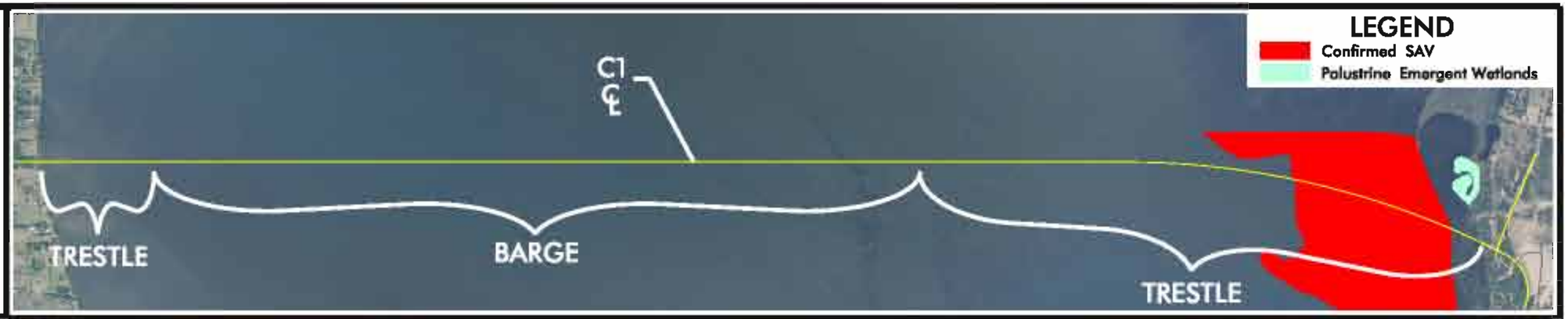


Figure # 5

TOP DOWN (EAST) + TRESTLE (WEST) + BARGE

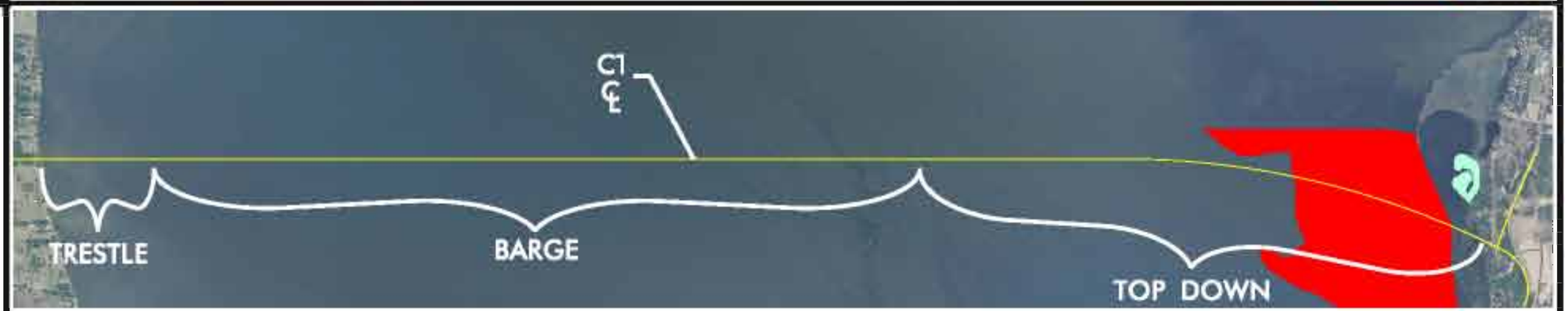


Figure # 6

TOP DOWN + BARGE

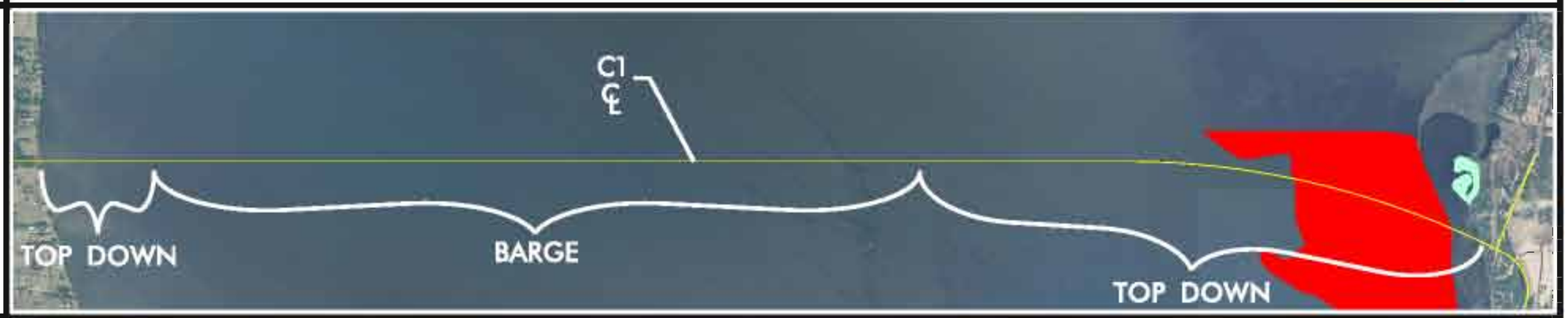


Figure # 7

TOP DOWN ONLY

NORTH CAROLINA
Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties
STIP No. R-2576

Assessment of Maple Swamp Groundwater System
Handout 28—November 2, 2010

Summary

Professional groundwater hydrologists reviewed available data regarding the groundwater system of Maple Swamp in Currituck County, North Carolina. Because of the very flat topography within the swamp, existing groundwater levels likely show only minimal elevation changes, and groundwater flows consequently are quite small. Assuming that the proposed Mid-Currituck Bridge Project is designed and constructed with appropriately sized culverts and/or bridges to adequately maintain surface water hydrology in Maple Swamp, existing groundwater flows and levels in the swamp essentially should be unaffected by fill in Maple Swamp.

Background

At the western (mainland) extents of the project, the proposed Mid-Currituck Bridge approach would cross a wetland area called Maple Swamp. One project alternative—Option B— assessed in the Draft Environmental Impact Statement would involve placing embankment fill in Maple Swamp to support the roadway, which extends from US 158 on the west across Maple Swamp to another topographic ridge in the east, near the community of Aydlett. Attached Figure 1 depicts the location of the proposed project across Maple Swamp, as well as the approximate limits of Maple Swamp.

As part of the environmental considerations for the project, questions have been raised by environmental resource and regulatory agencies regarding the potential effects of fill in Maple Swamp on existing groundwater hydrology within Maple Swamp. To address this issue, this handout presents a conceptualization of the Maple Swamp groundwater system, and an assessment of the likelihood for impacts on groundwater hydrology by new fill and other recent anthropogenic activities.

Maple Swamp Groundwater Hydrology

Site Topography

The project area is at the eastern limit of the Coastal Plain Physiographic/Geologic Province of North Carolina (CDG, 2009). The area generally consists of subdued topographic features (i.e., north-south oriented paleo-shoreline beach ridges) and relatively flat, low-lying terrain. This general topography can be seen in Figure 2, which depicts ground surface elevations in the area of the project west of Currituck Sound, including the relatively flat Maple Swamp bordered on either side by ridges.

As seen in Figure 2, the area of Maple Swamp to be crossed by the proposed project is very flat between the two flanking ridges, with a nearly constant ground elevation of approximately 2 feet above mean sea level (feet msl) for the entire east-west width of the swamp. The elevation in the middle of the swamp may be slightly lower than at the edges, but this potential difference appears to be at most on the order of inches. In a north-south direction, Maple Swamp very gradually slopes from the south (at approximate elevation 6 feet msl, near Macedonia Church Road) to the north (at approximate elevation 0 feet msl, adjacent to Currituck Sound). The ground surface topography of Maple Swamp and surrounding areas has a significant influence on the shallow groundwater flow system, as described below.

Regional Geological Setting

The regional geological setting near the proposed project has been described in various studies (e.g., Smith, 2003; Mallinson et al., 2005; Parham et al., 2007; CDG, 2009). In general, the uppermost geological units beneath the Maple Swamp area include the shallow aquifer system, the Yorktown confining unit, and the Yorktown aquifer. These aquifer layers are sedimentary in nature, deposited and eroded in generally horizontal strata over previous geologic ages through the action of stream flow, sea-level fluctuation, and other geological processes.

The shallow aquifer system is generally unconfined, and the water table forms the effective top of the aquifer. This shallow aquifer, which is comprised mainly of fine to medium-grained sands interbedded with layers of clays and silts, extends from ground surface to a maximum depth of approximately -95 feet msl at the project location across Maple Swamp (CDG, 2009). A thin layer of organic peat, ranging from approximately 0.5 to 2-feet thick, is present throughout most of Maple Swamp at ground surface above the surficial sands. According to the Phase 1A preliminary geotechnical investigation for the project (CDG, 2009), multiple borings along the proposed Maple Swamp crossing location showed a 10 to 20-foot-thick, possibly continuous clay layer between elevations of approximately -50 and -70 feet msl. This semi-confining feature may tend to isolate the upper 50 feet or so of shallow soils, confining the denser sands below and perhaps creating upper and lower flow zones in the shallow aquifer system.

Beneath these shallower interbedded sand and clay soils lies the Yorktown confining unit, which is described as a series of coalescing clay layers at or near the top of the Yorktown Formation (Smith, 2003). At the project location near Maple Swamp, the various references reviewed indicate that the Yorktown confining unit may be about 50-feet thick, extending from approximately elevation -95 feet msl down to -145 feet msl. Locally, this layer will provide good confinement between the shallow aquifer system and the deeper Yorktown aquifer. On a regional scale, the Yorktown confining unit is somewhat leaky and can allow vertical flow between these two aquifer systems (Smith, 2003).

The Yorktown aquifer is composed of the predominantly sandy deposits of the Yorktown Formation. The thickness of the Yorktown aquifer varies, but is approximately 100 to 200-feet thick in Currituck County. On a regional scale, the Yorktown aquifer generally thickens toward the east. Also, the top of the Yorktown Formation tends to be higher in the north than in the south, ranging from approximately -60 to -80 feet msl near Virginia Beach, to approximately -95 feet msl near the project site, and down to approximately -170 feet msl further south near Albemarle Sound (Smith, 2003; CDG, 2009).

Conceptualization of Maple Swamp Groundwater Flow System

The shallow, unconfined aquifer underlying Maple Swamp is the most critical aquifer with regard to wetland function and water levels. The deeper Yorktown aquifer is a more regional-scale feature, and because it is confined has less direct bearing on water levels in the swamp.

In general, groundwater flow patterns in the shallow aquifer of Currituck County are a reflection of surface topography. Toth (1963) defined local, intermediate, and regional groundwater flow patterns resulting from undulating topography as follows (see Figure 3):

- Regional flow patterns are defined by deep, long concentric paths from the watershed divides to the farthest extent of the discharge areas
- Local patterns are shallow, short concentric paths at the nearest edge of the discharge areas
- Intermediate flow patterns are the concentric paths between

The above description should apply well to groundwater flow patterns in the area of the project. The shallow aquifer near Maple Swamp is recharged by local precipitation. The higher-elevation sand ridge features allow precipitation to infiltrate readily, and groundwater percolates downward to the water table. The water table tends to mound beneath the sand ridges, and the mound forces freshwater to flow downward and outward toward the nearest surface water feature (e.g., river, discharging wetland, or sound).

The groundwater in the shallow aquifer is fresh (i.e., non-saline) beneath the higher recharge areas, until it discharges into and mixes with brackish water in the low-lying tidal rivers, bays, and sounds. According to data reported by Caldwell (2001), salinity measurements in Currituck Sound and its tributaries tend to vary over about one order of magnitude, but typically average approximately 2 parts per thousand, or about 5 percent of the salinity of seawater. Under normal conditions, it is expected that the majority of groundwater in Maple Swamp—particularly in the upper/southern portion of the swamp—is likely to be fresh as a result of the inflow of recharge from the surrounding ridges. Groundwater in the extreme northern end of the swamp closer to Currituck Sound might be somewhat brackish due to mixing, tidal influences, or periodic storm surges.

A conceptual model of groundwater hydrology in Maple Swamp was developed based on review of currently available information. The Toth conceptualization (Figure 3) provides a reasonable representation of regional and local groundwater flow patterns in the Coastal Plain province. More specifically at the location of Maple Swamp, conceptual hydrogeological sections were developed to depict graphically the conceptualization of typical groundwater levels and flow patterns in the swamp.

In profile view, two conceptual hydrogeological sections were prepared: one in a general east-west direction across Maple Swamp along the proposed project alignment (Figure 4); and another oriented approximately north-south, covering the roughly 6-mile length of the swamp from Macedonia Church Road in the south to Currituck Sound in the north (Figure 5). The approximate locations of these two sections are shown in plan view on Figure 1.

As seen in Figure 4, the water table of the shallow aquifer system near the project is expected to be highest beneath the two ridge features flanking Maple Swamp. The ridge to the west carrying US 158 is sometimes referred to as the Land of Promise Ridge, and the one to the east is called Powell's Ridge or Currituck Bluff (CDG, 2009). At this location within Maple Swamp, water table normally is present just slightly below ground surface at the east and west edges of the swamp, and often intersects ground surface in most of the middle area of the swamp. This likely results in periodic standing water in the center areas of the swamp and subsequent surface water discharge from the swamp via sheet flow northward into Currituck Sound.

For the east-west section (Figure 4), shallow aquifer groundwater flow is generally downward beneath the ridge mounds, then outward from the mounds in a horizontal direction, then finally upward into surface discharge areas, including the North River, Great Swamp, Maple Swamp, and Currituck Sound. Depending on the level of confinement provided by the shallow clay layer and the deeper Yorktown confining unit, groundwater flow in the deeper aquifer units may either conform to the above general description of concentric flow in the shallower soils, or may take a more regional

west-to-east flow direction toward Currituck Sound and the Atlantic Ocean (as suggested by the flow arrows in the figure).

In the north-south section (Figure 5), typical groundwater levels in the swamp will closely follow the natural shape of land surface, gradually sloping from south to north. As shown in the figure, water levels in the upper (southern) reaches of the swamp are likely to be a small depth below ground surface, while groundwater levels in the lower (northern) reaches of the swamp are expected typically to intersect ground surface. The flow gradient is oriented from south to north, but is quite small.

It is important to note that groundwater levels fluctuate based on precipitation amount, season of the year, and other factors. Water table levels tend to be higher during the wet season and following significant precipitation events, and lower during extended periods of dry weather. The water table elevations depicted in Figure 4 and Figure 5 represent one conceptualization of typical groundwater levels. Actual absolute water levels during the year could be higher or lower than those shown; however, the relative elevations shown in the sections are believed to be reasonably representative.

In summary, based on the above conceptualization, it is expected that groundwater primarily will flow into the swamp from the adjacent ridges on the east and west, and then slowly flow out of the swamp from south to north into Currituck Sound. Direct rainfall onto the swamp may contribute some additional inflow to groundwater, but this is expected to be a very small volume due to the organic surface soils, high water table (i.e., if water table is at land surface, rainfall cannot infiltrate and must run off), sheet flow discharges, and evapotranspiration.

Estimated Groundwater Flux through Maple Swamp

To complete an assessment of the potential for impact to Maple Swamp groundwater hydrology, it is useful to have an idea of the magnitude of existing groundwater flow through the swamp. A rough calculation can be made using Darcy's law in one-dimension (Bear, 1972):

$$Q = K A (h_1 - h_2) / L$$

where Q = volumetric flow rate [L^3T^{-1}]
K = hydraulic conductivity [L^1T^{-1}]
A = aquifer cross-sectional area [L^2]
$(h_1-h_2)/L$ = flow gradient, or head difference divided by aquifer length [L^1L^{-1}]

In the case of Maple Swamp, it can be assumed that approximately the upper 50 feet of the shallow aquifer system above the semi-confining clay comprises the effective subsurface groundwater flow system affecting swamp hydrology. Horizontal hydraulic conductivity values ranging from 1 to 50 feet per day are typical for fine to medium sands, while silts and clays (which are interbedded in the shallow aquifer) have much

lower hydraulic conductivities. For this calculation, a typical average hydraulic conductivity value of 20 feet per day is assumed based on the results of various aquifer tests and groundwater flow model calibrations completed in the shallow aquifer in this general region (Smith, 2003). In addition, an approximate cross-sectional area of 250,000 $feet^2$ (50-feet thick X 5000-feet wide) and flow gradient of 0.000125 (4 feet water table decline over 32,000-foot-long swamp) are assumed for Maple Swamp.

Using these assumed values, an estimate of the typical groundwater flux through Maple Swamp is computed as 625 $feet^3$/day, or 0.007 cubic feet per second (cfs). This estimate provides an indication of the relative scale of bulk groundwater movement through Maple Swamp. This approximate groundwater flow rate is orders of magnitude smaller than surface water flow rates expected in the swamp due to rainfall events, storm surges, and even sheet flow from the water table intersecting land surface.

Assessment of Groundwater Impact Potential

The above conceptual understanding of the groundwater flow system in Maple Swamp was used to complete an assessment of the expected likelihood of impacts because of the proposed project. The assessment is presented below as a series of questions of concern, followed by answers based on the conceptual modeling.

1. ***What likely effect may the proposed Mid-Currituck Bridge fill crossing (Option B) have on the groundwater hydrology of the swamp?***

A conceptual profile of the proposed fill crossing is depicted in attached Figure 6. As seen in the figure, the proposed design would include embankment fill placed in Maple Swamp between the two adjacent sand ridges. As currently proposed, construction also would include the undercutting and removal of approximately 0.5 to 2 feet of soft top soils, to be replaced by compacted granular fill. To allow for the passage of wildlife, two bridged overpasses and three culverts also are proposed for this option.

From a hydrologic perspective, the primary area of possible impact of the proposed project would be to the surface water flow system in the swamp from the proposed fill rather than to groundwater flows. However, impacts to the surface water flow system also are not expected to be substantial with proper design of the bridges and/or culverts (including culverts or pipes beyond those identified for wildlife passage) that will be included in the design across the swamp. If the proposed fill section were to be extended entirely, or mostly, across the swamp, it could act as a dam and potentially restrict surface water flows in the north-south direction. But proper design will mitigate this impact to a satisfactory level and allow surface water flows past the embankment fill. Assuming that the constructed project adequately maintains surface water hydrology in the swamp, groundwater flows and levels in Maple Swamp essentially should be unaffected.

As evidenced by the estimate of typical flux, groundwater flow rates through the swamp likely are much smaller than surface water flow rates and therefore less significant. Furthermore, groundwater flow through the swamp is primarily from south to north via the roughly 50 feet of shallow aquifer soils beneath ground surface. The placement of fill above this aquifer layer should not impede the normal flow of groundwater through the swamp. A very small portion of native soils at the proposed fill would be removed and replaced with granular soils. The hydraulic conductivity of these emplaced soils is not expected to differ greatly from the native soils (if anything, conductivity of the fill material could be greater than the organic peat and fine-grained materials near the surface), and these new fill soils would only influence a very small top portion of the groundwater aquifer cross-sectional area. As a result, the potential for this fill material to affect north-south groundwater flow is felt to be negligible.

One possible effect of the proposed fill could be to create a situation where the emplaced soils act as a French drain, allowing groundwater to flow from the east and west fringes toward the center of the swamp. This would be most likely to occur if the swamp was particularly valley-shaped and the fill material was highly conductive. Because existing ground surface is so flat across the entire east-west extent of Maple Swamp at the project location, it is felt that the potential for this effect is small. Even so, this minor possibility of increased groundwater drainage toward the center of the swamp as a result of wicking action of the granular fill material could readily be prevented, if the design team felt it necessary, through the inclusion of seepage blocks in the proposed embankment design.

With regard to groundwater levels, the only aspect of the proposed project that is expected to have the potential for significant impact would be if the existing normal daily surface water hydrology in the swamp was significantly altered. As long as the proposed design satisfactorily maintains existing daily surface water hydrology in the swamp, groundwater levels should also be effectively unchanged.

2. ***Could the new proposed fill crossing create a situation where the groundwater movement would change enough for part of the swamp to dry up and no longer be a wetland and/or no longer support its normal condition as a forested swamp?***

As described in the answer to Question 1 above, this is expected to be highly unlikely, as long as the design properly maintains surface water hydrology in the swamp.

3. ***What is the likely effect that an existing road in the forested Maple Swamp (Aydlett Road, located several hundred feet to the south of the new proposed fill) has had on the groundwater hydrology of the swamp?***

Not knowing the specific design and construction details of Aydlett Road, it is more difficult to develop an opinion on this issue; however, the same considerations described for the proposed Option B fill through the swamp also apply to Aydlett Road. From

available surface topography data (Figure 2), it appears that the original ground surface across the full width of Maple Swamp at the location of Aydlett Road was very flat, at a constant elevation of approximately 2 feet msl. As long as culverts beneath this existing road were designed and constructed to maintain satisfactorily surface water hydrology through the swamp, it is expected that Aydlett Road has had negligible effects on groundwater flows and levels in Maple Swamp. NCTA has commissioned a field verification program at Aydlett Road. Piezometers will be used to determine if the gradient across the road varies from the background gradient. Substantial differences would indicate the road is impeding groundwater flow.

4. ***What is the likely effect that extensive recent logging (taking into consideration the area logged and the condition in which it was left) has had on groundwater hydrology of the swamp? What might the recent logging have done to affect the swamp's status as a wetland, including water levels?***

Historically, Maple Swamp was entirely covered by forest. More recently, several areas of the swamp have been de-forested by private landowners for timber (see Figure 7). Our understanding is that the logging operations involved low-impact access methods to minimize rutting and minimize damage to the native soils. The main change in the swamp as a result of logging appears to be the removal of trees across large areas, and the presence of debris remaining on the ground in the logged areas.

Trees can have deep root systems and tend to transpire large volumes of groundwater. The most likely effect of extensive logging would be a potential reduction in total evapotranspiration from the swamp. Although new vegetation would grow in the de-forested areas, this likely would be dominated by smaller plant species with shallower root systems, which would not be able to reach as deeply into the surface soils to obtain water. As a result, some net reduction in evapotranspiration would still occur, modifying the water budget of the swamp and tending to increase groundwater levels in the logged areas.

As seen in Figure 7, most of the logged areas are in the northern, lower-elevation portion of Maple Swamp. Higher groundwater levels is this portion of the swamp likely mean some increase in the amount of surface water outflow from the swamp via sheet flow, because water table in the northern portion of the swamp is already near or at ground surface much of the time.

Overall, therefore, it is hypothesized that surface water outflows from the swamp may have increased slightly as a result of logging, and that groundwater flows and levels may have been very minimally affected. As the net effect of de-forestation is most likely a slight increase in groundwater levels and/or surface water outflows, the swamp's status as a wetland is not expected to have been reduced because of logging activities (i.e., water levels probably have not declined).

References

Bear, J., 1973. *Dynamics of Fluids in Porous Media*. Dover Publications, Inc., New York.

Caldwell, W., 2001. *Hydrologic and Salinity Characteristics of Currituck Sound and Selected Tributaries in North Carolina and Virginia*, 1998-99. U.S. Geological Survey Water-Resources Investigations Report 01-4097, Raleigh, North Carolina.

Currituck Development Group (CDG), 2009. *Phase 1A Preliminary Geotechnical Report, Based on Potential Route(s) for the Mid-Currituck Bridge Project*. Report prepared for North Carolina Turnpike Authority, October 26, 2009.

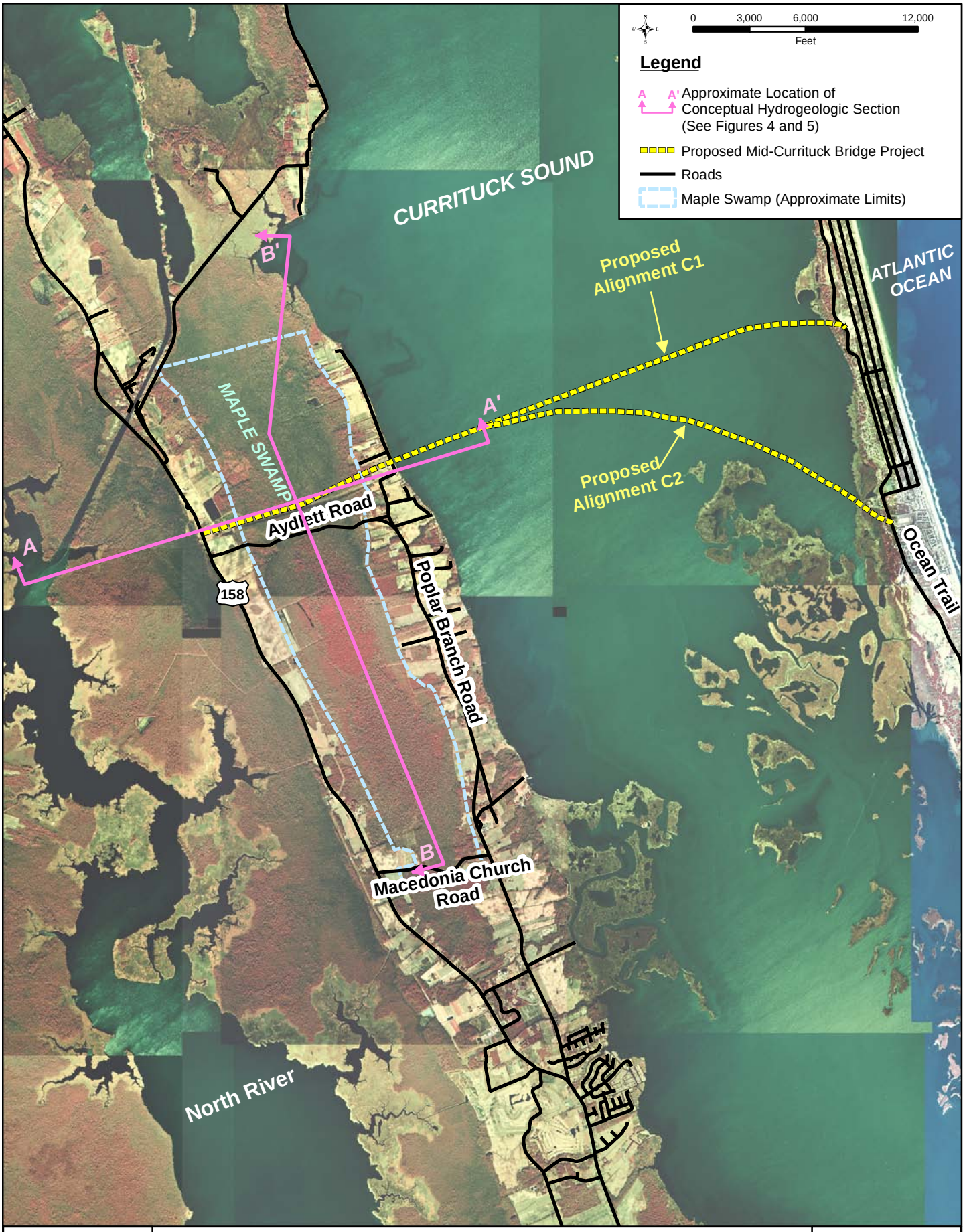
Mallinson, D., Riggs, S., Culver, S., Thieler, R., Foster, D., Corbett, D., Farrell, K., and Wehmiller, J., 2005. "Late Neogene and Quaternary evolution of the northern Albemarle Embayment (Mid-Atlantic Continental Margin, USA)", *Marine Geology*, vol. 217, pp. 97-117.

Parham, P., Riggs, S., Culver, S., and Mallinson, D., 2007. "Quaternary depositional patterns and sea-level fluctuations, Northeastern North Carolina", *Quaternary Research*, vol. 67, pp. 83-99.

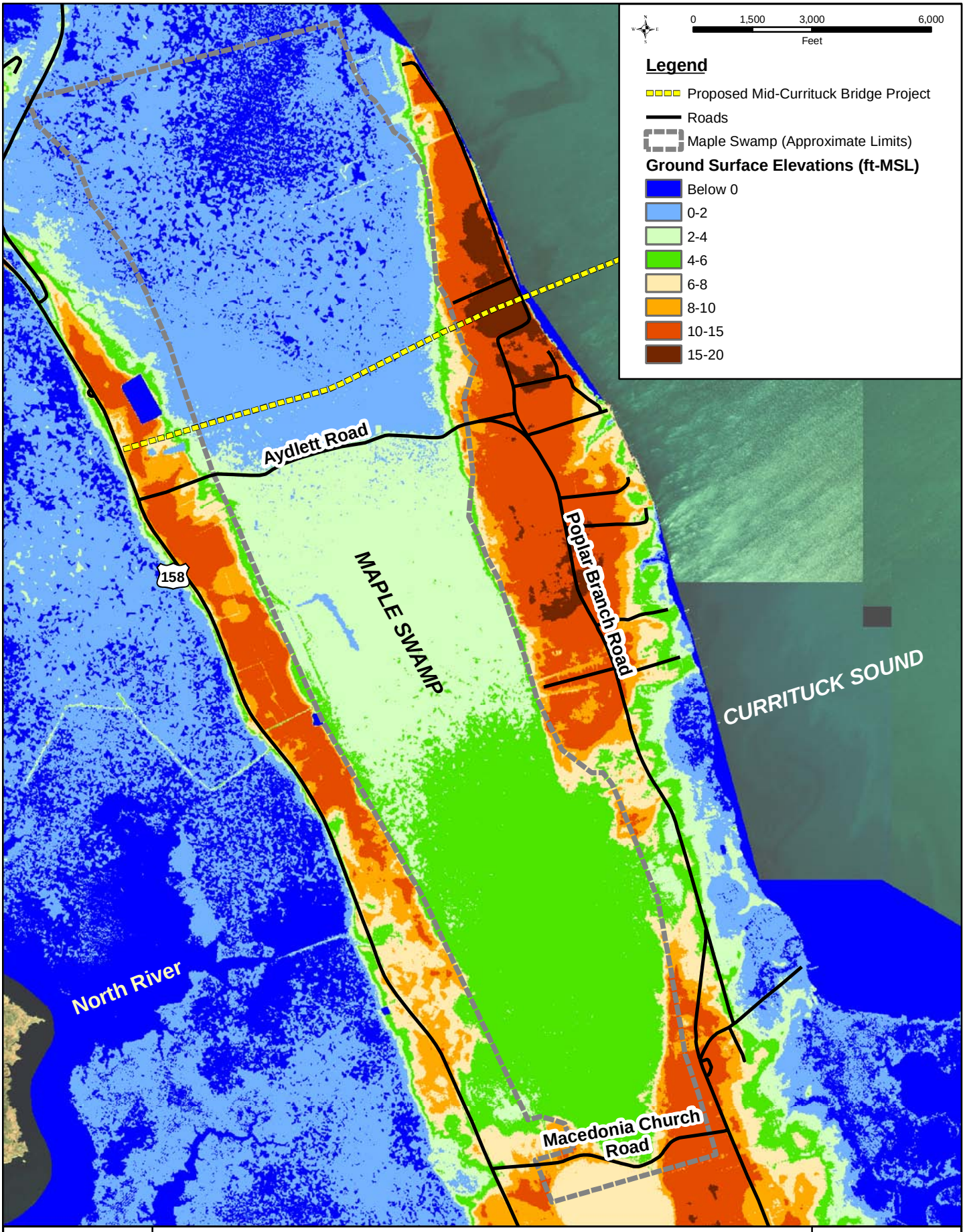
Sanford, W., 2002. "Recharge and ground-water models: an overview", *Hydrogeology Journal*, v. 10, pp 110-120.

Smith, B., 2003. *Ground-Water Flow and Saline Water in the Shallow Aquifer System of the Southern Watersheds of Virginia Beach, Virginia*. U.S. Geological Survey Water-Resources Investigations Report 03-4258, Richmond, Virginia.

Toth, J., 1963. "A theoretical analysis of ground-water flow in a small drainage basin", *Journal of Geophysical Resources*, v. 68, pp 4795-4812.



PB 125 YEARS	**Mid-Currituck Bridge Project** **Area Map and Location of Conceptual Hydrgeologic Sections**	**Figure 1**



Mid-Currituck Bridge Project
Surface Topography Map

Figure 2

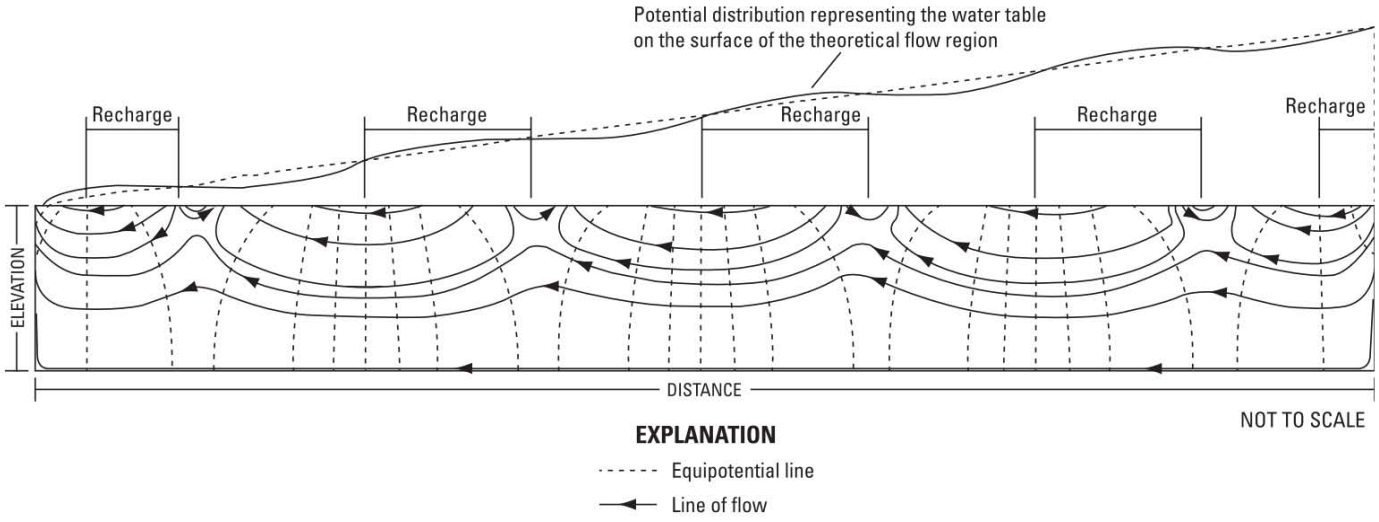
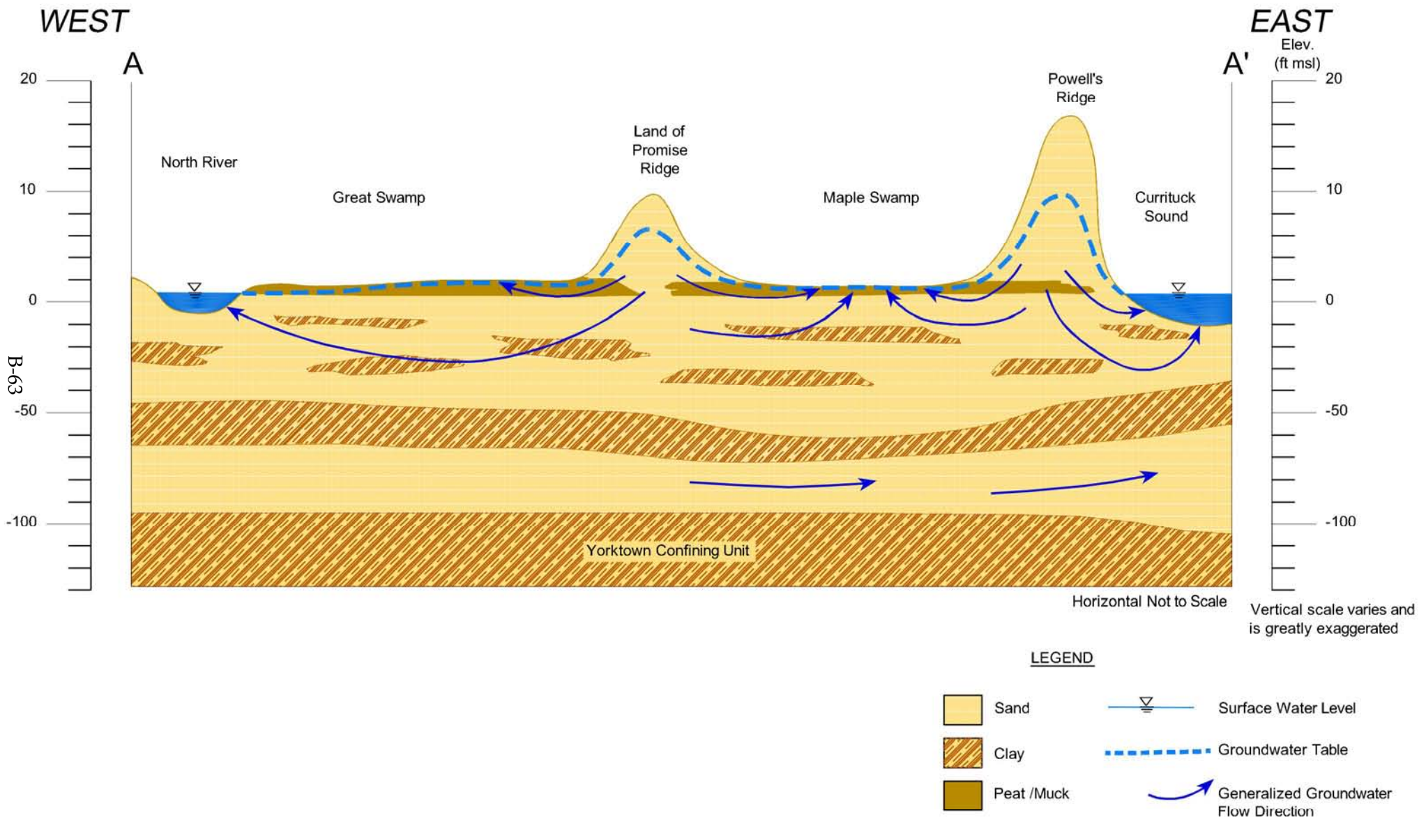


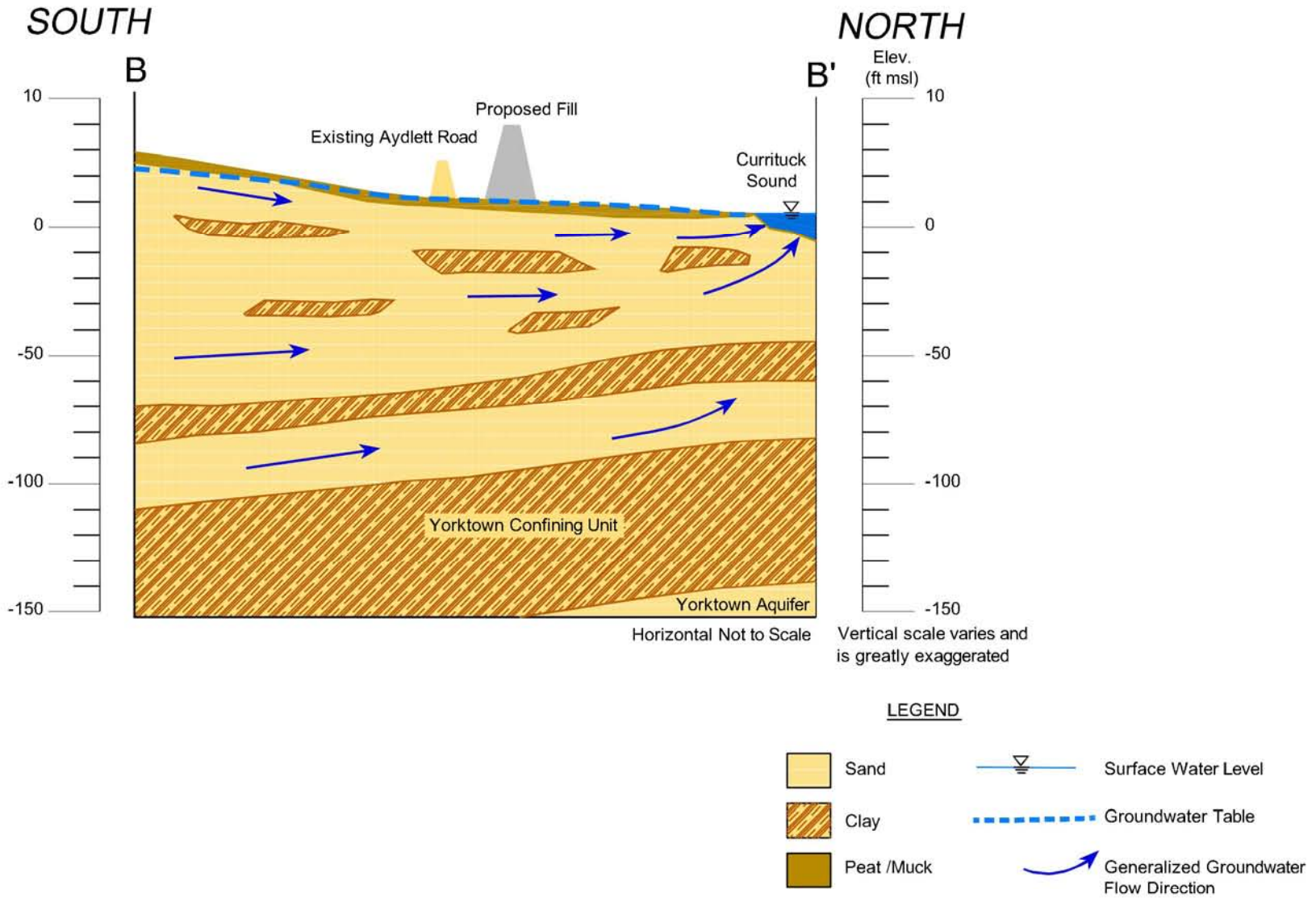
Figure 3. Toth's Theoretical Groundwater Flow Patterns Effected by Topography (Taken from Sanford, 2002)



PB 125 YEARS

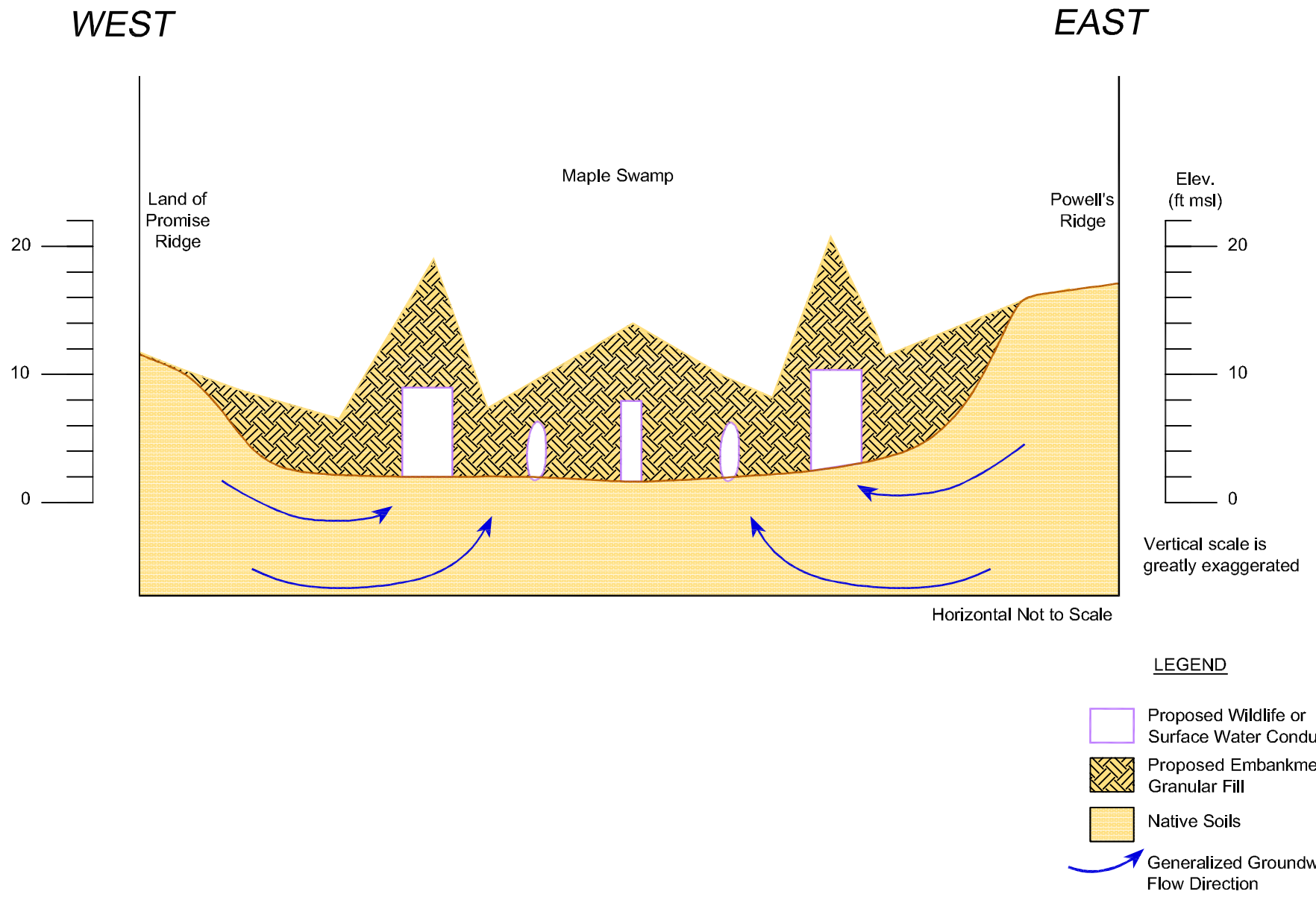
Conceptual Hydrogeologic Section A-A'

Figure 4



Conceptual Hydrogeologic Section B-B'

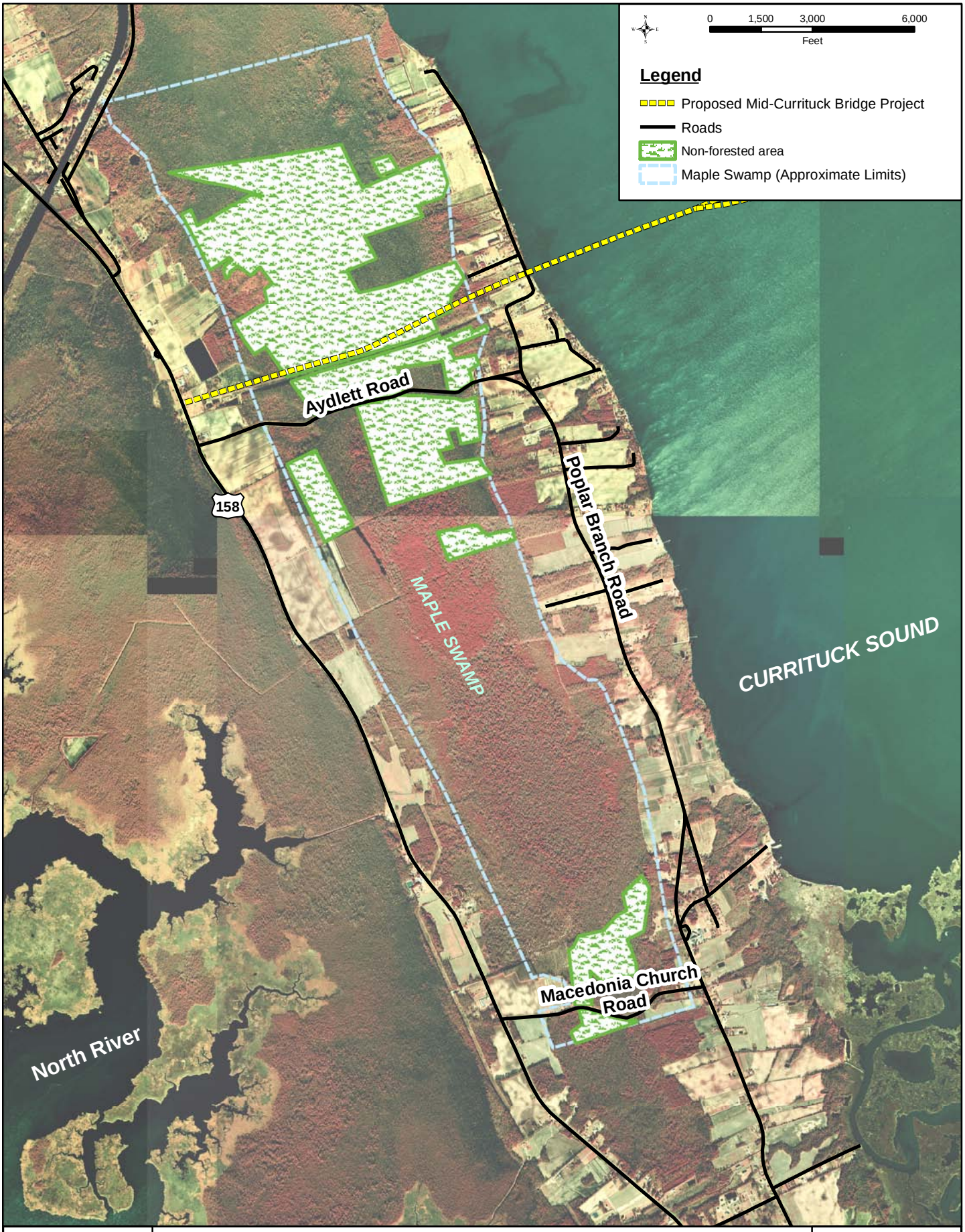
Figure 5



B-65

Conceptual Profile of Proposed Roadway Fill (Option B)

Figure 6



Mid-Currituck Bridge Project
Non-Forested Areas of Maple Swamp

Figure 7

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties
STIP No. R-2576

Supplemental Assessment of Mid-Currituck Bridge Impacts to Flood Elevations in Maple Swamp
Handout 29—November 2, 2010

Introduction

Initial hydraulic analyses were conducted in 2009 to determine whether proposed study alternatives would affect 100-year flood elevations. Two options were considered at that time: Option A and Option B. With Option A, the mainland approach road to the bridge over Currituck Sound would include approximately 1.5 miles of bridge over Maple Swamp. No significant impacts to flood flows or elevations were presumed for Option A because the bridge would be built above the base flood elevations mapped by the Federal Emergency Management Agency (FEMA). Therefore, it was concluded that detailed hydraulic modeling was not necessary for Option A. With Option B, the approach to the bridge over Currituck Sound would be a road placed on fill within Maple Swamp with five wildlife crossing structures and Aydlett Road would be removed and the roadbed restored as a wetland. Because the fill in Maple Swamp associated with Option B could potentially alter flood flows and elevations, the impacts of placing this fill on the 100-year Flood Elevations caused by tidal storm surge were analyzed. Hydraulic modeling results in 2009 showed an approximate 0.2-foot increase and 0.75-foot decrease in maximum water surface elevations north and south of the proposed fill, respectively, as compared to existing 100-year tidal storm surge elevations.

The North Carolina Turnpike Authority (NCTA) requested additional hydraulic studies in Maple Swamp to address agency comments on the Draft Environmental Impact Statement (DEIS). Consequently, the following major components were considered and are described in this supplemental assessment:

- More detailed August 2010 location survey for the Mid-Currituck Bridge project area. The 2010 survey included more data than the survey used for the 2009 hydraulics modeling, including more transects and cross-sections at critical areas in Maple Swamp, such as along Aydlett Road and the timbering access road;

- Recent logging within Maple Swamp;
- Hydraulic modeling of Option A's bridge across Maple Swamp; and
- Minimizing hydraulic impacts to flood elevations associated with placing fill within Maple Swamp.

Hydraulic Model

Consistent with the 2009 hydraulic studies, the US Army Corps of Engineers' (USACE) Unsteady Network Program (UNET) (Hydraulic Engineering Center-River Analysis System [HEC-RAS]), one-dimensional, unsteady flow model was used to simulate storm surge events for the 100-year storm for existing and proposed conditions. The 100-year storm surge hydrograph developed as the downstream boundary condition where the surge enters Maple Swamp near Coinjock for the previous hydraulic studies was also applied to the updated models described in this report. Storm surge hydrology was developed based on a peak stillwater elevation of 6 feet North American Vertical Datum of 1988 (NAVD88) for the 100-year storm in conjunction with guidance provided in Hydraulic Engineering Circular (HEC) 25 (Douglass and Krolak, 2008), *Tidal Hydrology, Hydraulics and Scour at Bridges*. The downstream end of Maple Swamp, where the tidal storm surge enters the swamp, is mapped as Zone AE with a 100-year base flood elevation of 6 feet NAVD88 according to the area's Digital Flood Insurance Rate Map (DFIRM). Based on the mapped FEMA base flood elevations, a peak storm surge elevation of 6 feet NAVD88 was used to develop the 100-year storm surge hydrograph for the downstream boundary condition.

Model Updates for New Survey and Logging within Maple Swamp

As discussed previously, a location survey was completed in August 2010 for the project area, including critical areas in Maple Swamp near US 158, Aydlett Road, and the proposed bridge/fill alignment across the swamp. The same cross-section locations from the 2009 hydraulic studies were used but updated to reflect this new survey. The updated cross-section information was applied to existing and proposed condition models.

Historically, almost all of Maple Swamp was covered by forest. Recent logging operations by private landowners, however, have de-forested considerable portions of the swamp. Approximately 1,232 acres of the 3,887-acres (32 percent) of the swamp (excluding only the marshland at the north end of the swamp) have been logged, and approximately 66 percent of the project corridor was recently logged. Most of the logging has occurred in the north-central portion of the swamp; some de-forestation is present at the southern end in the vicinity of Macedonia Church Road. Previous hydraulic models for existing and Option B conditions were updated to reflect the most current surface characteristics and account for any corresponding changes in flood flows

and elevations as a result of logging operations. Changes to the swamp surface characteristics as a result of logging were represented by adjustments to roughness coefficients (i.e., Manning's n values) within logged areas. Manning's n values were selected based on guidance provided in USACE's Hydraulic Reference Manual for HEC-RAS for floodplain areas with tree cover and cleared land. Previously, Manning's n values of 0.15 and 0.08 were used to represent the overbank and main channel areas within the swamp, respectively. Cleared land has less surface roughness and resistance to flow as compared to forested floodplains. Therefore, Manning's n values within the logged areas of the swamp were reduced to 0.08 and 0.06 for the overbank and main channel areas, respectively.

Changes in Existing Conditions as a Result of Logging Operations

A comparison of pre- and post-logging maximum water surface elevations for the 100-year storm was conducted for the purposes of assessing the impacts of recent logging operations to existing conditions. The existing conditions model was updated to reflect the corresponding changes to and most recent surface characteristics within Maple Swamp. Therefore, additional hydraulic studies of project alternatives and corresponding impacts were evaluated and are presented based on the updated (post-logging) existing conditions model.

For existing conditions, post-logging hydraulic modeling results show an approximate 0.2-foot increase in the maximum water surface elevation for the 100-year storm starting from the downstream (north) face of Aydlett Road as a result of logging operations. The 0.2-foot increase tapers to zero change in maximum water surface elevation for the 100-year storm at a point approximately 4,900 feet north of Aydlett Road. Results also show an approximate 0.10-foot decrease in the maximum water surface elevation for the 100-year storm from the downstream (north) face of the logging road located near Young Road. (The logging road is approximately 6,100 feet north of Aydlett Road.) The 0.1-foot decrease tapers to zero change in maximum water surface elevation for the 100-year storm at a point approximately 5,500 feet north of the logging road. These results are listed in Table 1.

Table 1. Comparison of Pre- and Post-Logging Maximum Water Surface Elevation for the 100-year Storm for Existing Conditions

	Change in 100-year Maximum Water Surface Elevation (Post-Pre Logging)	Distance of Change in Maximum Water Surface Elevation
Downstream (north) of Aydlett Road	+0.2 feet	4,900 feet
Downstream (north) of Logging Road	-0.1 feet	5,500 feet
Upstream (south) of Aydlett Road	N/A	N/A

Updated Comparison between Existing and Option B Conditions

Option B results from the updated model show a 0.2-foot increase in maximum water surface elevation from the north face of the proposed fill as compared to existing 100-year tidal storm surge elevations; this increase would taper to zero change at a point approximately 5,600 feet north of the proposed fill. Post-logging results for Option B show a slightly greater decrease of 1.3-feet in maximum water surface elevation south of the proposed fill as compared to existing conditions. This decrease would become negligible at a point approximately 5,500 feet south of the proposed fill. These results are listed in Table 2.

Table 2. Updated Comparison of Existing and Option B Maximum Water Surface Elevations for the 100-year Storm

	Change in 100-year Maximum Water Surface Elevation (Option B minus Existing)	Distance of Change in Maximum Water Surface Elevation
Downstream (north) of proposed fill	+0.2 feet	5,600 feet
Upstream (south) of proposed fill	-1.3 feet	5,500 feet

Additional hydraulic studies were conducted for additional Maple Swamp crossing scenarios. They also reflect new survey and logging operations information.

Hydraulic Impacts to Floodplain (100-year Event)

Option A's bridge across Maple Swamp was modeled to confirm whether there were no significant impacts to flood elevations under this scenario. The Option A bridge includes approximately 7,700 feet of bridge across Maple Swamp. Based on design drawings and documents, the Option A bridge across Maple Swamp includes 59, 2.5-foot wide piers spaced 130 feet apart and an approximate 7-foot thick bridge deck. Hydraulic modeling results affirmed no impacts to 100-year maximum water surface elevations as a result of Option A.

Several additional combinations of bridge and fill also were modeled to determine the minimum length of bridge that must be built across Maple Swamp in order to have no impacts to 100-year maximum water surface elevations. Hydraulic modeling results show that a minimum 2,500-foot wide bridge opening across the central and eastern portion of the swamp (i.e., the portion of the swamp with the lowest elevation) is required to have no effect on 100-year maximum water surface elevations. The same bridge pier assumptions used in the Option A modeling were used.

NORTH CAROLINA Turnpike Authority

Mid-Currituck Bridge Study

Currituck and Dare Counties
STIP No. R-2576

Response to Written Comments on the October 2010 Preferred Alternative Report
Handout 30—January 20, 2011

US Army Corps of Engineers—October 29, 2010

1. **Comment:** According to the Coordination Plan, agencies will not be asked to concur with this report, but asked to submit any significant objections in writing to FHWA and NCTA. We are somewhat confused with this approach as we have been asked to concur with the preferred alternative, but based on the Coordination Plan; the NCTA/FHWA will formally identify its preferred alternative separately after considering all comments received from Participating Agencies, including both written comments and comments received in the TEAC meetings.

   Response: *You are correct in your understanding of the Coordination Plan. NCTA and FHWA will identify their Preferred Alternative separately after considering all comments received from Participating Agencies.*

2. **Comment:** Typically, when an NCDOT project is developed through the Merger 01 Process, actual estimated environmental and human impacts are identified according to preliminary design standards and decisions regarding the selection of the Least Environmentally Damaging Practicable Alternative (LEDPA) are made using that data. This was considered a critical decision point on larger TIP projects where impacts and costs could be accurately compared across alternatives prior to selection of a preferred alternative or LEDP A. This project is not using the Merger Process and to date there are still not definite impact numbers for NCTA's preferred alternative (MCB4) because the decision to bridge Maple Swamp has not been made. Additionally, as we identified in our June 7, 2010 letter, construction techniques that involve dredging in Currituck Sound are a major concern of ours and the resource agencies and, typically, permits for this type of activity have been difficult to obtain. As these two issues remain unresolved at this time, and after considering the funding and project location constraints that have been placed upon the NCTA by

the NC State Legislature, we have no choice but to make a determination that either alternative ER 2 or MCB4/A/C1 may represent the LEDPA for the project.

Response: *NCTA, after considering agency comments, has revised its recommended Preferred Alternative from that presented in the October 2010 Preferred Alternative Report. The recommended Preferred Alternative, MCB4/C1, now includes Option A, bridging Maple Swamp, rather than Option C. The January 2011 Preferred Alternative Report reflects this change. Regarding dredging, NCTA will continue to work with the resource agencies as the project progresses to see if an acceptable approach to dredging can be developed. NCTA has considered the comments on dredging made at the November 2, 2010 TEAC meeting, as well as the comments made on the October 2010 Preferred Alternative Report, and has modified its proposed dredging strategy based on those comments. See the response to USEPA comment 1 and the January 2011 Preferred Alternative Report.*

3. **Comment:** The issue of whether ER 2 is practicable due to funding and tolling constraints placed upon it by the NC State legislature is more problematic. As you are aware, the Corps is obligated to insure that projects have an appropriate level of analysis for evaluating compliance with the Section 404(b)(1) Guidelines (Guidelines). In order to accomplish this, the Corps must assess a reasonable number of alternatives that appear to meet the purpose and need for the project and that each is practicable considering cost, logistics, and existing technology. We remain extremely concerned that state law has potentially limited the range of alternatives that may be available to the NCTA but that may otherwise be practicable under our 404(b)(1) Guidelines. We cannot allow a state legislature to define a project's location thus circumventing our requirements under the National Environmental Policy Act or the 404 (b)(l) Guidelines. For example, pursuant to SL2010-31, an annual appropriation will be allocated from the Highway Trust Fund to the North Carolina Turnpike Authority to be used to pay debt service or related financing expenses on revenue bonds of notes issued for the construction of the Mid-Currituck Bridge. Based on the same law, gap funding cannot be used to fund ER 2, for a variety of reasons. One of those is that gap funding allocated to NCTA, pursuant to G.S.136-89.183, only authorizes the NCTA 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." We believe a state law which so severely restricts funding sources to a defined project at a defined location is not a valid constraint to the building of one alternative over another pursuant to the Guidelines.

   Response: *The USACE's position is acknowledged.*

4. **Comment:** On page 3 of the document titled "Reasons for a Determination that ER 2 is Not a Practicable Alternative to a Bridge Across Currituck Sound" (Handout 25) it is stated that tolls cannot be used on local roads logistically or according to state law. This section continues with the statement that "the only location on the road

network where tolls logistically could be conceivably charged would be for trips across the Wright Memorial Bridge." Are there any other compelling reasons beyond those given in the document that relate to the NCTA's enabling legislation that would preclude tolling ER 2?

Response: *There are no other reasons in the enabling legislation that would preclude tolling ER2 beyond those presented on pages 3 and 4 of Handout 25 as follows:*

a. *Tolls cannot be used according to state law unless an alternative non-toll route exists and the toll authority is prohibited from converting parts of the non-tolled highway system to toll facilities. (G.S. § 136-89.197 and G.S. § 136-89.187)*
b. *State appropriations can only be spent by NCTA for a Mid-Currituck Bridge. (G.S. § 136-89.183)*
c. *Toll projects must be in the State Transportation Improvement Plan (STIP) and a NC 12/US 158 interchange is in the only part of ER2 included in the current STIP. (G.S. § 136-89.183(a)2)*

Also, as indicated in Handout 25 and noted in this comment, NC 12 cannot be tolled logistically from an operational perspective, irrespective of state or federal law. As noted in this comment, the Wright Memorial Bridge could be tolled logistically from an operational perspective, but cannot be tolled under current state law, as indicated by item "a" above.

Title 23 United States Code (23 USC) Section 129 allows FHWA to reach an agreement with states to allow free (i.e., non-tolled) bridges, in the context of their reconstruction or replacement, to be converted to toll facilities. However, the toll agreement must require that all toll revenues are first used for any of the following: debt service, reasonable return on private investment, and operation and maintenance, including work for reconstructing, resurfacing, restoring, and rehabilitating. The agreement may also include a provision regarding toll revenues in excess of those needed for the required uses outlined above. This provision allows excess revenues to be used for highway and transit purposes authorized under Title 23 if the state certifies annually that the toll facility is being adequately maintained.

Although not related to the issue of the enabling legislation and tolling, Section 136-89.183A(a) of NCTA's enabling legislation specifies:

- *A Currituck Sound Bridge is needed;*
- *It is to be a toll bridge;*
- *It should be implemented in an environmentally sensitive manner; and*
- *The character of the existing road system is to be preserved.*

5. **Comment:** In accordance with the Guidelines, the Corps can authorize only the LEDPA. Based on the information contained in the Draft Environmental Impact Statement (DEIS) and the associated handouts that have been provided to date, the Corps believes that either ER2 or MCB4/A/C1 with modifications (smaller footprint of the proposed US 158 interchange and a reduction of the amount of four-lane widening along NC 12 from 4.2 miles to 1 mile), coupled with significant reductions in the proposed dredging impacts, as explained in the October 2010 Preferred Alternative Report could be the LEDPA for this project. As you are aware, Option A of alternative MCB4 bridges Maple Swamp and therefore reduces wetland impacts considerably, making those impacts comparable to those of ER2.

   Response: *NCTA agrees that MCB4/A/C1 could be the LEDPA. As indicated at the November 2, 2010 TEAC meeting, MCB4/A/C1 (with reversing lanes on US 158 for hurricane evacuation) as presented in the DEIS in Table 3-9 would fill 10.6 acres of wetland (wetland within the slope-stake line plus 25 feet) versus 8.6 acres for ER2. However, design changes associated with NC 12 reduce the MCB4 impacts by approximately 4 acres, while the additional safety feature (median acceleration lane) at Waterlily Road increases the MCB4 impacts by approximately 0.5 acre. The net result is a reduction of approximately 3.5 acres, which would bring the MCB4/A/C1 (with reversing lanes on US 158 for hurricane evacuation) impacts down to approximately 7.1 acres of wetland filled, which is less than ER2. Based on comments from the agencies, MCB4/A/C1 is now proposed as the Preferred Alternative. These numbers represent an estimate that will be confirmed when the revised preliminary engineering is completed in January.*

6. **Comment:** As stated in our June 7, 2010 letter, "it will be incumbent upon you to demonstrate that using non-toll financing is infeasible if during the process for identifying the Preferred Alternative NCT A wishes to select an alternative that involves tolling based on the mere fact that non-tolling alternatives cannot be financed or funded in the short or long term." We have determined that State Legislation/Law is not an adequate reason to consider ER2 an alternative that is not practicable.

   Response: *NCTA acknowledges your position related to state laws. However, although the fact that non-tolled alternatives cannot be financed or funded in the short- or long-term is an important part of NCTA's position on the practicability of ER2, it is not the only reason for NCTA's position. Handout 25 listed four reasons why ER2 is not practicable from NCTA's perspective, as follows:*

   a. *Widening NC 12 contradicts local plans.*
   b. *Local community opposition to widening NC 12 is strong.*
   c. *Meeting the purpose and need of the project is problematic. Problematic is defined in the following ways:*

- *MCB4 achieves more than twice the reduction in congestion and travel time benefit of that for ER.*
- *Hurricane evacuation benefits can be achieved with ER2 only by adding a third outbound lane for 25 miles of US 158.*
- *Because of items "a" to "c" above, it is highly unlikely ER2 could be implemented in the foreseeable future, so its selection would be the equivalent of selecting the No-Build Alternative.*

d. It cannot be financed and no traditional funding is available.

NCTA would like to bring your attention to reasons "a" to "c" and the logistical issues from an operational perspective related to reason "d."

US Environmental Protection Agency—November 30, 2010

1. **Comment:** All dredging in Currituck Sound should be avoided by using a 'top-down' construction method.

Response: *NCTA will continue to work with the resource agencies in developing acceptable approaches for building the Mid-Currituck Bridge. Based on NCTA's review of updated bathymetric data and alignment refinements to C1 (straight bridge), NCTA envisions building the bridge with barges over a longer length than proposed in the October 2010 Preferred Alternative Report. The barge use limits are currently envisioned for the westernmost 3.8 miles of the bridge. Trestle would be used for 0.8 mile. In the area of SAVs, NCTA would use a trestle.*

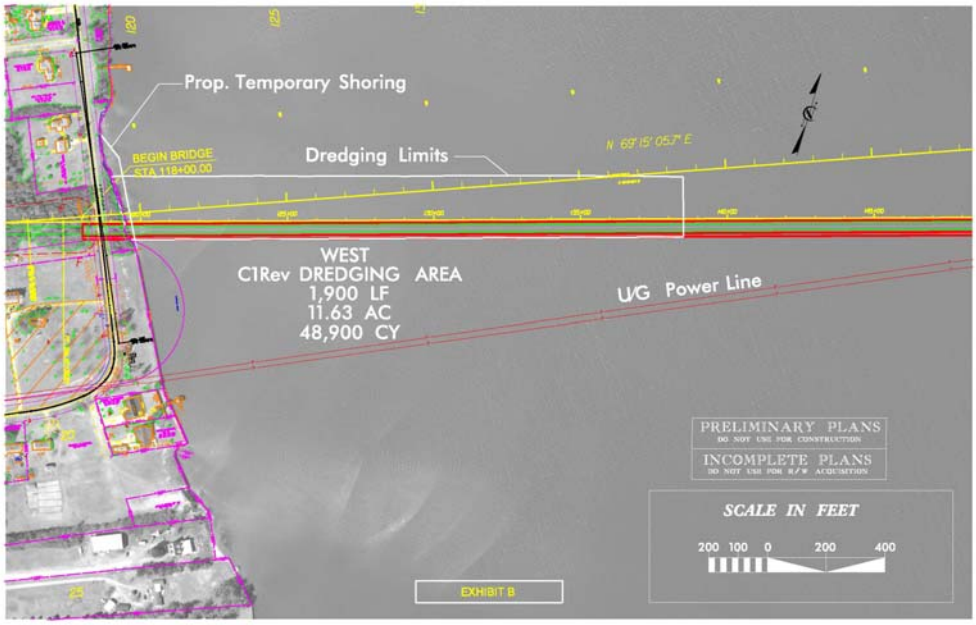
On the west side of the sound, NCTA envisions dredging only in the areas identified in the drawing included at the end of this response.

After consideration of additional options for bringing supplies to the bridge and barges, the west side supply dock noted in the October 2010 Preferred Alternative Report is no longer proposed. As an alternative, temporary shoring could be built that extends the existing north/south seawall/bulkhead from just south of the new bridge to just north of the new bridge. With the temporary shoring in place to stabilize the shoreline, a crane could be parked along the shoreline and used to load material on to waiting barges. If desired, this shoring could be left in place after construction is completed.

The dredging quantities for this approach would be:

Dredging Length: 1,900 feet
Dredging Area: 11.63 acres
Dredging Volume: 48,900 cubic yards

Again, NCTA will continue to coordinate with the resource agencies in developing acceptable solutions for building the bridge.



2. **Comment:** Maple Swamp should be bridged to avoid and minimize jurisdictional impacts to high quality wetlands.

   Response: *NCTA, after considering agency comments, has revised its recommended Preferred Alternative from that presented in the October 2010 Preferred Alternative Report. The recommended Preferred Alternative, MCB4/C1, now also includes Option A, bridging Maple Swamp, rather than Option C. The January 2011 Preferred Alternative Report reflects this change.*

3. **Comment:** Floodplain encroachment needs to be completely addressed and potential impacts avoided and minimized.

   Response: *Based on agency comments, MCB4/A/C1 is now recommended as the Preferred Alternative. This alternative would not affect 100-year flood elevations. The only DEIS design scenario that would have caused a change in existing flood elevations was Option B across Maple Swamp; however, Option B is not proposed as a part of the Preferred Alternative. As discussed in the DEIS, the Option A interchange would place fill in 10.4 acres of floodplain. However, this use would not change the area's flood elevations. As indicated in Section 3.4.7 of the DEIS and Section 6.0 of the Other Physical Features Technical Report, 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. Unlike upland riverine floodplains, the flood levels in the project area are primarily dependent on barometric pressure and the correlated storm surge height. The only reason Option B would affect flood elevations is because it would block a substantial part of the storm surge's route southward in Maple Swamp.*

Although Option A (bridging Maple Swamp) is now part of the recommended Preferred Alternative, it should be noted that recent studies found that a bridge span in Maple Swamp of a minimum of 2,500 feet would be enough to ensure flood elevations in Maple Swamp would not be affected.

4. **Comment:** Storm water runoff from the new bridge needs to be collected and treated. Alternative methods of keeping the bridge free from the build-up of sediment and pollutants have not been adequately demonstrated. While some 'sweeping' and 'vacuuming' may be environmentally acceptable in lieu of total collection and treatment of storm water, the current plans as proposed are not believed to be adequate and are not presented as formal environmental commitments.

   Response: *Further refinements in the proposed bridge deck cleaning program are expected, developed in association with NCDENR-DWQ. NCDOT and NCTA will 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. This will include pollutant source control through regular bridge deck cleaning (sweeping/vacuuming) on both the bridge over Currituck Sound and the bridge over Maple Swamp. In addition, the merits of stormwater capture will be investigated for the ends of the bridges (approximately 600 feet) where geometrically feasible irrespective of the presence of wetlands. Infiltration strips or basins will be used for treatment of stormwater from paved surfaces. Pervious pavements will be considered for parking areas and multi-use paths. Finally, acquisition of land parcels identified in Currituck County as having a potential to improve water quality through land conservation and restoration will be investigated. Potential parcels are identified in the November 2006 report for Currituck County by the North Carolina Coastal Land Trust: Countywide Land Parcel Prioritization Strategy for Water Quality Enhancement.*

   In the FEIS, NCTA will formally commit to working with NCDENR-DWQ and other resource agencies during the permit process to finalize a stormwater management plan.

5. **Comment:** Based upon comments received following the issuance of the DEIS, EPA's concerns for indirect and cumulative impacts resulting from the new bridge are further heightened. Potential measures to avoid and minimize these impacts, including formal environmental commitments from other parties, have not been addressed.

   Response: *Comments received related to the DEIS's indirect and cumulative impact assessment will be addressed in the FEIS. Opportunities to avoid and minimize these impacts exist in local land use plans, development regulations, and regulatory powers. These will be noted in the final indirect and cumulative impact assessment in the FEIS.*

6. **Comment:** The issue concerning the control of invasive exotic plant species has not been fully explored.

   Response: *EPA made a similar comment related to invasive plant species in its DEIS comments. This concern will be addressed in the FEIS. The control of invasive species during construction of the proposed project, while important, is not directly relevant to the selection of a Preferred Alternative. NCTA does not consider the risk of introducing invasive plant species during construction to be a factor that would lead one to conclude that nothing should be built or that one alternative should be built over the other.*

7. **Comment:** Compensatory mitigation for unavoidable impacts to jurisdictional wetlands has not been fully addressed or proposed. As previously requested, EPA believes that compensatory mitigation should be 'in-kind' and within the same hydrologic catalog unit.

   Response: *Compensatory mitigation for unavoidable wetland impacts was discussed in Section 3.3.6.4 of the DEIS. The focus in identifying a Preferred Alternative is on avoidance and minimization. As per the project's Section 6002 Coordination Plan, compensatory mitigation will be finalized after the selection of a Preferred Alternative.*

NCDENR-Division of Coastal Management—December 7, 2010

1. **Comment:** Based upon comments made by state and federal agencies to date, it appears as though a determination may be made that the proposed dredging of Currituck Sound will have a significant adverse effect on wildlife or fresh water, estuarine or marine fisheries. The N.C. Dredge and Fill Law [113-229(e)] requires that: "…The Department may deny an application for a dredge or fill permit upon finding: (1) that there will be significant adverse effect of the proposed dredging and filling on the use of the water by the public; or (2) that there will be significant adverse effect on the value and enjoyment of the property of any riparian owners; or (3) that there will be significant adverse effect on public health, safety, and welfare; or (4) that there will be significant adverse effect on the conservation of public and private water supplies; or (5) that there will be significant adverse effect on wildlife or fresh water, estuarine or marine fisheries."

   Response: *After its selection of a Preferred Alternative, NCTA will continue to work with the resource agencies as the project progresses to see if an acceptable approach to dredging that minimizes adverse impacts can be developed. NCTA has considered the comments on dredging made at the November 2, 2010 TEAC meeting, as well as the comments made on the October 2010 Preferred Alternative Report, and has modified its proposed dredging strategy based on those comments. See the response to USEPA comment 1 and the January 2011 Preferred Alternative Report.*

2. **Comment:** As I stated at the 11/2/10 NCTA TEAC meeting, the dredging access channels, and the dredging for the construction staging area, are subject to the requirements of 15A NCAC 07H .0208(b)(1), which states as follows: "Navigation channels, canals, and boat basins shall be aligned or located so as to avoid primary nursery areas, shellfish beds, beds of submerged aquatic vegetation as defined by the MFC, or areas of coastal wetlands except as otherwise allowed within this Subchapter." Please continue to coordinate with the N.C. Division of Marine Fisheries regarding implementation of the requirement to avoid beds of submerged aquatic vegetation as defined by the MFC.

   Response: *NCTA will continue to coordinate with NCDENR-DMF regarding dredging. No dredging is currently proposed in primary nursery areas, shellfish beds, beds of submerged aquatic vegetation, or areas of coastal wetlands.*

3. **Comment:** As stated on page 3, item 8, of the 6/4/10 DCM DEIS comments, and as I mentioned at the 11/2/10 NCTA TEAC meeting, the N.C. Administrative Code [15A NCAC 07H .0208(a)(2)(H)] requires that development shall not impede navigation or create undue interference with access to, or use of, public trust areas or estuarine waters. The N.C. Turnpike Authority should continue to coordinate with DCM to ensure that the navigational clearance of the mid-Currituck Bridge complies with this requirement. DCM is currently considering whether the proposed 16-foot clearance for the mid-Currituck Bridge, and the proposed 35-foot clearance for the navigation span, will be adequate to meet the requirements of 15A NCAC 07H .0208(a)(2)(H).

   Response: *NCTA acknowledges that NCDENR-DCM is considering whether the bridge would jeopardize the use of waters in Currituck Sound, including estuarine waters, for navigation or for other public trust rights in public trust areas. However, the Administrative Code does not indicate the criteria NCDENR-DCM uses in making their determination. On December 15, 2010, NCTA asked NCDENR-DCM to provide these criteria*

NCDENR-Division of Marine Fisheries—November 22, 2010

1. **Comment:** Construction- As stated in the NCDMF's May 14, 2010 comments regarding the DEIS the NCDMF would request that top-down construction be used to complete all construction in Currituck Sound. Currituck Sound is a pathway for migrating anadromous fish into anadromous fish spawning areas (AFSA). It has been well documented that dredging has negative adverse impacts on spawning migrations and larval development therefore the NCDMF would object to dredging during the construction process. The NCDMF appreciates the commitment by the Turnpike Authority (TA) to adhere to a February 15 through September 30 dredging moratorium if the project is permitted. During the November 2, 2010 meeting members of the Turnpike Authority stated that the barges needed would have a 1

foot draft and 3-4 foot draft loaded. The NCDMF understands the need for a little extra depth for weather conditions, but would recommend transporting smaller loads on the barge in these areas (less draft required) with a "staging" boat nearby in deeper waters or construct using top-down methods in the "dredging" sections. These two alternatives may reduce the need for dredging in Currituck Sound. Will construction start on both sides of Currituck Sound and meet in the middle?

Response: *NCTA will continue to work with the resource agencies in developing acceptable approaches for building the Mid-Currituck Bridge. NCTA's current thoughts are summarized in the response to USEPA comment 1. The potential dredging moratorium and schedule constraints result in the need for multiple construction locations simultaneously. It is anticipated that construction would occur on both sides of Currituck Sound concurrently.*

2. **Comment:** Supply Dock- The NCDMF is concerned with the location of the supply dock and its adverse impacts to SAV and Essential Fish Habitat. How far out will the dock extend? Will dredging be required if used? Will the supply dock be removed once the bridge is constructed? If permitted, avoid impacts to SAV and site where dredging will not be necessary. What are the dimensions of the dock (height, width, and length)? Please supply a map with location of dock, including the water depths and location of SAV.

   Response: *NCTA will continue to coordinate with the resource agencies in developing acceptable solutions for building the Mid-Currituck Bridge. As indicated in the response to USEPA comment 1, after consideration of additional options for bringing supplies to the bridge and barges, the west side supply dock noted in the October 2010 Preferred Alternative Report is no longer proposed. As an alternative, temporary shoring could be built that extends the existing north/south seawall/bulkhead from just south of the new bridge to just north of the new bridge. With the temporary shoring in place to stabilize the shoreline, a crane could be parked along the shoreline and used to load material on to waiting barges. If desired, this shoring could be left in place after construction is completed.*

3. **Comment:** Hydrology- The TA has suggested a ½ mile bridged section as an alternative to fill for the part of the bridge crossing Maple Swamp with openings to allow for surface water flows to continue past the new bridge. At this time the specific design specifications (size, height, and distance apart) of these openings are not final so it is difficult to make a determination if this will be adequate to allow flows to continue along other parts of the fill/bridge. If it is determined that a new bridge is necessary, the alternative that removes the existing Aydlett Road and constructs a new bridge over the swamp to allow water to flow unimpaired through Maple Swamp is recommended by NCDMF. This option would reduce the amount of fill and reduce the amount of shading throughout the entire swamp.

Response: *Option A, which bridges Maple Swamp for approximately 7,740 feet, is now a part of NCTA's recommended Preferred Alternative. The 7,740-foot length is slightly less than the 7,913 feet presented in the October 2010 Preferred Alternative Report for Option A because an alignment adjustment on the mainland (that resulted from the straighter Mid-Currituck bridge) put approximately 173 feet of Maple Swamp bridge over upland, which allowed the bridge length to be reduced. NCDENR-DMF's recommendation on Aydlett Road is noted; however, the removal of Aydlett Road was found during the DEIS public and agency comment period to be an unacceptable community impact by both the residents of Aydlett and Currituck County officials. Those impacts are discussed in Section 3.1.2 of the DEIS beginning on page 3-9.*

4. **Comment:** SAV- As defined by the Marine Fisheries Commission, SAV habitat is submerged land that is vegetated with submerged aquatic vegetation or has been occupied by one or more submerged aquatic species within the past 10 continuous growing seasons and meets the average growing conditions needed. According to this definition (15A NCAC 03I .0101), the NCDOT needs to consider documented occurrences and maps of SAV in Currituck Sound since 2000 to determine SAV habitat and the impacts to SAV habitat. In addition to DOT and USACE imagery, mapping of this area was done in 1994, 2004, and 2007 by NOAA, Elizabeth City State University, and DENR. The NCDMF requests that SAV impacts be avoided and minimized for the Mid-Currituck Bridge. ER2 as previously described avoids all impacts to SAV (approximately 17 acres in original DEIS) and in the NCDMF's opinion is a way to avoid all SAV impacts. Are there plans for SAV mitigation? The NCDMF is also concerned with the adverse impacts of the dredging on the eastern side of Currituck Sound. This area is located adjacent to SAV beds which will be adversely impacted by dredging (elevated turbidity levels) and it is potential SAV habitat. At this time the NCDMF would object to the dredging in the eastern portion of Currituck Sound. The NCDMF is also concerned with the driving of piles in SAV areas and will request a February 15 through September 30 piling moratorium in the SAV areas to prevent adverse impacts to the SAV and the associated fauna in these specific areas. This moratorium will minimize impacts to both SAV during the peak biological activity and the anadromous fish that use SAV as refuge and feeding grounds. The elevated noise and turbidity levels have been known to have adverse impacts on aquatic fauna (Street et al. 2005). Working outside of this period will ensure that the environmental integrity of the area is protected during the peak of biological activity.

   Response: *NCTA is currently gathering information on SAV trends in the project area over the last 10 growing seasons. Trestle construction would be used in areas of existing SAV on the east side of the sound. No dredging would be conducted within the existing SAV beds. With pile driving, there would be minimal disturbance to SAV. The area of this disturbance would be approximately equal to the circumference of the tip of the pile. NCTA anticipates that pile driving activities would take place during the whole year.*

Special care would be taken in the areas of existing SAV during pile driving operations to minimize/contain turbidity. Turbidity curtains would be used during specified periods of the year as agreed to with the resource agencies. NCTA also is open to other construction impact mitigation suggestions.

In terms of mitigating potential long-term impacts to SAV, the following options would be considered in coordination with the resource agencies:

a. *NCTA could coordinate its efforts with the Currituck Sound Environmental Restoration project being led by the USACE Wilmington District. One of the three work groups for this study is responsible for SAV. These work groups are composed of a variety of scientists and engineers from several state and federal agencies and organizations. Elizabeth City State University (ECSU) has been responsible for SAV portions of the study and has been working on some restoration tasks, each of which could represent an opportunity for this project to contribute to SAV research, including:*

   - *Producing digital polygon maps of potential SAV restoration sites in Currituck Sound;*
   - *Completing some experimental SAV plantings to assess plant survival, vigor, and feasibility of SAV restoration efforts in Currituck Sound (ECSU has conducted some experimental plantings);*
   - *Calibration of light attenuation models (an important factor affecting SAV survival and distribution);*
   - *Producing GIS data layers of the bathymetry of Currituck Sound and Back Bay (ECSU has already completed this but might need assistance [financial or personnel] in updating images or producing other layers such as extensive mapping of locations of SAV); and*
   - *Hosting a workshop to communicate SAV restoration techniques.*

b. *SAV restoration or enhancement is an option. Information exists to support that SAV restoration or enhancement is possible in North Carolina. The 2010 Draft Coastal Habitat Protection Plan (CHPP) has a comprehensive summary of SAV in North Carolina, including the status of SAV restoration and enhancement, and references to techniques and success criteria for SAV restoration. The plan recommends first targeting areas of historically abundant SAV that are now reduced or absent. Models could also be developed to pick the sites with the highest probabilities of success based on site conditions and other parameters. There were 12 SAV restoration projects (total of 1.95 acres of bottom habitat restored) in Carteret and Onslow counties between 1978 and 1991. Since then, there have been four more NCDOT projects with SAV impacts (1 to 2 acres each), but mitigation was almost*

always out-of-kind. A permit, with compensatory SAV mitigation of 6+ in-kind acres, was issued for impacts associated with approximately 4 acres of primarily freshwater/brackish SAV in Chowan County. According to the CHPP, a study near the project area (Corolla) to monitor the restoration of a dredged channel that had eliminated the SAV in the area has documented natural re-establishment of SAV in the restored area.

c. *The 2010 Currituck Sound Feasibility Scoping Meeting Report (CSFSMR) indicates that some portions of the sound may benefit from the restoration of marsh islands currently being eroded (or completely gone) as a result of wind/wave action and lack of over-wash from the beach front because of beach development. Another cause might be wakes from boats and/or jet skis eroding the island. CSFSMR suggests that construction of some islands may create waters protected from wave energy and thereby enhance/create/restore favorable environments for supporting SAV and fringing marsh communities. NCTA could also explore methods to protect existing islands in danger of being lost.*

d. *Both the CHPP and CSFSMR identify restoring/enhancing/preserving aquatic and terrestrial wetland and upland habitats adjacent to the Currituck Sound, which function as buffers that help to filter pollutants (e.g., nutrients, chemicals, sediment) from runoff before entering the sound, as an option to mitigating potential long-term impacts to SAV. This would help to create a more favorable environment for SAV communities.*

e. *The CHPP suggests that hard clam restoration would enhance water quality and may promote SAV growth. The CHPP reported that SAV had been observed to be expanding near clam aquaculture facilities in Virginia and North Carolina.*

5. **Comment:** Storm water- According to the EMC Coastal Stormwater Rules the first 1½ inches of rainfall needs to be collected and treated. The NCDMF understands the design challenges associated with a project of this size, but the NCDMF requests that as much runoff as possible be captured and treated. The TA has proposed using a street sweeper to reduce pollutants from entering Currituck Sound and Maple Swamp. The TA has proposed cleaning the bridge weekly after the peak summer season. Will there be monitoring to ensure that the street sweeping equipment is working as designed? The results from the NCDOT study are promising, but they focus primarily on completely freshwater systems. If the sweepers are not effectively removing pollutants is there a back-up plan? Can the bridge be modified to add in other means of treating stormwater? In handout 26, it states that this practice will be used for the 50 years of the public private partnership, are there plan for after the 50 years? Where will the waste be disposed? The NCDMF requests that no stormwater from the bridge be directly discharged into SAV habitat where the concentrated water may increase the energy and have an adverse impact on SAV and the habitat. The NCDMF also requests that no stormwater from the bridge over

Maple Swamp be directly discharged into the wetlands. Will there be some measures taken to offset not being able to meet the stormwater rules?

Response: *Further refinements in the proposed bridge deck cleaning program are expected, developed in association with NCDENR-DWQ. NCDOT and NCTA will 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. This will include pollutant source control through regular bridge deck cleaning (sweeping/vacuuming) on both the bridge over Currituck Sound and the bridge over Maple Swamp. In addition, the merits of stormwater capture will be investigated for the ends of the bridges (approximately 600 feet) where geometrically feasible irrespective of the presence of wetlands. Infiltration strips or basins will be used for treatment of stormwater from paved surfaces. Pervious pavements will be considered for parking areas and multi-use paths. Finally, acquisition of land parcels identified in Currituck County as having a potential to improve water quality through land conservation and restoration will be investigated. Potential parcels are identified in the November 2006 report for Currituck County by the North Carolina Coastal Land Trust: Countywide Land Parcel Prioritization Strategy for Water Quality Enhancement.*

With respect to a backup plan for deck cleaning, NCTA will prepare and implement a maintenance and monitoring plan, which will include provisions for appropriate spare parts and equipment. With respect to waste disposal, it will be in a suitable landfill. Measures to dissipate the flow of stormwater coming from bridge scuppers over Currituck Sound and Maple Swamp will be incorporated into the project where needed to minimize potential disturbance of the sound bottom or erosion in the swamp potentially caused by any water free fall.

6. **Comment:** Alternatives- As described in previous comments, the NCDMF's preferred and least environmentally damaging alternative is ER2. ER2 would avoid impacts to SAV, wetlands, and other critical habitat and not violate the coastal stormwater rules while still meeting the TA's purpose of improving traffic flow, reducing travel times, and reducing hurricane evacuation times. The topic of funding continues to arise in discussion of the alternatives, but at one time, was public funding made available for this type of project? Is it possible to obtain funding for improving portions of the existing roads until the project is complete? Is it possible to put tolls on improved roads until the construction costs have been paid off?

Response: *In general, public funding has not been available for this project except for planning. Several years ago, a small amount was allocated for right-of-way acquisition; however, public funding of the full cost of the project has never been proposed. Legislation providing for the tolling of a Mid-Currituck Bridge was first approved in 1993, well before the creation of NCTA in 2002. As indicated in Handout 25, traditional*

highway funds are not available to improve existing roads. The STIP includes no traditional highway funds for R-2576 that could be used to build or improve existing roads. In addition, the reallocation of Division 1 funds to pay for improving existing roads is not a realistic proposal. In the current STIP, Division 1 is anticipated to get approximately $569 million in traditional funds over a 7-year period. With an estimated cost in the neighborhood of $500 million, funding ER2, for example, would require delaying or deleting most other projects in Division 1. The replacement of the Bonner Bridge at an anticipated cost of $300 million also is scheduled within this 7-year window.

It is not possible to put tolls on improved roads for reasons noted in Handout 25 and in the response to USACE comment 4. In addition, as indicated in Handout 25 and the response to USACE comment 6, meeting the purpose and need of the project by improving existing roads is problematic for several reasons. Finally, as indicated in Handout 25, NCDENR-DCM made a provisional determination that ER2 is inconsistent with the Town of Duck's Coastal Area Management Act land use plan.

NCDENR-Division of Water Quality—November 29, 2010

1. **Comment:** Subsequent to this handout being distributed, the NCTA and the DWQ had a meeting to discuss potential stormwater treatment and issues regarding this project. The DWQ is not certain how applicable the NCDOT stormwater study is to this project. This is due in part, as is stated in the handout:

   - only two of the 30 sites studied were located in the Coastal Plain;
   - Neither of those two sites were located over estuarine waters; and
   - Estuarine waters exhibit different characteristics than freshwater with respect to chemical interactions.

   As has been stated by the DWQ several times, the stormwater rules have changed since the Wright Memorial Bridge, the US 64 bridges over Roanoke Sound and Croatan Sound here [sic] designed and built. The regulations have become more stringent, requiring the first 1.5 inches of stormwater to be captured and treated and do not allow for direct discharge of stormwater any longer. The DWQ understands the constraints of the project with respect to stormwater capture and treatment and financial feasibility. However, the DWQ must still require the NCTA to capture and treat stormwater to the best extent practicable. During the meeting, the DWQ presented the NCTA with some other potential possibilities for getting credit without having to capture and treat the first 1.5 inches of stormwater from the entire length of the bridge.

   As was also discussed during the meeting, submerged aquatic vegetation (SAV) is present in the project corridor. This is a very sensitive and fragile resource that the DWQ believes should be protected. As such, the effects of stormwater on SAV have

not been sufficiently researched and documented according to a National Marine Fisheries SAV biologist.

The DWQ believes that sweeping the bridge as discussed in the handout is a good first step: however, it is not the only action that will be required to meet current stormwater regulations. The DWQ will continue its effort to work with the NCTA to assure that adequate stormwater measures are implemented to satisfactorily meet the coastal stormwater rules based on the understood constraints of the project.

Response: *Further refinements in the proposed bridge deck cleaning program are expected, developed in association with NCDENR-DWQ. NCDOT and NCTA will 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. This will include pollutant source control through regular bridge deck cleaning (sweeping/vacuuming) on both the bridge over Currituck Sound and the bridge over Maple Swamp. In addition, the merits of stormwater capture will be investigated for the ends of the bridges (approximately 600 feet) where geometrically feasible irrespective of the presence of wetlands. Infiltration strips or basins will be used for treatment of stormwater from paved surfaces. Pervious pavements will be considered for parking areas and multi-use paths. Finally, acquisition of land parcels identified in Currituck County as having a potential to improve water quality through land conservation and restoration will be investigated. Potential parcels are identified in the November 2006 report for Currituck County by the North Carolina Coastal Land Trust: Countywide Land Parcel Prioritization Strategy for Water Quality Enhancement.*

2. **Comment:** A table is included which includes a row for "Project Duration" in which the estimated duration of the project, based on the various combinations of construction methods, is estimated. In the "Pile Setup" section of the document, it is stated that piles will need to set up for anywhere from two to thirty days. It is understood that more geotechnical data regarding substrate/pile installation will need to be conducted. However, it is unclear what duration of pile setting days was used to estimate the project length. Additionally, on this project, "time is money" and it is unclear how deviations from the estimation used to calculate the project duration would affect both the project duration as well as the overall cost of the project. Suppose a worst case scenario, and it is determined that piles will need to set up for 30 days, how much would this add to the overall cost of the project versus a two day time that could be required?

   Response: *NCTA schedule durations reflect pile set-up time to be between two and five days and already reflect this time-frame. The 30 days was a worst-case scenario for a large closed-end pile. The piles anticipated for use on this project are open-ended and should not require set-up times that exceed seven days. More information on set-up*

times will be known once additional geotechnical investigations are completed during final design of the bridge.

3. **Comment:** The DWQ's preferred bridge construction method would entail a combination of no dredging and top-down construction over the SAV beds. Such scenarios are presented in Figures 5, 6, and 7. However, the DWQ realizes that a construction method that strictly involves top down construction (Figure 7) is probably impracticable from a project duration and cost aspect. A temporary trestle or work bridge over the SAV beds, even though temporary (estimated to be five to eight months), would have additional impacts to SAV beds that would need to be considered. If permanent vegetation loss is associated with such a structure, the impact may be considered a permanent impact and additional mitigation may be required. An example might be shading effects of the temporary structure; which is estimated to be 2.19 acres. It is also believed that installing/removing the necessary piles for a temporary structure would increase turbidity in the SAV bed area(s) and would be an adverse affect. Therefore, the DWQ does not support a construction combination that includes a temporary structure over SAV areas.

   Response: *NCTA will continue to coordinate with the resource agencies in developing acceptable solutions for building the Mid-Currituck Bridge. See the response to USEPA comment 1, which includes a revised proposal for how the Mid-Currituck Bridge would be built. Also see the response to NCDENR-DMF comment 4, which discusses approaches to minimizing SAV impact during construction and options for mitigating long-term SAV impact. In addition, NCTA could use, if preferred by the resource agencies, an open trestle with either open grating or beams only to support the crane. This should allow greater light penetration with minimal shading over SAVs (see photo example).*

   NCTA envisions shading to be minimally invasive in SAV beds; less than 0.7 acre. NCTA will coordinate with NCDENR-DWQ on any necessary mitigation offsets for theoretical SAV shading.

4. **Comment:** It is stated in the response to question 1 that "...impacts to the surface water flow system also are not expected to be substantial with proper design of the bridges and/or culverts…" The text makes a reference to impacts not being "substantial", however does not define what would be considered substantial (or non-substantial). In that same discussion, it is also stated that "…proper design will mitigate this impact [to surface water flows] to a satisfactory level…" Again, it is

unclear what would be considered "satisfactory." Both "substantial" and "satisfactory" should be defined as they relate to the discussion.

Response: *In the statement "…impacts to the surface water flow system also are not expected to be substantial with proper design of the bridges and/or culverts…", the phrase "not…substantial" is intended to mean "insignificant," "essentially zero," or "immeasurable" under typical climatic conditions. Additionally, the term "satisfactory" is intended to mean "complying with North Carolina design requirements for the permitting of engineered stormwater systems."*

5. **Comment:** It is stated on page 7 that with Option C Aydlett Road would be left in place. It is still the DWQ's preference to have the road removed and the area restored with potential mitigation credits available.

Response: *NCDENR-DWQ's position is noted; however, the removal of Aydlett Road was found during the public and agency comment period to be an unacceptable community impact by both the residents of Aydlett and Currituck County officials. Those impacts are discussed in Section 3.1.2 on page 3-9 of the DEIS. NCTA also has now minimized the impact to Maple Swamp by including Option A in its recommended Preferred Alternative. Option A would retain Aydlett Road.*

6. **Comment:** With respect to the proposed stormwater management plan of bridge sweeping, should a bridge be constructed, there is a commitment to monitor water quality to determine the effectiveness of the sweeping program. While no monitoring plan has been developed at this time, the plan should include a pre-construction monitoring component so background levels of targeted pollutants can be determined and compared to post-construction conditions. This will better allow those concerned to determine program effectiveness and set targets. Additionally, the plan should allow for some oversight and allow resource agencies to review the water quality monitoring data as necessary to ensure sweeping and other measures are effective.

Response: *NCTA will prepare and implement a maintenance and monitoring plan for bridge operations. In addition, pre-construction and post-construction monitoring programs will be developed in the context of the permitting process.*

7. **Comment:** The "Costs and Design Considerations" section states that "With MCB4, hurricane evacuation improvements would only be needed for the 5 miles between the Mid-Currituck Bridge and NC 168, plus for 1,600 feet west of US 158/NC 12 intersection, instead of the 25 miles with ER2, reducing costs and environmental impacts." The DWQ must consider the project from a holistic view; hurricane evacuation as discussed here is just a single component. While this idea is true for hurricane evacuation, when considering the whole project, ER2 has less overall

environmental impacts and the overall cost ($416.1 to $523.4 million) is considerably less than that of MCB4/C1 ($600.7 to $816.2 million).

Response: *NCDENR-DWQ's position is noted. NCTA agrees that while individual benefits are important to note, a "holistic" view also must be considered.*

8. **Comment:** The "Travel Benefits Considerations" section indicates that an interchange at the US 158/NC 12 intersection would not be needed because enough traffic would be diverted to the Mid-Currituck Bridge that improvements would not be needed. The DWQ has not seen any studies indicating that a future interchange would not be needed. To our knowledge, the project is still listed in the STIP as R-4457.

Response: *The referenced section of the Preferred Alternative Report does not say that the interchange at US 158/NC 12 would not be needed. It says: "With the Mid-Currituck Bridge included in MCB4, a future interchange at NC 12 and US 158 would not carry as much traffic (some 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)." An interchange is needed but a smaller interchange with less impact.*

9. **Comment:** It is stated on Page 11 that "The construction approach described for MCB4/C1 seeks to minimize construction related impacts to Currituck Sound as practicable." It is discussed earlier in the document that dredging would be a part of this construction technique for this alternative. Based on financial projections presented in Handout 27 ("Construction Methodologies for Mid-Currituck Bridge"), all construction methods, with exception of the top-down only method are at least partially in the black, indicating that they are conceivably feasible financially. Furthermore, since all methods have been shown to be effective bridge construction techniques which are widely used, all should be practicable from a constructability stand point. Therefore, the DWQ does not agree that the method proposed to construct the MCB4/C1 alternative is one that minimizes construction related impacts to Currituck Sound as it includes a dredging component, which is very destructive to the Sound bottom, while other practicable methods which do not involve dredging are seemingly practicable.

Response: *Although a particular construction approach is "partially in the black," as the cost of the project increases (whether because of project design features or the construction methods used), so does the risk that higher than expected construction costs or bond interest rates could increase project costs beyond what is affordable. Therefore, regarding dredging, NCTA will continue to work with the resource agencies as the project progresses to see if an acceptable approach to dredging can be developed. NCTA has considered the comments on dredging made at the November 2, 2010 TEAC meeting, as well as the comments made on the October 2010 Preferred Alternative Report, and has*

modified its proposed dredging strategy based on those comments. See the response to USEPA comment 1 and the January 2011 Preferred Alternative Report.

10. **Comment:** The DWQ commends the NCTA for efforts taken thus far to avoid and minimize impacts to the natural and human environment, including the realignment of the C1 corridor on the outer banks and using lane-reversal on US 158 for hurricane evacuation. However, the NCTA is respectfully reminded that they should continue to look for ways to avoid and minimize impacts to the natural and human environment throughout the planning and design process of the project, as is required by 15A NCAC 2H .0506(b) and 15A NCAC 2H .0506(c).

    Response: *NCTA will continue to look for ways to avoid and minimize impacts to the natural and human environments throughout the planning and design process for the proposed project.*

11. **Comment:** It has been well documented in literature that SAV are a very important yet sensitive resource. The NCTA should ensure that every possible measure is taken to avoid and reduce impacts to SAV through bridge design and during construction, should a bridge be built.

    Response: *Minimizing impacts to SAV is important to NCTA. This is evidenced in part by the fact that NCTA has never proposed dredging in existing SAV beds, as well as by its responses in this handout to other SAV-related comments.*

12. **Comment:** In general, the DWQ supports the United States Army Corps of Engineer's (USACE) letter dated October 29, 2010. The DWQ especially supports item number two in the letter. First, there are certain aspects of the project, such as the bridging of Maple Swamp and bridge construction techniques that have not been fully decided at this time. Because of this, the impacts from the potential construction of the bridge have not been established. Furthermore, based on information presented thus far, the DWQ also agrees with the USACE that that either ER2 or MCB4/A/C1 (with the modifications to the bridge landing as presented at the November 2, 2010 TEAC meeting) and a construction method that does not involve dredging represent the LEDPA at this time.

    Response: *NCTA, after considering agency comments, has revised its recommended Preferred Alternative from that presented in the October 2010 Preferred Alternative Report. The recommended Preferred Alternative, MCB4/C1, now also includes Option A, bridging Maple Swamp, rather than Option C. The January 2011 Preferred Alternative Report reflects this change. Regarding dredging, as previously stated, NCTA will continue to work with the resource agencies as the project progresses to see if an acceptable approach to dredging can be developed. See the response to USEPA comment 1 and the January 2011 Preferred Alternative Report.*

NCDENR-Wildlife Resources Commission—December 3, 2010

1. **Comment:** NCWRC supports the proposal to perform routine sweeping on the bridge over Currituck Sound; however it is not evident that this practice alone will provide sufficient treatment. If this methodology is adopted at a minimum NCTA should utilized this opportunity to collect the appropriate data needed to supplement the findings in NCDOT's "Stormwater Runoff from Bridges". Furthermore, we recommend not discharging directly over SAV areas or shallow water habitat. Directly discharging over these areas may result in vegetation damage, erosion during low wind tide events, as well as a localized increase in turbidity levels.

   Response: *NCTA will prepare and implement a maintenance and monitoring plan and will collect appropriate data indicating its stormwater management plan's effectiveness so that it can be refined, as needed. Measures to dissipate the flow of stormwater coming from bridge scuppers over Currituck Sound and Maple Swamp will be incorporated into the project where needed to minimize potential disturbance of the sound bottom or erosion in the swamp potentially caused by any water free fall.*

2. **Comment:** In reviewing the construction methodologies for the bridge over Currituck Sound, Page 4 of handout 27 states "…with additional geotechnical information and engineering analysis in conjunction with construction methodologies, an optimal balance between pile size/length, bridge characteristics such as span-length and construction duration could be determined" this is essential information needed to make a definitive determination of practicable construction methods. Until more detailed geotechnical information and engineering analysis is conducted it is unclear how accurate the current estimated construction duration and pile count is. Furthermore WRC does not support the dredging of high quality habitat such as that found in the shallow water areas of Currituck Sound. More specifically, dredging to the edge of SAV coverage as is currently shown would likely still result in loss of habitat due to turbidity as well as channel sloughing. We support the NCTA commitment to observe an in water work moratorium of February 15 to September 30 for all approved dredging activities; however WRC also recommends this moratorium extend to all bottom disturbing activities in SAV areas. SAV areas provide an important function for aquatic species in the form of foraging, refuge, and nursery habitat, disturbance to these areas during this timeframe could result in adverse impacts to aquatic species.

   Response: *NCTA used best approach and worst-case scenarios for the estimated number and length of piles in developing its construction scenarios. NCTA will refine its schedule as the project progresses. See the response to USEPA comment 1, which includes a revised proposal for how the Mid-Currituck Bridge would be built. Also see the response to NCDENR-DMF comment 4, which discusses both approaches to minimizing SAV impact during construction and options for mitigating long-term SAV*

impact, as well as the response to NCDENR-DWQ comment 3 regarding SAV shading during construction.

3. **Comment:** Maple Swamp is designated a Significant Natural Heritage Area (SNHA) of state significance. Consisting of non-riverine swamp forest, non-riverine wet hardwood forest, and one of the largest loblolly bay forests in the state, this area provides exemplary habitat for a multitude of species. Fragmentation of this area would have significant adverse impacts on the quality of this habitat and its use by wildlife. Hydrologic alteration in these non-riverine wetland systems can result in permanent changes in the vegetative community. Handout 28 concludes that surface water hydrology is the dominant hydrologic factor for Maple Swamp and the proposed crossing of Maple Swamp would not have a significant effect on this area if "the design properly maintains surface water hydrology." For that reason bridging the entire crossing of Maple Swamp would preserve both surface and subsurface hydrology through this area resulting in the least environmentally damaging effect to Maple Swamp.

   Response: *NCTA, after considering resource agency comments, has revised its recommended Preferred Alternative from that presented in the October 2010 Preferred Alternative Report. The recommended Preferred Alternative, MCB4/C1, now includes Option A, bridging Maple Swamp, rather than Option C. Surface water and groundwater hydrology, however, also could have been maintained with Option C.*

4. **Comment:** It is essential to ensure that the implementation of this project does not contribute to the continued decline of the Currituck Sound ecosystem.

   Response: *NCTA understands NCWRC's position.*

Appendix C

Letter from Currituck County Emergency Management (October 7, 2010)

Phone (252) 232-2115
Fax (252) 232-2750

Mary Beth Newns
Director

Currituck County
EMERGENCY MANAGEMENT
P.O. Box 240 •
Currituck, North Carolina 27929

October 7, 2010

Ms. Jennifer H. Harris, P.E.
NC Turnpike Authority
1578 Mail Service Center
Raleigh, NC 27699-1578

Re: Evacuation of Currituck Beaches

Dear Ms. Harris:

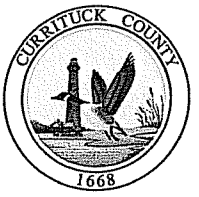
I wanted to take a moment to make you aware of traffic issues we encountered during the recent evacuation of the Currituck Outer Banks due to anticipated effects of Hurricane Earl.

The Emergency Operations Center determined that there was too much uncertainty in Hurricane Earl's forecasted track and that an evacuation of our visitors would be appropriate. The tourists staying at our beaches were very compliant and traffic volumes started to build. Although traffic was heavy, it was moving adequately until an accident occurred in Duck which was then compounded by a malfunctioning traffic light. This turned the Currituck portion of highway 12 into a literal parking lot for several hours. Our call center was over loaded with concerned, scared and angry tourists.

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.

As the storm passed, the Currituck Emergency Operations Center started working on re-entry. The same challenges surfaced immediately; when was Dare County going to let people re-enter and were Southern Shores and Duck going to permit our returning population back into the Currituck Outer Banks? Mr. Scanlon's previous statement about having control of our financial destiny was certainly pondered in those hours.

Phone (252) 232-2115
Fax (252) 232-2750



Mary Beth Newns
Director

Currituck County
EMERGENCY MANAGEMENT
P.O. Box 240 •
Currituck, North Carolina 27929

Currituck County Emergency Operations looks forward to the progress in the efforts to build a mid-county bridge.

Sincerely,

Mary Beth Newns

Mary Beth Newns

Cc: Currituck County Board of Commissioners
Dan Scanlon, Currituck County Manager
Sandy Sanderson, Dare County Emergency Management
Jerry Jennings, North Carolina Department of Transportation