Topsail Island Bridge Replacement
(Bridge No. 16 over Intracoastal Waterway)
Surf City, Pender County

Federal Aid Project No. BRSTP-50(10)
WBS No. 40233.1.1
TIP Project No. B-4929

ADMINISTRATIVE ACTION

ENVIRONMENTAL ASSESSMENT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
AND
N.C. DEPARTMENT OF TRANSPORTATION

Submitted pursuant to 42 U.S.C. 4332(2) (c)

APPROVED:

10/24/11
Date FOR **Gregory J. Thorpe, Ph.D., Manager**
Project Development and Environmental Analysis Branch, NCDOT

10/24/11
Date for **John F. Sullivan, III, PE, Division Administrator**
Federal Highway Administration

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ENVIRONMENTAL ASSESSMENT

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PROJECT COMMITMENTS

Topsail Island Bridge Replacement
(Bridge No. 16 over Intracoastal Waterway)
Surf City, Pender County

Federal Aid Project No. **BRSTP-50(10)**
State Project No. **40233.1.1**
TIP Project No. **B-4929**

Project Development and Environmental Analysis Branch:

1. Construction activities will adhere to the guidelines outlined in Precautions for Construction in Areas which May be Used by the West Indian Manatee in North Carolina (2003 USFWS).

2. NCDOT is investigating re-use options for the existing riveted Warren through truss swing span (eligible for the National Register of Historic Places). Results from these investigations will be included in subsequent documentation. Upon selection of the LEDPA/Preferred Alternative, FHWA will initiate Adverse Effects Process and identify further minimization/mitigation efforts, which will be included in the Section 106 Memorandum of Agreement.

3. NCDOT is coordinating the potential Soundside Park impacts and mitigation measures with the Town of Surf City. Determination of de minimis impacts will be further investigated and described in the project's subsequent documentation.

4. NCDOT will continue to coordinate with the Town of Surf City on appropriate cost sharing agreement for sidewalk improvements in the Project Study Area.

5. Throughout project development, final design, and construction, NCDOT will coordinate with the regulatory agencies to obtain the necessary permits. The following is a list of permits that may be required for this project. Final determination of permit applicability lies with the regulatory agencies.
    - Section 404 (Impacts to Waters of the United States - Clean Water Act)
    - Section 401 General Water Quality Certification (Clean Water Act)
    - Section 9 (Bridge Permit)
    - Section 10 (Permit for Work in Navigable Waters - Rivers and Harbors Act)
    - CAMA Major Development Permit
    - United States Coast Guard (USCG)Bridge Closure Permit
    - State Stormwater Permit
    - Public Water Supply

Table of Contents Page

E.0 EXECUTIVE SUMMARY E-1

E.1 Type of Action E-1

E.2 Description of Action E-1

E.3 Summary of Purpose and Need E-1

E.4 Alternatives Considered E-2

E.5 Summary of Environmental Effects and NCDOT Recommended Alternative E-2

E.6 Anticipated Permit Requirements E-4

E.7 Project Initiation E-4

E.8 Coordination E-5

E.9 Additional Information E-5

1.0 DESCRIPTION OF PROPOSED ACTION 1-1

1.1 General Description 1-1

1.2 Schedule and Cost 1-1

2.0 PURPOSE AND NEED FOR PROJECT 2-1

2.1 Purpose of Project 2-1

2.2 Need for Project 2-1

2.2.1 Description of Existing Conditions 2-1

2.2.1.1 Functional Classification 2-1

2.2.1.2 Project History 2-1

2.2.1.3 Physical Description of Existing Facility 2-1

2.2.1.4 School Bus Usage 2-3

2.2.1.5 Traffic Volumes and Capacity Analysis 2-3

2.2.1.6 Airports 2-4

2.2.1.7 Other Highway Projects in the Area 2-4

2.2.2 Transportation and Land Use Plans 2-4

2.2.2.1 NCDOT State Transportation Improvement Program 2-4

2.2.2.2 Local Thoroughfare Plans 2-4

2.2.2.3 Land Use Plans 2-4

2.2.2.4 Safety 2-5

2.2.2.5 Maintenance 2-5

2.2.3 System Linkage 2-5
2.2.4 Travel Time 2-5
2.2.5 Access Needs 2-6
2.3 Study Area Defined 2-6
2.3.1 Project Study Area 2-6
2.3.2 Demographic Study Area 2-7
2.4 Benefits of Proposed Project 2-7
3.0 ALTERNATIVES 3-1
3.1 No Build Alternative 3-1
3.2 Repair and Rehabilitate Existing Bridge Alternative 3-1
3.3 Alternative Modes of Transportation 3-2
3.3.1 Alternative Modes of Travel 3-2
3.3.2 Traffic Management Alternative 3-2
3.4 Build Alternative Corridors 3-2
3.4.1 Low-Level Moveable Bridge Alternatives 3-2
3.4.2 Mid-Level Moveable Bridge Alternatives 3-3
3.4.3 High-Level Fixed Bridge Alternatives 3-4
3.4.4 Initial Screening (Alternatives Eliminated) 3-5
3.5 Alternatives Evaluation 3-6
3.5.1 Corridor Alternatives Grouping 3-6
3.5.2 Alternatives Evaluation Matrix 3-6
3.5.3 Community Feedback 3-8
3.5.4 Evaluation Criteria Summary 3-8
3.5.4.1 Northern Alternatives Group (High-Level Fixed Bridge Alternatives) 3-8
3.5.4.2 Central Alternatives Group (Moveable Bridge Alternatives) 3-9
3.5.4.3 Southern Alternatives Group (High-Level Fixed Bridge Alternatives) 3-10
3.6 Detailed Study Alternatives 3-11
3.7 NCDOT Recommended Alternative 3-12
4.0 PROPOSED IMPROVEMENTS 4-1
4.1 Roadway Cross-Section and Alignment 4-1
4.2 Right-of-Way and Access Control 4-1

4.3 Speed Limit 4-1
4.4 Anticipated Design Exceptions 4-1
4.5 Intersections and Interchanges 4-2
4.6 Roundabouts 4-3
4.7 Service Roads 4-3
4.8 Structures 4-3
4.8.1 Low-Level\Mid-Level Moveable Bridge 4-3
4.8.1.1 Bascule Bridge 4-4
4.8.1.2 Vertical Lift Bridge 4-4
4.8.1.3 Swing Span Bridge 4-4
4.8.1.4 Recommended Permanent Moveable Bridge Type 4-4
4.8.1.5 Recommended Temporary Moveable Bridge Type 4-4
4.8.2 High-Level Fixed Bridge 4-4
4.8.3 Operations and Maintenance Costs 4-4
4.8.3.1 Movable Bridge Alternatives 4-5
4.8.3.2 Fixed Bridge Alternatives 4-5
4.9 Bicycle and Pedestrian Facilities 4-7
4.10 Utilities 4-7
4.11 Noise Barriers 4-7
4.12 Work Zone, Traffic Control, and Construction Phasing 4-7
5.0 ENVIRONMENTAL EFFECTS OF PROPOSED ACTION 5-1
5.1 Natural Resources 5-1
5.1.1 Biotic Resources 5-1
5.1.1.1 Terrestrial Communities 5-1
5.1.1.2 Terrestrial Community Impacts 5-2
5.1.1.3 Terrestrial Wildlife 5-3
5.1.1.4 Aquatic Communities 5-3
5.1.1.5 Invasive Communities 5-3
5.1.2 Waters of the United States 5-4
5.1.2.1 Ponds 5-4
5.1.2.2 Streams 5-4

5.1.2.3 Wetlands 5-5
5.1.2.4 Avoidance, Minimization, and Mitigation 5-6
5.1.2.5 Anticipated Permit Requirements 5-7
5.1.3 Rare and Protected Species 5-8
5.1.3.1 Federally Protected Species 5-8
5.1.3.2 Bald and Golden Eagle Protection Act 5-14
5.1.3.3 Endangered Species Act Candidate Species 5-14
5.1.3.4 Essential Fish Habitat 5-14
5.1.4 Topography and Soils 5-14
5.2 Cultural Resources 5-16
5.2.1 Compliance 5-16
5.2.2 Historic Architectural Resources 5-16
5.2.3 Archaeological Resources 5-17
5.3 Section 4(f) Resources 5-17
5.3.1 Bridge No. 16 5-18
5.3.1.1 Avoidance Alternatives 5-18
5.3.1.2 Measures to Minimize Harm 5-18
5.3.1.3 Coordination 5-19
5.3.2 Soundside Park 5-19
5.3.2.1 Avoidance Alternatives 5-19
5.3.2.2 Alternatives 6 and 7 5-19
5.3.2.3 Alternative 17 5-20
5.3.2.4 Section 4(f) *De Minimis* Impact Background 5-20
5.4 Farmland 5-21
5.5 Social Effects 5-21
5.5.1 Neighborhoods/Communities 5-21
5.5.2 Community Demographics 5-22
5.5.3 Relocation of Residences and Businesses 5-23
5.5.4 Environmental Justice 5-23
5.5.4.1 Environmental Justice Impacts 5-24
5.5.4.2 Other Populations 5-24

5.5.5 Bicycle and Pedestrian Facilities 5-24
5.5.6 Recreational Facilities 5-24
5.5.7 Other Public Facilities and Services 5-25
5.6 Economic Effects 5-25
5.7 Land Use 5-26
5.7.1 Existing Land Use and Zoning 5-26
5.7.2 Future Land Use and Zoning 5-26
5.7.3 Community Character 5-27
5.7.4 Visual Impacts 5-27
5.7.4.1 Alternative 4 5-27
5.7.4.2 Alternative 5 5-27
5.7.4.3 Alternative 5R 5-28
5.7.4.4 Alternative 6 5-28
5.7.4.5 Alternative 7 5-28
5.7.4.6 Alternative 11 5-28
5.7.4.7 Alternative 17 5-28
5.7.5 Project Compatibility with Local Plans 5-29
5.8 Indirect and Cumulative Effects 5-29
5.8.1 Indirect Summary Statement 5-29
5.8.2 Alternatives 4, 5, and 5R 5-30
5.8.2.1 Scope of Project 5-30
5.8.2.2 Change in Accessibility 5-30
5.8.2.3 Available Land 5-30
5.8.2.4 Water/Sewer Availability 5-30
5.8.2.5 Market for Development 5-30
5.8.2.6 Public Policy 5-30
5.8.2.7 Environmental Features 5-30
5.8.3 Alternatives 6 and 7 5-31
5.8.3.1 Scope of Project 5-31
5.8.3.2 Change in Accessibility 5-31
5.8.3.3 Available Land 5-31

5.8.3.4 Water/Sewer Availability 5-31
5.8.3.5 Market for Development 5-31
5.8.3.6 Public Policy 5-31
5.8.3.7 Environmental Features 5-31
5.8.4 Alternatives 11 and 17 5-32
5.8.4.1 Scope of Project 5-32
5.8.4.2 Change in Accessibility 5-32
5.8.4.3 Available Land 5-32
5.8.4.4 Water/Sewer Availability 5-32
5.8.4.5 Market for Development 5-32
5.8.4.6 Public Policy 5-32
5.8.4.7 Environmental Features 5-32
5.8.5 Cumulative Effects Summary Statement 5-33
5.8.5.1 Past Development Projects 5-33
5.8.5.2 Future Development Projects 5-34
5.8.5.3 Notable Environmental Resources 5-34
5.8.5.4 Impacts on Environmental Resources 5-34
5.8.5.5 Cumulative Effects Summary 5-34
5.9 Flood Hazard Evaluation 5-35
5.10 Traffic Operations Analysis 5-36
5.11 Traffic Noise Analysis 5-38
5.11.1 Title 23 Code of Federal Regulations, Part 772 (23 CFR 772) 5-38
5.11.2 NCDOT Traffic Noise Abatement Policy 5-38
5.11.3 Ambient Noise Levels 5-38
5.11.4 Predicting Future Noise Levels 5-39
5.11.5 Traffic Noise Impacts 5-39
5.11.6 Potential Traffic Noise Abatement Measures 5-39
5.11.7 Construction Noise 5-40
5.11.8 Traffic Noise Analysis Summary 5-40
5.12 Air Quality Analysis 5-40
5.12.1 Attainment Status 5-40

5.12.2 Carbon Monoxide 5-40
5.12.3 Mobile Source Air Toxics 5-41
5.12.3.1 NEPA Context 5-42
5.12.3.2 Analysis of MSAT in NEPA Documents 5-42
5.12.3.3 Qualitative MSAT Analysis 5-42
5.12.3.4 Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis 5-43
5.12.3.5 MSAT Conclusion 5-45
5.12.4 Other Emissions 5-45
5.12.5 Burning of Debris 5-45
5.12.6 Air Quality Summary and Results 5-45
5.13 Utilities 5-46
5.14 Hazardous Material 5-46
5.15 Summary of Environmental Effects 5-47
6.0 PUBLIC INVOLVEMENT AND AGENCY COORDINATION 6-1
6.1 Public Involvement 6-1
6.1.1 Mailing List and Newsletters 6-1
6.1.2 Phone and Email Correspondence 6-1
6.1.3 Project Website 6-1
6.1.4 Media 6-1
6.1.5 Citizens Informational Workshop #1 6-1
6.1.6 Citizens Informational Workshop #2 6-2
6.2 Public Hearing 6-2
6.3 Project Initiation 6-2
6.4 Section 404/NEPA Merger Process 6-3
6.4.1 Agency Coordination 6-3
6.4.2 Concurrence Point 1 6-3
6.4.3 Concurrence Point 2 6-3
6.4.4 Future Section 404/NEPA Merger Process and Concurrence 6-4

List of Tables Page No.

Table E-1: Detailed Study Alternatives Environmental Effects Summary E-3
Table 2-1: Study Intersections 2-2
Table 2-2: Historically Incurred Maintenance Costs for Bridge No. 16 2-5
Table 3-1: Alternatives Evaluation Matrix 3-7
Table 4-1: Estimated Operations and Maintenance Costs for Moveable Bridges (75 years) 4-6
Table 4-2: Estimated Operations and Maintenance Costs for Fixed Bridges (75 Years) 4-6
Table 5-1: Terrestrial Communities 5-1
Table 5-2: Impacts to Terrestrial Communities 5-3
Table 5-3: Jurisdictional Streams 5-4
Table 5-4: Jurisdictional Wetlands 5-5
Table 5-5: Impacts to Jurisdictional Wetlands 5-5
Table 5-6: Federally Protected Species Listed for Pender County 5-9
Table 5-7: Commercial Fish Species 5-15
Table 5-8: Soils 5-15
Table 5-9: Residential and Business Relocations 5-23
Table 5-10: Community Facilities 5-25
Table 5-11: 2035 Intersection Level of Service Summary 5-37
Table 5-12: Hazardous Sites 5-47
Table 5-13: Detailed Study Alternatives Environmental Effects Summary 5-48

List of Appendices

Appendix A: Figures

Figure 1-1: Project Vicinity
Figure 1-2: Study Area
Figure 2-1: Study Intersections and Daily Traffic Volumes
Figure 2-2: Existing Utilities
Figure 3-1: Preliminary Alternative Corridors
Figure 3-2: Preliminary Corridor Alternative Groups
Figure 4-1: Proposed Typical Sections
Figure 5-1: Alternative 4 Affected Environment
Figure 5-2: Alternative 5 Affected Environment
Figure 5-3: Alternative 5R Affected Environment
Figure 5-4: Alternative 6 Affected Environment
Figure 5-5: Alternative 7 Affected Environment
Figure 5-6: Alternative 11 Affected Environment
Figure 5-7: Alternative 17 Affected Environment
Figure 5-8: Terrestrial Communities
Figure 5-9: Alternative 6 – Soundside Park Impacts
Figure 5-10: Alternative 7 – Soundside Park Impacts
Figure 5-11: Alternative 17 – Soundside Park Impacts
Figure 5-12: Farmland Classification
Figure 5-13: Future Land Use Study Area
Figure 5-14: Floodplains
Figure 5-15: Alternative 4 – 2035 Peak Hour Traffic Diagrams
Figure 5-16: Alternative 5 & 5R – 2035 Peak Hour Traffic Diagrams
Figure 5-17: Alternative 6 & 7 – 2035 Peak Hour Traffic Diagrams
Figure 5-18: Alternative 11 – 2035 Peak Hour Traffic Diagrams
Figure 5-19: Alternative 17 – 2035 Peak Hour Traffic Diagrams
Figure 5-20: Traffic Noise Impacts

Appendix B: "Start of Study" Letters and Agency Responses

Appendix C: Programmatic Section 4(f) Evaluation

Appendix D: Summary of August 17, 2011 Meeting with the Town of Surf City (Soundside Park Impacts Coordination)

Appendix E: NRCS-CPA-106 Form (Farmland Conversion Impact Rating Form)

Appendix F: Relocation Reports

Appendix G: Artistic Renderings of Detailed Study Alternatives

Appendix H: Project Newsletters

Appendix I: Section 404/NEPA Merger Team Meeting (Concurrence Point) Minutes and Signature Forms

E.0 EXECUTIVE SUMMARY

E.1 Type of Action

This Environmental Assessment (EA) has been prepared to evaluate the potential impacts associated with the replacement of the Topsail Island Bridge (Bridge No. 16). From this assessment, the North Carolina Department of Transportation (NCDOT) and Federal Highway Administration (FHWA) do not anticipate any significant environmental impacts as a result of this project. The findings contained within this document and subsequent public review of this document shall determine if the proposed action has significant impacts.

NCDOT initiated studies for this replacement project in accordance with the requirements set forth in the National Environmental Policy Act (NEPA) of 1969, as amended. The general vicinity of Bridge No. 16, relative to Pender County and Topsail Island, is shown in Figures 1-1 and 1-2 (all referenced figures herein are included in Appendix A).

E.2 Description of Action

NCDOT, in consultation with FHWA, proposes to replace the existing Topsail Island Bridge (Bridge No. 16) along NC 50/210 over the Intracoastal Waterway (Topsail Sound) in Pender County, North Carolina. Bridge No. 16 is located within the town limits of Surf City and consists of a main channel swing span with concrete deck girder approach spans. The existing length of the bridge is 463 feet, with a main channel swing span length of 254 feet. This bridge opens for commercial vessel traffic on demand and for daytime recreational vessels at the top of each hour. The existing vertical waterway clearance under the moveable bridge span is approximately 13 feet.

NCDOT inspects their bridges a minimum of every two years. Bridge No. 16 was last inspected in 2010 and the corresponding report indicates that the bridge is in poor condition, with a sufficiency rating of six out of 100 and restricted loads of 14 tons for single vehicles and 18 tons for truck tractor with semi-trailer.

This project is included in the 2011-2020 North Carolina State Transportation Improvement Program (STIP). The STIP budget allocation is approximately $3 million for right-of-way acquisition and $31 million for construction costs. The current estimated construction costs based on preliminary design plans range between $45.6 and $68.5 million. Right-of-way acquisition costs range between $5.0 and $22.3 million. Right-of-way acquisition is scheduled to begin in Federal Fiscal Year (FFY) 2014, with construction scheduled for FFY 2016.

E.3 Summary of Purpose and Need

- The purpose of the proposed project is to improve bridge safety and functionality.
- The need for the project is to replace the structurally deficient, functionally obsolete bridge.

E.4 Alternatives Considered

NCDOT evaluated numerous design alternatives for this project, including a No Build Alternative; Repair and Rehabilitate Existing Bridge Alternative; Alternative Modes of Transportation; and 20 Build Alternatives. During the early stages of the study, the No Build Alternative, Repair and Rehabilitate Existing Bridge Alternative, and Alternative Modes of Transportation were dropped from consideration.

For the 20 Build Alternatives considered, NCDOT evaluated three types of bridges: a low-level moveable, a mid-level moveable, and a high-level fixed, with vertical navigational clearances (VNC) of 15, 30, and 65 feet respectively.

Using the functional design plans, NCDOT prepared qualitative impacts and costs for all 20 Build Alternatives and presented them to the project stakeholders during the second Citizens Informational Workshop (CIW #2) held on October 21, 2010. The same information was presented on December 14, 2010, to the Section 404/NEPA Merger Team members (Merger Team). Based on input received from the project stakeholders and Merger Team, NCDOT selected the following seven alternatives as the Detailed Study Alternatives Carried Forward:

- Northern Alternatives Group: Alternatives 4, 5, and 5R (high-level fixed bridges)
- Central Alternatives Group: Alternatives 6 and 7 (low/mid-level moveable bridges, respectively)
- Southern Alternatives Group: Alternatives 11 and 17 (high-level fixed bridges)

Depending on the alternative chosen, Bridge No. 16 will be replaced with a new 500 to 4,000-foot long bridge. The new bridge will accommodate two-way traffic with two 12-foot travel lanes, two four-foot bike lanes, and two 5.5-foot sidewalks. Curb and gutter will provide a two-foot separation between the bicycle lanes and sidewalk. The approach roadway section will match the new bridge section, with the exception that sidewalks will not be provided. Instead, a ten-foot earth berm will be constructed behind the curb and gutter.

E.5 Summary of Environmental Effects and NCDOT Recommended Alternative

Preliminary design plans, along with detailed quantitative impact and cost analyses, were developed for the seven Detailed Study Alternatives. Table E-1 provides a summary of the resulting environmental effects, which are further discussed in Chapter 5 of this EA.

Currently, NCDOT has not chosen a recommended alternative. Before making an alternative recommendation, the environmental effects discussed in this EA will be presented to the community and local project stakeholders at the corridor public hearing. Copies of EA will also be distributed to federal, state and local project stakeholders. Subsequent to the corridor public hearing, a recommended alternative will be identified based on the design information prepared and public outreach comments received. This recommended alternative will be presented to the Merger Team at Concurrence Point 3 meeting. At this meeting, the Least Environmentally Damaging Practicable Alternative (LEDPA)/Preferred Alternative will be chosen.

Table E-1: Detailed Study Alternatives Environmental Effects Summary

Category	Alt 4	Alt 5	Alt 5R	Alt 6	Alt 7	Alt 11	Alt 17
Project Description							
Project Length (miles) - including permanent bridge length	1.1	1.0	1.0	0.5	0.5	1.1	0.9
Permanent Bridge Length (ft) - fixed length/moveable length	4,250	4,076	4,054	319/201	819/201	4,180	3,725
Detour Bridge Length (ft) - fixed length/moveable length	-	-	-	1,331/156	1,331/156	-	-
Human Environment Effects							
Community Facilities Impacted	-	-	-	-	-	-	-
Church (Faith Harbor United Methodist Church - property only)	1	1	1	-	-	1	-
Total Residential Relocations (number)	4	2	13	-	-	4	1
Total Business Relocations (number)	5	4	7	1	3	1	3
Property Only (number)	32	38	32	18	18	30	43
Low Income / Minority Residential/Business Relocations	-	-	-	-	-	-	-
Physical Environment Effects							
Section 4(f) Resources Soundside Park property impacts -- permanent/temporary (acres)	-	-	-	0.03[+]/0.4[*]	0.01[+]/0.4[*]	-	0.2[++]
Bridge No. 16 (also recognized as a Historic Architecture Resource)	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect
Farmlands	-	-	-	-	-	-	-
Archaeological Sites	TBD[**]	TBD[**]	TBD[**]	TBD[**]	TBD[**]	TBD[**]	TBD[**]
Known or Potential Hazardous Material Sites (number)	-	1	2	1	1	-	3
Superfund Sites	-	-	-	-	-	-	-
Natural Environment Effects							
Ponds	-	-	-	-	-	-	-
Stream Crossings (number)[#]	2	2	2	1	1	1	1
Wetlands: non-riparian/CAMA (acres)	1.1/ -	1.1/ -	1.1/ -	- /0.3	- /0.1	1.0/-	0.8/ 0.4
Federally Protected Species	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]
Costs ($M 2011)							
Construction Costs (includes relocation costs for water and sewer utilities)	$51,100,000	$48,800,000	$48,500,000	$50,200,000	$55,900,000	$50,200,000	$44,600,000
Utility Pole Relocation Costs	$939,090	$1,361,538	$1,430,662	$12,580,030	$12,580,030	$1,040,170	$1,015,778
Right-of-Way Costs	$12,625,000	$13,975,000	$22,250,000	$4,975,000	$6,875,000	$9,925,000	$8,125,000
Sub Total	$64,664,090	$64,136,538	$72,180,662	$67,755,030	$75,355,030	$61,165,170	$53,740,778
Bridge Operations and Maintenance Costs (75 Years)	$3,631,500	$3,631,500	$3,631,500	$25,964,500	$25,964,500	$3,631,500	$3,631,500
Total	$68,295,590	$67,768,038	$75,812,162	$93,719,530	$101,319,530	$64,796,670	$57,372,278

Note: Impacts are calculated from slope stake to slope stake, plus an additional 25 feet outside of each limit as determined from the May, 2011 preliminary design plans for each alternative.

[+] Represents fill slope impacts to the northern side of Soundside Park.
* Represents temporary impacts to Soundside Park as a result of the detour bridge.
[++] Represents minimal impacts to the southern end of Soundside Park.
[**] To be determined based on surveys to be completed after LEDPA/Preferred Alternative is chosen
[#] Both streams in the Project Study Area will be bridged, therefore no permanent stream impacts are anticipated.
[***] MA/NLAA – May Affect/Not Likely to Adversely Affect the following two species: West Indian manatee (Trichechus manatus) and Loggerhead sea turtle (Caretta caretta)

E.6 Anticipated Permit Requirements

The following is a list of permits that may be required for this project. Final determination of permit applicability lies with the regulatory agencies. Throughout project development process, NCDOT will coordinate with the regulatory agencies to obtain the necessary permits.

- Section 404 (Impacts to Waters of the United States - Clean Water Act)
- Section 401 General Water Quality Certification (Clean Water Act)
- Section 9 (Bridge Permit)
- Section 10 (Permit for Work in Navigable Waters - Rivers and Harbors Act)
- CAMA Major Development Permit
- United States Coast Guard (USCG) Bridge Closure Permit
- State Stormwater Permit
- Public Water Supply

E.7 Project Initiation

During project initiation, NCDOT provided "start of study" letters to the following federal, state and local agencies. Written comments were received and considered from agencies noted with an asterisk (*) during the preparation of this EA. These "start of study" letters, along with the agencies' initial concerns, are included in Appendix B.

US Army Corps of Engineers (USACE)
USCG, 5th District
US Environmental Protection Agency (USEPA)
* US Fish and Wildlife Service (USFWS)
National Marine Fisheries Service (NMFS
* North Carolina Department of Environment and Natural Resources (NCDENR)
* North Carolina Division of Coastal Management (NCDCM)
North Carolina State Clearing House
* North Carolina Department of Cultural Resources (NCDCR)
North Carolina Department of Public Instruction
* North Carolina Division of Water Quality (NCDWQ)
* North Carolina Wildlife Resources Commission (NCWRC)
North Carolina Natural Heritage Program (NCNHP)
Region "O" Planning Agency
NCDOT Division 3 Board Member
Region "O" Planning Agency
NCDOT Division 3 Board Member
* Mayor of Town of Surf City
Mayor of Topsail Beach
Mayor of North Topsail Beach

E.8 Coordination

For many NCDOT projects, the Section 404/NEPA Merger Process (Merger Process) is initiated to streamline agreements between NCDOT, state and federal permitting agencies, and local units of government. To this effect, the Merger Process provides a forum for appropriate agency representatives to discuss and reach consensus on ways to facilitate meeting the regulatory requirements of Section 404 of the Clean Water Act during the NEPA decision-making phase of transportation projects. Cooperating agencies included in the Merger Process of this project are as follows:

- USACE
- USEPA
- USCG
- USFWS
- NMFS
- FHWA
- NCDOT
- NCWRC
- North Carolina Division of Marine Fisheries (NCDMF)
- NCDCM
- NCDWQ
- NCDCR
- United States Forest Service (USFS)
- Cape Fear Rural Planning Organization (non-signatory)

Copies of this EA will be distributed to the above listed agencies and public. Comments received will be considered in the selection of the LEDPA/Preferred Alternative and will be incorporated into the subsequent documentation.

E.9 Additional Information

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

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Chapter 1

Description of Proposed Action

1.0 DESCRIPTION OF PROPOSED ACTION

1.1 General Description

The North Carolina Department of Transportation (NCDOT) proposes to replace the existing Topsail Island Bridge (Bridge No. 16) along NC 50/210 over the Intracoastal Waterway (Topsail Sound) in Pender County, North Carolina. Bridge No. 16 is located within the town limits of Surf City. NCDOT initiated studies for this replacement project in accordance with the requirements set forth in the National Environmental Policy Act (NEPA) of 1969, as amended. The general vicinity of Bridge No. 16, relative to Pender County and Topsail Island, is shown in Figures 1-1 and 1-2 (all referenced figures herein are included in Appendix A).

The replacement of Bridge No. 16 over the Intracoastal Waterway entails the removal and replacement of an existing swing span bridge currently providing access to Topsail Island. This bridge is one of only two access points onto Topsail Island, the other bridge being located approximately seven miles north, in the Town of North Topsail Beach.

More than 20 design alternatives were initially evaluated for this project. These alternatives included options to construct a new high-level fixed bridge or moveable bridge. The new bridge would be built either in the same location, to the north, or to the south. A No Build Alternative, Repair and Rehabilitate Existing Bridge Alternative, and Alternative Modes of Transportation were also evaluated.

Depending on the alternative chosen, Bridge No. 16 will be replaced with a new 500 to 4,000-foot long bridge. The new bridge will accommodate two-way traffic with two 12-foot travel lanes, two four-foot bicycle lanes, and two 5.5-foot sidewalks. Curb and gutter will provide a two-foot separation between the bicycle lanes and sidewalk. The approach roadway section will match the new bridge section, with the exception that sidewalks will not be provided. Instead, a ten-foot earth berm will be constructed behind the curb and gutter.

1.2 Schedule and Cost

This project is included in the 2011-2020 North Carolina State Transportation Improvement Program (STIP). The STIP budget allocation is approximately $3 million for right-of-way acquisition, and $31 million for construction costs. The current estimated construction costs based on preliminary design plans range between $45.6 and $68.5 million. Right-of-way acquisition costs range between $5.0 and $22.3 million. Right-of-way acquisition is scheduled to begin in Federal Fiscal Year (FFY) 2014, with construction scheduled for FFY 2016.

Chapter 2

Purpose and Need for Project

2.0 PURPOSE AND NEED FOR PROJECT

2.1 Purpose of Project

The purpose of the proposed project is to improve bridge safety and functionality.

2.2 Need for Project

The need for the project is to replace the structurally deficient, functionally obsolete bridge.

2.2.1 Description of Existing Conditions

2.2.1.1 Functional Classification

NC 50/210 is classified as a major collector roadway and has been designated as both hurricane evacuation and bicycle routes.

2.2.1.2 Project History

Bridge No. 16, also known as the Sears Landing Bridge, was completed in 1955 to replace a pontoon bridge previously utilized by the United States Navy during World War II. This bridge replacement project was first placed on the NCDOT TIP in 2005 after structural inspections indicated a very poor bridge sufficiency rating.

2.2.1.3 Physical Description of Existing Facility

The existing bridge cross-section consists of a main channel swing span with concrete deck girder approach spans. The existing length of the bridge is 463 feet, with a main channel swing span length of 254 feet. This bridge opens for commercial vessel traffic on demand and for daytime recreational vessels at the top of each hour. The existing vertical waterway clearance under the moveable bridge span is approximately 13 feet.

Structures
Bridge No. 16 is the only major structure in the project vicinity. NCDOT inspects their bridges a minimum of every two years. Bridge No. 16 was last inspected in 2010 and the corresponding report indicates that the bridge is in poor condition, with a sufficiency rating of six out of 100 and restricted loads of 14 tons for single vehicles and 18 tons for truck tractor with semi-trailer.

Roadway Cross-Section
The existing bridge has two 12-foot lanes and is abutted on each side by three-foot sidewalks. The existing roadway approaches along NC 50/210 are three-lane open shoulder

sections with an opposing left-turn center lane and shoulder widths ranging from two to five-feet wide. There are no sidewalks along the existing roadway approaches.

Horizontal and Vertical Alignment

The existing bridge and approach roadways are located along a horizontal tangent section of NC 50/210. Each end of the existing bridge has adequate vertical curvature with no sight distance concerns.

Right-of-Way and Access Control

The existing right-of-way along NC 50/210 varies from 80 to 100 feet, with no control of access.

Speed Limit

The posted speed limit on NC 50/ 210 west of Bridge No. 16 is 45 miles per hour (mph). To the east of the bridge, the speed limit is 35 mph.

Intersections and Interchanges

A list of the 14 study intersections included in the Project Study Area (PSA) are shown in Figure 2-1 and listed in Table 2-1 below. No interchanges are located in the project vicinity.

Table 2-1: Study Intersections

No.	Intersection Location
1	NC 50/Roland Avenue at NC 210/Belt Road
2	NC 50/210 at J H Batts Road
3	Roland Avenue at Little Kinston Road/Atkinson Point Road
4	Roland Avenue at New River Drive/NC 210
5	Roland Avenue at Topsail Drive/NC 50
6	New River Drive/NC 210 at Greensboro Avenue
7	New River Drive/NC 210 at Goldsboro Avenue
8	New River Drive/NC 210 at New Bern Avenue
9	Topsail Drive at Greensboro Avenue
10	Topsail Drive at Goldsboro Avenue
11	Topsail Drive at New Bern Avenue
12	Topsail Drive/NC 50 at Kinston Avenue
13	Topsail Drive/NC 50 at Raleigh Avenue
14	Topsail Drive/ NC 50 at Charlotte Avenue

Bicycle and Pedestrian Facilities

NC 210 is designated as NC Bike Route 3 (Ports of Call Route). No dedicated bicycle lane currently exists on Bridge No. 16 or along the roadway approaches. On Topsail Island, NC 50 has a dedicated bicycle lane in both directions.

The existing bridge has three-foot sidewalks in both directions. There are no sidewalks along the roadway approaches. The roadway approaches have open shoulders ranging in width from two to five feet.

Utilities

The following provides a brief summary of utilities in the vicinity of Bridge No. 16. Locations of utilities in the project vicinity are shown in Figure 2-2.

Electric: Jones-Onslow Electric Membership Corporation (JOEMC) has a transmission line along the south side of NC 50/210. This line supplies power to Surf City and extends from the eastern coast to the utility station located on the mainland side (approximately 0.5 miles from the bridge). In addition, JOEMC has several energized electrical boxes underground. These boxes are used to feed power to docks and boat slips.

Telephone and Fiber Optics: Embarq has telephone and fiber optics lines located either underground or on the Jones-Onslow transmission poles.

Cable: Charter Communications has cable lines located on the JOEMC transmission poles.

Water Lines: The Town of Surf City has an existing 12-inch water main parallel to Roland Avenue, approximately 450 feet north, beneath the Intracoastal Waterway. The water main intersects with NC 50/210 at Kinston Road to the west and approximately 400 feet beyond the existing bridge to the east, where it reduces to a ten-inch water main.

Sewer Lines: The Town of Surf City has an existing 12-inch sanitary sewer main parallel to Roland Avenue on the north, which switches to the south side of Bridge No. 16 as it crosses the Intracoastal Waterway. In addition, on the mainland side, the town also has a ten-inch gravity sewer line, parallel to Roland Avenue on the north.

2.2.1.4 School Bus Usage

North Topsail Elementary School, Topsail Middle School, and Topsail High School are located in Hampstead, approximately ten miles south of Bridge No. 16. Combined, these schools have four buses, with one additional bus available on an as-needed basis. During the school year, the students are transported by two daily round-trip crossings on the bridge.

2.2.1.5 Traffic Volumes and Capacity Analysis

According to the traffic forecasts for this project, the 2010 Existing Conditions traffic demand along Bridge No. 16 is approximately 12,000 vehicles per day (vpd) and the 2035 No Build Conditions traffic demand is projected to be approximately 29,100 vpd. This represents an approximate 6% rate of increase per year for the next 25 years.

The 2010 Existing Conditions intersection capacity analysis indicates that the existing traffic demand at the 14 study intersections operates at Level of Service D or better throughout the day, which is an acceptable rate of traffic flow.

The 2035 No Build Conditions intersection capacity analysis indicates that five out of the 14 study intersections will either approach or exceed the roadway capacity limits, operating at Level of Service E or F during at least one of the daily peak hours. The remaining nine intersections will function at Level of Service D or better throughout the day, which is an acceptable rate of traffic flow.

2.2.1.6 Airports

The nearest commercial passenger service airports are located approximately 30 miles from the Bridge No. 16: one to the south in Wilmington, North Carolina, and the other to the north in Jacksonville, North Carolina. Two other small airports/airstrips are located approximately seven miles from Bridge No. 16: Holly Ridge/Topsail Island Airport and Camp Davis.

2.2.1.7 Other Highway Projects in the Area

The NCDOT 2011-2020 STIP does not list any other funded major highway projects in the PSA. One feasibility study (FS-0703A) is listed in the STIP and consists of the widening of a 5.3-mile section of NC 210 from US 17 to Bridge No. 16. The nearest funded major STIP project is Hampstead Bypass (R-3300), which proposes construction of a fourteen-mile bypass from US 17 in New Hanover County to US 17 north of Hampstead in Pender County.

2.2.2 Transportation and Land Use Plans

2.2.2.1 NCDOT State Transportation Improvement Program

This bridge replacement project is included in the NCDOT 2011-2020 STIP. Right-of-way acquisition is scheduled to begin in FFY 2014, with construction beginning in FFY 2016.

2.2.2.2 Local Thoroughfare Plans

NCDOT's Transportation Planning Branch has developed the Topsail Area Comprehensive Transportation Plan (CTP). The CTP was adopted by the NCDOT Board of Transportation in November 2009, and lists the replacement of Bridge No. 16 as an important element in meeting transportation needs and providing access for the area residents.

2.2.2.3 Land Use Plans

The Towns of Surf City and Topsail Beach completed land use plans in 2005. The Town of North Topsail Beach completed their land use plan in 2010.

2.2.2.4 Safety

As stated in Section 2.2.1.3, according to NCDOT's 2010 inspection report, Bridge No. 16 is in poor condition, with a sufficiency rating of six out of 100 and restricted loads of 14 tons for single vehicles and 18 tons for truck tractor with semi-trailer. The existing 24 feet of travel width is abutted on each side by three-foot sidewalks. These narrow widths and close proximity of vehicles, bicycles, and pedestrians create an unsafe multimodal travel condition.

2.2.2.5 Maintenance

NCDOT routinely performs maintenance on Bridge No. 16. These costs have escalated through time as the bridge has aged and correspondingly, the sufficiency rating has decreased. Recent five-year historical NCDOT maintenance costs are included below in Table 2-2.

Table 2-2: Historically Incurred Maintenance Costs for Bridge No. 16

Year	Incurred Maintenance Costs
2010	$109,900
2009	$37,800
2008	$85,400
2007	$157,700
2006	$109,300

Bridge No. 16 has experienced occurrences of mechanical or electrical failure that have left the bridge inoperable. During these failure periods, the resulting inconvenience to vehicle and vessel crossing has been substantial. As the bridge continues to age, these failure occurrences are expected to increase.

2.2.3 System Linkage

Bridge No. 16 is one of only two access points onto Topsail Island. The second bridge is located in the Town of North Topsail Beach, approximately seven miles north of the project site. The absence of a connecting link between Topsail Island and the Surf City mainland would result in an inefficient transportation system separating Surf City town services and have economic impacts to the surrounding communities. In addition, not replacing the bridge at this site would be inconsistent with the Topsail Area CTP.

2.2.4 Travel Time

NC 50/210 is a designated hurricane evacuation route and Bridge No. 16 is a vital link in providing hurricane evacuation for the Topsail Island communities. Without Bridge No. 16 in place, all evacuees would be forced to use the North Topsail Bridge, which may result in disorderly evacuations, evacuation delays, and jeopardize the safety of Topsail Island residents. The detour required would include

approximately 25 miles of additional travel, resulting in an approximate 30 to 45 minute delay under good traffic conditions.

Bridge No. 16 opens for commercial vessel traffic on demand and for daytime recreational vessels at the top of each hour. On average, the bridge opens about six to eight times a day. During peak months, these openings increase to approximately 20 per day. Each opening results in vehicular traffic delays, which can delay emergency services between the mainland and island. During the peak vacation months, the bridge tender has documented more than 400 waiting vehicles when the bridge is opened for vessel traffic on numerous occasions.

2.2.5 Access Needs

The connectivity of Topsail Island to the mainland is imperative for the economic vitality of the area and commutes associated with daily living. Business interaction between the island and mainland is apparent given the limited basic goods and services on the island. Residents travel to the mainland for items, including healthcare, groceries, postal services, retail shopping, and other needs. Likewise, mainland populations travel to the island to take advantage of the recreational opportunities offered at the beach. Furthermore, mainland residents of Surf City and Topsail Beach travel to the island for municipal government-related activities, including utility bill payments.

NC 50/210 is a designated bicycle route and Bridge No. 16 provides a pedestrian and bicycle connection between the mainland and island. A public park and boat landing are immediately adjacent to the bridge, reinforcing the need for pedestrian and bicycle accommodations on the bridge.

2.3 Study Area Defined

To evaluate the environmental consequences of the proposed bridge replacement project to the immediate surrounding area, a PSA was defined, as shown in red on Figure 1-2. Environmental field studies were performed within this area. In addition, a larger Demographic Study Area was also defined to provide a study boundary of the demographic characteristics surrounding the project. This Demographic Study Area is also shown on Figure 1-2 in yellow.

2.3.1 Project Study Area

The PSA is defined as the area surrounding a construction project that is likely to be directly affected during construction and after project completion. The PSA defined for this project is entirely within the town limits of Surf City. The PSA limits extend along NC 50/210 away from the current bridge site approximately one mile to the west, past the J H Batts Road (SR 1612) intersection; approximately 0.5 miles to the east, past the NC 50 intersection; and up to 2,500 feet north and south of Bridge No. 16 (See Figure 1-1).

2.3.2 Demographic Study Area

The Demographic Study Area is a broader area that includes all communities that may be affected directly or indirectly by the proposed project. Since this bridge services all of Topsail Island, the entire island has been included in the Demographic Study Area, corresponding to Pender County Census Tract 98.01-001 Block Group and Onslow County Census Tract 0.04-005 Block Group. Also included in the Demographic Study Area is the mainland portion of Surf City between the Intracoastal Waterway and US 17, which is included in the Pender County Census Tract 98.01-002 Block Group. To the west, US 17 is a logical boundary of the Demographic Study Area, given that the Block Group boundary coincides with US17 and the Surf City town limits, which extends to US 17.

The purpose of this Demographic Study Area is to expand Bridge No. 16's immediate area to provide accurate demographic characteristics that will provide a clear understanding of the broader community characteristics and concerns of surrounding residents and businesses.

2.4 Benefits of Proposed Project

The proposed bridge replacement project will address the purpose and need stated above. In summary, the following are the primary benefits of this project:

- Improve the bridge's safety by increasing the structural capacity of the bridge and providing adequate travel widths for multimodal traffic crossing the bridge.
- Maintain current system linkage between the island and mainland, and accommodate needs for emergency service vehicles, as well as other vehicular, bicycle, pedestrian, and vessel traffic.
- Depending on the alternative chosen, the number of bridge openings can be reduced by 20% (low-level moveable bridge) to 100% (high-level fixed bridge), minimizing the delay for all means of travel.

Chapter 3

Alternatives

3.0 ALTERNATIVES

NCDOT evaluated numerous design alternatives for this project, including a No Build Alternative; Repair and Rehabilitate Existing Bridge Alternative; Alternative Modes of Transportation; and Build Alternatives, including construction of a new moveable or high-level fixed bridge either in the same location, to the north, or to the south.

Provided below is a summary of the alternatives considered, along with a description of the evaluation process utilized in the selection of the Detailed Study Alternatives. Environmental impacts associated with the Detailed Study Alternatives are presented in Chapter 5 of this document.

3.1 No Build Alternative

The No Build Alternative serves as a basis of comparison between not replacing the bridge and the associated impacts with the other study alternatives. If the bridge is not replaced, it is expected that the moveable sections of the bridge will be in disrepair within a few years, resulting in closure and detouring of vehicular traffic to the North Topsail Bridge, located approximately seven miles to the north.

The No Build Alternative would result in no new construction costs; no impacts to streams, wetlands, or other natural or cultural resources; and no residential or business relocations. However, this alternative would result in increased maintenance cost for a period of a few years prior to complete bridge closure. The eventual closure would result in delays in emergency services, delays in travel to and from the island, and detrimental impacts to the local economy. The No Build Alternative would not meet the purpose of the proposed project to improve bridge safety. This alternative was dropped from consideration.

3.2 Repair and Rehabilitate Existing Bridge Alternative

Bridge No. 16 was constructed in 1955 with a design load of HS-15, which is much less than the current standards (design load of HS-25). It is comprised of a 250-foot through truss swing span and six reinforced concrete deck girder approach spans, each 35 feet long.

NCDOT's State Bridge Management Unit (SBMU) completed an evaluation of the repair/rehabilitation alternative for Bridge No. 16 (see memorandum dated November 1, 2010). The existing bridge is rated "fair" and has areas of deterioration throughout. This bridge is also "structurally deficient," "functionally obsolete," and "fracture critical," and has a sufficiency rating of six out of a possible 100.

The SBMU recommends that the repair/rehabilitation alternative be dropped from consideration for the following reasons:

- The repair/rehabilitate alternative will cost approximately $13.5 million and will only extend the bridge life by 25 years; however, annual maintenance will be required after the tenth year.

- Even after the repairs, the repaired and rehabilitated bridge will remain "functionally obsolete" and be classified as "fracture critical" due to the condition of the truss swing span. Therefore, the repaired and rehabilitated bridge would not meet the purpose of the proposed project to improve bridge safety.
- These repairs are expected to improve the bridge's sufficiency rating only to 28 out of possible 100, which is substantially below the required 80 to qualify for Federal Highway Bridge Program funds.
- During rehabilitation, the bridge would be out of service for approximately nine months, requiring a temporary detour bridge and resulting in additional costs.

3.3 Alternative Modes of Transportation

3.3.1 Alternative Modes of Travel

Currently, there is no fixed route transit service in the study area. Were alternative modes of transportation (such as bus or rail) to be provided in the future between the mainland and island, these transportation modes would neither meet the purpose of this project, nor provide an efficient means of travel to and from Topsail Island. A ferry system in lieu of a bridge crossing would be impractical given the large amount of traffic volumes crossing the bridge. A ferry system would not meet the purpose of the project, to improve the bridge functionality. This alternative was dropped from consideration.

3.3.2 Traffic Management Alternative

No traffic management alternatives, including Travel Demand Management (TDM) or Transportation Systems Management (TSM), exist that alone would reduce the volume of traffic to a level where a bridge crossing is not required. This alternative was dropped from consideration.

3.4 Build Alternative Corridors

NCDOT evaluated three types of bridge replacements for this project: a low-level moveable, a mid-level moveable, and a high-level fixed, with vertical navigational clearances (VNC) of 15, 30, and 65 feet, respectively. It should be noted that, under open condition, moveable bridges provide unlimited VNC (except vertical lift bridge). All bridge types considered in this project provide a minimum horizontal navigational clearance of 90 feet. At the first Citizens Informational Workshop (CIW #1) held on June 25, 2009, attendees were asked to draw their alignment ideas on large study area aerial maps. Based on these ideas and input from other project stakeholders, 20 build alternative corridors were developed, as shown in Figure 3-1. Included below are descriptions of these 20 build alternative corridors.

3.4.1 Low-Level Moveable Bridge Alternatives

The existing bridge has a VNC of approximately 13 feet and is considered a low-level bridge. Only a small percentage of the vessel traffic can pass underneath this bridge unimpeded. The United States Coast Guard (USCG) has established the minimal VNC for bridge replacements to be 15 feet. In addition,

NCDOT requires the bridge machinery platform elevation to be five feet above the 100-year storm event. Given that the 100-year storm event at Bridge No. 16 is elevation 7.7 feet, a 15-foot VNC meets both criteria. Additional information regarding these guidelines and analysis are included in the project's Preliminary Design Technical Report, dated July 2011.

One alternative corridor utilizing the low-level bridge type was developed:

- **Alternative 6** replaces the bridge in the same location as the existing bridge. This alternative requires an adjacent temporary detour bridge during construction. The temporary detour bridge has approximately 15-foot VNC, similar to the existing bridge.

3.4.2 Mid-Level Moveable Bridge Alternatives

Raising the VNC of a moveable bridge will result in taller vessels passing under the bridge unimpeded, with fewer bridge openings and less vehicular delays. However, as the roadway is elevated to allow for increased VNC, surrounding environmental impacts will increase.

An optimal VNC, which would minimize the number of bridge openings with consideration for the environmental impacts, was investigated. Vessel height surveys were performed in May and October of 2010 at the existing bridge site. Based on analysis of the survey data, an optimal 30-foot VNC was determined. The 30-foot VNC allows approximately half of vessels to pass underneath unimpeded, thus eliminating one out of every three bridge openings. Additional information regarding the survey methodology, analysis, and results are included in the project's Vessel Height Survey Report, dated July 2011.

NCDOT developed four alternative corridors utilizing the mid-level bridge type as follows:

- **Alternative 5A** is located approximately 500 feet north of the existing bridge location, beginning on the mainland side just west of Atkinson Point Road, and ending on the island side at Roland Avenue.
- **Alternative 7** replaces the bridge in the same location as the existing bridge. This alternative requires an adjacent temporary detour bridge during construction. The temporary detour bridge would have approximately 15 feet of VNC, similar to the existing bridge.
- **Alternative 9** is located approximately 200 feet south of the existing bridge location, beginning on the mainland side just east of Little Kinston Road, and ending on the island side at Roland Avenue.
- **Alternative 10A** is located approximately 400 feet south of the existing bridge location, beginning on the mainland side just west of Little Kinston Road, and ending on the island side at Topsail Drive (NC 50). This alternative forms a new island tie-in location along Topsail Drive (NC 50), approximately 500 feet south of Roland Avenue.

3.4.3 High-Level Fixed Bridge Alternatives

USCG regulations dictate that high-level fixed bridge types provide a minimum 65 feet of VNC spanning the Intracoastal Waterway. This bridge type eliminates bridge openings and thereby accommodates both vessel and vehicular traffic unimpeded. Increased environmental impacts are usually associated with these longer, elevated bridge structures. As described below, 15 alternative corridors were developed for this bridge type. None of these alternatives (with the exception of Alternative 8) require either a detour bridge or a temporary closure of the existing bridge.

- **Alternative 1** is located approximately 2,300 feet north of the existing bridge location. The geometry consists of a sweeping curved alignment with an island tie-in that is parallel to New River Drive (NC 210).
- **Alternative 2** is located approximately 2,100 feet north of the existing bridge location, beginning on the mainland side just west of J H Batts intersection, and ending on the island side at New Bern Avenue. This alternative forms a new island tie-in location along New River Drive (NC 210), approximately 2,100 feet north of Roland Avenue.
- **Alternative 3** is located approximately 1,700 feet north of the existing bridge location with a sweeping curved alignment, beginning on the mainland side just west of J H Batts Road, and ending on the island side at Roland Avenue.
- **Alternative 4** is located approximately 800 feet north of the existing bridge location, beginning on the mainland side just east of Sea Oaks Drive and ending on the island side at Goldsboro Avenue. This alternative forms a new island tie-in location along New River Drive (NC 210), approximately 1,100 feet north of Roland Avenue.
- **Alternative 5** is located approximately 500 feet north of the existing bridge location, beginning on the mainland side just west of Atkinson Point Road, and ending on the island side at Roland Avenue.
- **Alternative 5R** is a small alignment adjustment to Alternative 5 that was developed after CIW #2 to address marina access comments received from the community. This alternative is located approximately 400 feet north of the existing bridge location, beginning on the mainland side just west of Atkinson Point Road, and ending on the island side at Roland Avenue. The small alignment adjustment will avoid the navigable water channel leading to the marina at the island terminus.
- **Alternative 8** is located in the existing bridge location. This alternative would require utilization of the North Topsail Island Bridge as a detour during the demolition and construction of the new bridge. The detour would be approximately 25 miles.
- **Alternative 10** is located approximately 450 feet south of the existing bridge location, beginning on the mainland side just west of Little Kinston Road, and ending on the island side at Topsail Drive (NC 50). This alternative forms a new island tie-in location along Topsail Drive (NC 50), approximately 450 feet south of Roland Avenue.

- **Alternative 11** is located approximately 1,200 feet south of the existing bridge location, beginning on the mainland side just west of Little Kinston Road, and ending on the island side between Raleigh Avenue and Durham Avenue. This alternative forms a new island tie-in location along Topsail Drive (NC 50), approximately 1,500 feet south of Roland Avenue.
- **Alternative 12** is located approximately 2,000 feet south of the existing bridge location, beginning on the mainland side just west of Little Kinston Road, and ending on the island side with a realignment of Charlotte Avenue slightly south of its existing location. This alternative forms a new island tie-in location along Topsail Drive (NC 50), approximately 2,200 feet south of Roland Avenue.
- **Alternative 13** is located approximately 1,800 feet south of the existing bridge location with a sweeping curved alignment, beginning on the mainland side just west of Little Kinston Road, and ending on the island side at Roland Avenue.
- **Alternative 14** is located approximately 2,100 feet south of the existing bridge location with a sweeping curved alignment, beginning on the mainland side just west of Little Kinston Road, and ending on the island side with a realignment of Charlotte Avenue slightly south of its existing location. This alternative forms a new island tie-in location along Topsail Drive (NC 50), approximately 2,200 feet south of Roland Avenue.
- **Alternative 15** is located approximately 2,100 feet south of the existing bridge location with a sweeping curved alignment, beginning on the mainland side just west of J H Batts Road, and ending on the island side with a realignment of Charlotte Avenue slightly south of its existing location. This alternative forms a new island tie-in location along Topsail Drive (NC 50), approximately 2,200 feet south of Roland Avenue.
- **Alternative 16** is located approximately 2,400 feet south of the existing bridge location with a sweeping curved alignment, beginning on the mainland side just west of J H Batts Road, and ending on the island side at Roland Avenue.
- **Alternative 17** is located approximately 1,100 feet south of the existing bridge location. This alignment begins on the mainland side just west of Little Kinston Road and ends on the island side at Topsail Drive (NC 50), forming a new island tie-in location along Topsail Drive, approximately 300 feet south of Roland Avenue. This alternative was developed after CIW #2 in an effort to minimize impacts to Southside Park

3.4.4 Initial Screening (Alternatives Eliminated)

NCDOT performed an initial screening and eliminated four alternatives as follows:

- **Alternative 1** was eliminated due to the high right-of-way impacts, longer bridge length with associated higher construction costs, and substantial alterations to travel patterns to and from North Topsail Beach.
- **Alternative 8** was eliminated due to the high amount of property impacts. Design of the approximately 70–foot high bridge along the existing bridge alignment impacted the

corridor's central business district. In addition, the requirement for an off-site detour during construction added costs and detrimental impacts to travel patterns and local business access.

- **Alternative 9** was eliminated due to the impacts associated with Soundside Park, which is a property protected by Section 4(f) of the US Department of Transportation Act of 1966.
- **Alternative 12** was eliminated due to the similarity with Alternative 14. Alternative 12 right-of-way impacts were higher than Alternative 14.

3.5 Alternatives Evaluation

3.5.1 Corridor Alternatives Grouping

To effectively communicate the remaining 16 alternative corridors with project stakeholders, the three alternative groupings are described below and are shown in Figure 3-2.

Northern Alternatives Group – Alternatives 2, 3, 4, 5, and 5R are included in the Northern Alternatives Group. All alternatives in this grouping replace the existing bridge with a high-level fixed bridge having a 65-foot VNC.

Central Alternatives Group – Alternatives 5A, 6, 7, and 10A are included in the Central Alternatives Group. All alternatives in this grouping replace the existing bridge with a moveable bridge. Alternative 6 is a low-level moveable bridge alternative having a VNC of 15 feet. Alternatives 5A, 7, and 10A are mid-level moveable bridge alternatives having a VNC of 30 feet.

Southern Alternatives Group - Alternatives 10, 11, 13, 14, 15, 16, and 17 are included in the Southern Alternatives Group. All alternatives in this grouping replace the existing bridge with a high-level fixed bridge having a 65-foot VNC.

3.5.2 Alternatives Evaluation Matrix

Functional design plans for all the 16 corridor alternatives under study were developed. Preliminary impact and qualitative cost analysis were compiled based on the functional design plans and are summarized in the Alternatives Evaluation Matrix shown in Table 3-1. For each of the alternatives grouping (Northern, Central, and Southern), the highest impact or cost alternative is highlighted in red and the lowest impact or cost alternative is highlighted in green.

Table 3-1: Alternatives Evaluation Matrix

Category		Northern Group					Central Group				Southern Group						
		Alt 2	Alt 3	Alt 4	Alt 5	Alt 5R	Alt 5A	Alt 6	Alt 7	Alt 10A	Alt 10	Alt 11	Alt 13	Alt 14	Alt 15	Alt 16	Alt 17
Project Description																	
Project Length (miles) - including permanent bridge length		1.4	1.5	1.1	1.1	1.1	1.1	0.4	0.4	0.9	0.9	1.1	1.4	1.3	1.6	1.9	1.0
Bridge Length (ft) - fixed length/moveable length		5,515	5,500	3,990	4,116	4,054	3,996/120	400/120	1,180/120	2,997/120	3,300	4,240	5,005	5,175	6,176	7,250	3,318
Bridge Structure (sf)	· fixed area	287,618	275,000	203,346	205,800	202,700	199,800	20,000	59,000	153,956	169,347	218,960	250,250	264,782	314,832	362,500	165,900
	· moveable area	-	-	-	-	-	6,000	6,000	6,000	6,000	-	-	-	-	-	-	-
Detour Bridge Length (ft) - fixed length/moveable length		-	-	-	-	-	-	1,367/120	1,392/120	-	-	-	-	-	-	-	-
Detour Bridge Structure	· fixed area	-	-	-	-	-	-	53,313	54,288	-	-	-	-	-	-	-	-
	· moveable area	-	-	-	-	-	-	4,680	4,680	-	-	-	-	-	-	-	-
Human Environment Impacts																	
Community Facilities Impacted (number)		-	1	2	-	-	-	-	-	1	1	-	1	-	-	1	-
Agricultural Lands (number)		1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-
Section 4(f) Resource	Soundside Park property impacts -- permanent/temporary (acres)	-	-	-	-	-	-	0.07[+]/0.36*	0.07[+]/0.33*	<0.1[++]	<0.1[++]	-	-	-	-	-	0.16[**]
	Bridge No. 16	TBD[***]	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***	TBD***
Church (Faith Harbor United Methodist Church)		1	-	1	1	1	1	-	-	-	-	1	1	1	1	1	-
Total Residential Relocations (number)		7	6	3	2	2	2	-	-	-	-	4	6	6	7	2	-
Total Business Relocations (number)		2	2	7	2	4	2	-	1	3	3	-	3	-	4	7	1
Property Only (number)		40	24	51	36	34	36	11	11	50	50	24	31	38	46	44	26
Natural/Physical Environment Impacts																	
Wetlands: CAMA / 404 (non-riparian) (acres)		0.28/3.03	0/1.41	0/1.68	0/1.34	0/1.34	0/1.34	0.05/0	-	0.48/0.52	0.24/0.52	0/0.97	0.10/1.15	0.24/1.07	0.19/0.80	0.11/0.94	1.14/0.04
Stream Crossings (#/linear feet)		1/145'	1/145'	1/190'	-	-	-	-	-	-	-	-	-	-	-	-	-
Known or Potential Hazardous Material Sites (number)		-	2	-	2	2	2	1	1	1	1	-	2	-	-	2	1
Costs/Public Feedback																	
Initial Construction Costs		Very High	Very High	High	High	High	Very High	Medium	High	High	Medium	High	Very High	Very High	Very High	Very High	Medium
Operations & Maintenance Costs (75 Years)		Medium	Medium	Medium	Medium	Medium	Very High	Very High	Very High	Very High	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Public Preference at CIW #2 (% for Alternatives in each group)		15%	15%	18%	41%	[+++]	12%	13%	45%	17%	43%	16%	14%	3%	6%	6%	[+++]

Represents alternative with least impacts/costs in each group

Represents alternative with highest impacts/costs in each group

[+] Represents fill slope impacts caused to the northern side of Soundside Park.

* Represents temporary impacts to Soundside Park as a result of the detour bridge.

[++] Represents impacts caused by spanning over Soundside Park.

[**] Represents minimal impacts caused to the southern end of Soundside Park.

[+++] Represents alternatives developed based on CIW #2 feedback from the public and local officials.

[***] To be determined based on coordination with FHWA and SHPO

Notes: 1) No impacts to riparian wetlands, archaeological sites, superfund sites, or ponds are expected. Therefore, these impact categories are not provided.
2) Impacts are based on functional design right-of-way and easement limits, December 2010.

3.5.3 Community Feedback

On October 21, 2010, NCDOT held CIW #2 and presented the functional design plans and alternative impact comparisons to local elected town officials and citizens. Attendees reviewed the available information and completed comment cards that included their alternative preference in each of the three groupings. Additional information concerning the public outreach and stakeholder's involvement is included in Chapter 6.

Alternative preference results indicate that Alternatives 5, 7, and 10 were the preferred alternatives for the Northern, Central, and Southern groupings, respectively. Alternatives 5R and 17 were developed subsequent to CIW #2 and because of comments received from the citizens and review agencies.

3.5.4 Evaluation Criteria Summary

To carry forward the most practical alternatives for further study, the 16 corridor alternatives under study were evaluated using information derived from Table 3-1. The evaluation criteria used for each alternative is summarized below.

3.5.4.1 Northern Alternatives Group (High-Level Fixed Bridge Alternatives)

- **Alternative 2**:
  - Moderate support – 15% of respondents chose this as the preferred northern alternative
  - Similar to Alternative 4, but with more bridge length and project costs
  - Further from the existing alignment and Central Business District than Alternative 4
- **Alternative 3**:
  - Moderate support – 15% of respondents chose this as the preferred northern alternative
  - Sweeping curved alignment requires a fully superelevated section on the bridge leading to challenging constructability and drainage conditions
  - More bridge length and project costs than other northern Alternatives 4 and 5
- **Alternative 4**:
  - Moderate support – 18% of respondents chose this as the preferred northern alternative
  - Lowest expected cost and shortest bridge alternative for the Northern Alternatives Group
  - If Alternative 2 is eliminated, then Alternative 4 is the only remaining off-alignment northern alternative

- **Alternative 5**:
  - Significant support – 41% of respondents chose this as the preferred northern alternative
  - One of the lowest cost and shortest bridge length alternatives
  - Closest northern alternative to the existing bridge site
  - Roundabout intersection design is consistent with the Topsail Area CTP
- **Alternative 5R**:
  - A small alignment adjustment to Alternative 5 that maintains navigable water channel access leading to the island side marina, the only private marina on the island
  - One of the lowest cost and shortest bridge length alternatives
  - Closest northern alternative to the existing bridge site
  - Roundabout intersection design is consistent with the Topsail Area CTP

3.5.4.2 Central Alternatives Group (Moveable Bridge Alternatives)

- **Alternative 5A**:
  - Moderate support – 12% of respondents chose this as the preferred central alternative
  - Significant support for the high-fixed bridge alternative (Alternative 5) in this location
  - Roundabout intersection design is consistent with the Topsail Area CTP
- **Alternative 6**:
  - Moderate support – 13% of respondents chose this as the preferred central alternative
  - Most similar alternative to the existing conditions with a similar horizontal and vertical alignment
  - Least overall project impacts and costs
- **Alternative 7**:
  - Significant support – 45% of respondents chose this as the preferred central alternative
  - Similar to existing conditions with the vertical alignment raised by approximately 15 feet, which allows approximately half of vessels to pass underneath unimpeded
  - One out of every three bridge openings will be eliminated with a mid-level moveable bridge

- **Alternative 10A**:
  - Moderate support – 17% of respondents chose this as the preferred central alternative
  - Alternative 10A bisects Soundside Park and thereby uses property that is protected under Section 4(f) of the US Department of Transportation Act of 1966.

3.5.4.3 Southern Alternatives Group (High-Level Fixed Bridge Alternatives)

- **Alternative 10**:
  - Significant support – 43% of respondents chose this as the preferred southern alternative
  - Alternative 10 bisects Soundside Park and thereby uses property that is protected under Section 4(f) of the US Department of Transportation Act of 1966.
- **Alternative 11**:
  - Moderate support – 16% of respondents chose this as the preferred southern alternative
  - Second lowest expected cost and second shortest bridge alternative for the Southern Alternatives Group
  - Fewest property impacts for the Southern Alternatives Group
- **Alternative 13**:
  - Moderate support – 14% of respondents chose this as the preferred southern alternative
  - Sweeping curved alignment requires a fully superelevated section on the bridge leading to challenging constructability and drainage conditions
  - High project costs and bridge length
  - Roundabout intersection design is consistent with the Topsail Area CTP
- **Alternative 14**:
  - Very low support – 3% of respondents chose this as the preferred southern alternative
  - High project costs and bridge length
- **Alternative 15**:
  - Low support – 6% of respondents chose this as the preferred southern alternative
  - High project costs and bridge length
- **Alternative 16**:
  - Low support – 6% of respondents chose this as the preferred southern alternative

- Sweeping curved alignment requires a fully superelevated section on the bridge leading to challenging constructability and drainage conditions
- High project costs and bridge length
- Roundabout intersection design is consistent with the Topsail Area CTP

- **Alternative 17**:
  - Capitalizes on many of the design features preferred by citizens and FHWA:
    - Closer to the existing bridge location than the other Southern Group Alternatives
    - Minimizes impacts to Soundside Park, a section 4(f) protected property
    - Following coordination with the Town of Surf City, FHWA currently considers this alternative to have a *de minimis* impact to Soundside Park and in compliance with section 4(f) regulations as outlined in 23 CFR 774
    - Incorporates a roundabout intersection at the island terminus, allowing for improved traffic flow operations from all approaches
    - Provides a shorter bridge and re-alignment length
    - Sweeping curved alignment requires a fully superelevated section on the bridge leading to challenging constructability and drainage conditions
  - Roundabout intersection design is consistent with the Topsail Area CTP

3.6 Detailed Study Alternatives

On December 14, 2010, the Section 404/NEPA Merger Team (Merger Team) met for the Concurrence Point 2 (CP 2) meeting to discuss Detailed Study Alternatives. During the meeting, the 16 corridor alternatives were presented, along with a summary of the alternative's impacts and costs. In addition, the results from CIW #2 were presented, along with other citizen and agency comments that were received. Subsequent to the presentation and corresponding discussions, the Merger Team concurred on Concurrence Point 2, Detailed Study Alternatives Carried Forward. Seven Detailed Study Alternatives were selected for additional study:

- Northern Alternatives Group: Alternatives 4, 5, and 5R (high-level fixed bridges)
- Central Alternatives Group: Alternatives 6 and 7 (low/mid-level moveable bridges, respectively)
- Southern Alternatives Group: Alternatives 11 and 17 (high-level fixed bridges)

3.7 NCDOT Recommended Alternative

Currently, NCDOT has not chosen a recommended alternative. Preliminary design plans were developed for the seven Detailed Study Alternatives. A more detailed quantitative impact and cost analysis was prepared, as compared with the previous functional design plans. Results of this more detailed analysis are discussed in Chapter 5.

This information will be presented to the community and local project stakeholders at the corridor public hearing. Copies of EA will also be distributed to federal, state and local project stakeholders. Subsequent to the corridor public hearing, a recommended alternative will be identified based on the design information prepared and public outreach comments received. This recommended alternative will be presented to the Merger Team at the CP 3 meeting. At this meeting, the Least Environmentally Damaging Practicable Alternative (LEDPA)/Preferred Alternative will be chosen.

Chapter 4

Proposed Improvements

4.0 PROPOSED IMPROVEMENTS

The seven Detailed Study Alternatives were described in Chapter 3. Depending on the alternative chosen, Bridge No. 16 will be replaced with a new 500 to 4,000 foot-long bridge either in the same location, to the north, or to the south. This chapter provides a summary of improvements associated with the Detailed Study Alternatives.

4.1 Roadway Cross-Section and Alignment

The new bridge will accommodate two-way traffic with two 12-foot travel lanes, two four-foot bike lanes, and two 5.5-foot sidewalks. Curb and gutter will provide a two-foot separation between the bicycle lanes and sidewalks. The approach roadway section will match the new bridge section, with the exception that sidewalks will not be provided. Instead, a ten-foot earth berm will be constructed behind the curb and gutter. Both the new bridge and roadway approach typical sections are provided in Figure 4-1.

4.2 Right-of-Way and Access Control

The existing right-of-way width along NC 50/210 ranges between 80 and 100 feet, with no control of access. The proposed right-of-way width is as follows:

- Bridge – 120 feet
- Roadway approaches – varies between 60 to 75 feet
- Connecting cross-streets – varies between 70 to 100 feet

All seven Detailed Study Alternatives will impact residential and/or business properties, requiring acquisition of additional right-of-way. The new bridge, as well as the roadway approaches immediately adjacent to the bridge ends, will not require control of access.

4.3 Speed Limit

The new bridge, roadway approaches, and most of the connecting cross-streets will be designed using a 40 mph design speed and each facility is anticipated to be posted at a 35 mph speed limit. Kinston Avenue, Charlotte Avenue, and Goldsboro Avenue will be designed using a 30 mph design speed and are anticipated to be posted at a 25 mph speed limit, which is consistent with the existing conditions. The temporary detour bridges required for Alternatives 6 and 7 will be designed for a 30 mph design speed and are anticipated to be posted at a 25 mph speed limit.

4.4 Anticipated Design Exceptions

No design exceptions are anticipated for this project.

4.5 Intersections and Interchanges

Intersection improvements or new intersection facilities will be required for each of the Detailed Study Alternatives. To provide more efficient traffic operations, utilization of signalized intersections or roundabout facilities will be designed as described below:

- **Alternative 4:**
  - Mainland tie-in:
    - Roland Avenue between J H Batts Road and Little Kinston Road – new unsignalized intersection
  - Island tie-in:
    - New River Drive at Goldsboro Avenue – new traffic signal
- **Alternatives 5 & 5R:**
  - Mainland tie-in:
    - Roland Avenue between J H Batts Road and Little Kinston Road – new unsignalized intersection
  - Island tie-in:
    - Roland Avenue west of New River Drive – new roundabout
- **Alternatives 6 & 7:**
  - Mainland tie-in:
    - Roland Avenue east of Little Kinston Road/Atkinson Point Drive – no changes to existing intersection at Little Kinston Road/ Atkinson Point Drive
  - Island tie-in:
    - Roland Avenue at New River Drive – new traffic signal
- **Alternative 11:**
  - Mainland tie-in:
    - Roland Avenue between J H Batts Road and Little Kinston Road – new unsignalized intersection
  - Island tie-in:
    - New River Drive between Raleigh Avenue and Durham Avenue – traffic signal will be required at new intersection
- **Alternative 17:**
  - Mainland tie-in:
    - Little Kinston Road – add new turn-lanes to this unsignalized intersection

- Realigned Roland Avenue at Atkinson Point Road – new unsignalized intersection

- Island tie-in:
  - South of Roland Avenue at New River Drive and Topsail Drive – new roundabout

No interchanges are located in the project vicinity.

4.6 Roundabouts

Roundabouts are an intersection type that allows traffic yield conditions prior to entering into a circular loop connecting to other cross streets. This circular flow allows for improved traffic operations given that the traffic is not delayed by a mandated stop condition prior to entering the intersection. Alternatives 5, 5R, and 17 include a single lane roundabout on new location, intersecting the new bridge replacement alignment with the existing NC 50/210 roadways on the island. In addition to the intersection traffic flow condition improvements, the roundabouts also offer the unique opportunity to add landscaping and aesthetic features as well as other improvements that encourage economic and social activity. A schematic of these roundabouts is shown in the artistic renderings of Alternatives 5, 5R, and 17, which are included in Appendix G.

4.7 Service Roads

With the exception of Alternative 7, no service roads are recommended or currently exist in the study area. Under Alternative 7, a service road will be built adjacent to Roland Avenue in the northeast quadrant of the proposed bridge. This service road will provide access to businesses and the RV campground.

4.8 Structures

Bridge No. 16 is the only existing major structure in the project vicinity. As described in Section 3.4, three types of replacement bridges were evaluated for this project: a low-level moveable bridge with 15 feet VNC; a mid-level moveable bridge with 30 feet VNC, and a high-level fixed with 65 feet VNC. All three bridge types would provide a minimum horizontal navigational clearance of 90 feet.

4.8.1 Low-Level\Mid-Level Moveable Bridge

Generally, three moveable bridge types are utilized where vehicle and vessel traffic conflict. These bridge types include: Bascule, Vertical Lift, and Swing Span. The clearance above water for each of these bridges can be increased to accommodate additional vessel traffic with fewer bridge openings. Bridges that are designed at a lower elevation (< 15 feet VNC) are known as low-level and those that are more accommodating to vessels are known as mid-level (15 to 35 feet VNC). The advantages for these three moveable bridge types are outlined below:

4.8.1.1 Bascule Bridge

Bascule bridges are comprised of mechanical platforms known as leaves that are open by fixing one end and raising the other end to a vertical position such that vessels can pass through the roadway crossing. Advantages associated with this bridge type include; fast operating times, economical, unlimited vertical clearance in vertical position, and most often viewed as aesthetically pleasing.

4.8.1.2 Vertical Lift Bridge

Vertical lift bridges are comprised of two columns that support a span member that is raised to allow vessel passage underneath. The primary advantage associated with this bridge type is that they are easy to erect, accelerating construction schedules.

4.8.1.3 Swing Span Bridge

Swing span bridges are comprised of a center column that supports a truss span, swinging open and closed by pivoting on the center support. When compared with the bascule type, the swing span has no advantages other than longer spans can be accommodated and possible aesthetic preference.

4.8.1.4 Recommended Permanent Moveable Bridge Type

Due to the advantages listed above along with less anticipated impacts on the environmentally sensitive area and adjacent properties, a double leaf bascule bridge is recommended as the permanent moveable bridge type for both Alternatives 6 and 7.

4.8.1.5 Recommended Temporary Moveable Bridge Type

Given the ease of construction associated with a vertical lift bridge, this bridge type is commonly used for temporary conditions; therefore, for the required temporary detour bridge associated with Alternatives 6 and 7, a vertical lift bridge is recommended.

4.8.2 High-Level Fixed Bridge

Five of the seven Detailed Study Alternatives propose a high-level fixed bridge. Based on preliminary evaluation of structural considerations, these high-level fixed bridges will most likely be designed with a precast concrete beam superstructure of approximate depth 7.5 feet and a cast-in-place deck. Additional information regarding evaluations of this bridge type is included in the project's Preliminary Design Technical Report, dated July 2011.

4.8.3 Operations and Maintenance Costs

A comparison of the operations and maintenances costs for all Detailed Study Alternatives over a 75-year period (assumed to be life-span of a bridge) is documented below.

4.8.3.1 Movable Bridge Alternatives

Operations: Alternative 6 and 7 will require a bridge tender on site at all times, opening the bridge for vessels unable to pass underneath the new bridge. Based on historic NCDOT moveable bridge records, operations costs for Alternatives 6 and 7 are estimated to be $150,000 per year.

Maintenance: Alternatives 6 and 7 will require routine maintenance and inspections, as well as periodic replacement of the fender system, machinery, controls and coating on the bascule bridge. During a 75-year life cycle, these costs are estimated to be approximately $26 million. Table 4-1 provides details associated with these costs.

4.8.3.2 Fixed Bridge Alternatives

In comparison with moveable bridges, fixed bridges (Alternatives 4, 5, 5R, 11, and 17) incur lower maintenance and negligible operations costs. The maintenance costs for the fixed bridges include routine maintenance and inspections, as well as replacement of the fender system. During a 75-year life cycle, these costs are estimated to be approximately $3.6 million. Table 4-2 shows additional breakdown of these costs.

Table 4-1: Estimated Operations and Maintenance Costs for Moveable Bridges (75 years)

Item	Estimated Cost Per Year	Estimated Cost Per Occurrence	Multiplier (per Year or Occurrence)	Total Cost
Average Maintenance Cost, first 10 years	$25,000	-	10	$250,000
Average Maintenance Cost, after 10 years	$55,000	-	65	$3,575,000
Replace Machinery (1 in 75 years)	-	$3,000,000	1	$3,000,000
Replace Controls (2 in 75 years)	-	$1,500,000	2	$3,000,000
Replace Coating Bascule Span (2 in 75 yrs)	-	$750,000	2	$1,500,000
Fender System Replacement (2 in 75 years)	-	$1,500,000	2	$3,000,000
Routine Bridge Inspection (Every 2 Years)	-	$3,000	38	$114,000
Fender System Inspection (Every 2 Years)	-	$1,500	38	$57,000
Machinery Inspection (Every 2 Years)	-	$3,500	38	$133,000
Underwater Inspection (Every 4 Years)	-	$4,500	19	$85,500
Bridge Operation	$150,000	-	75	$11,250,000
Total				**$25,964,500**

Table 4-2: Estimated Operations and Maintenance Costs for Fixed Bridges (75 Years)

Item	Estimated Cost Per Year	Estimated Cost Per Occurrence	Multiplier (per Year or Occurrence)	Total Cost
Average Maintenance Cost	$5,000	-	75	$375,000
Fender System & Replacement (2 in 75 years)	-	$1,500,000	2	$3,000,000
Routine Bridge Inspection (Every 2 Years)	-	$3,000	38	$114,000
Fender System Inspection (Every 2 Years)	-	$1,500	38	$57,000
Underwater Inspection (Every 4 Years)	-	$4,500	19	$85,500
Total				**$3,631,500**

4.9 Bicycle and Pedestrian Facilities

The new bridge will accommodate four-foot bicycle lanes and five-foot sidewalks in each direction. The approach roadway section will include four-foot bicycle lanes with no sidewalks. The project will replace existing bicycle lanes and sidewalks on the existing corridors; however, new bicycle lanes and sidewalks will not be added to any other facility within the study area.

4.10 Utilities

Major utilities in the vicinity of Bridge No. 16 include water, sanitary sewer, electrical power, and fiber optic service. This project will result in utility relocations as described in Chapter 5 of this document.

4.11 Noise Barriers

No noise abatement measures are proposed as part of this project.

4.12 Work Zone, Traffic Control, and Construction Phasing

Traffic will be maintained on the existing bridge during construction of the new location Alternatives (4, 5, 5R, 11, and 17). Traffic will be maintained on a new temporary detour bridge, which will be constructed south of the existing bridge during construction of the replace on existing location Alternatives (6 and 7).

Shifting of traffic to provide adequate construction clearance may be required during construction of the roadway approaches and connecting cross-streets. Traffic shifts may require temporary pavement widening and traffic control separation devices, such as temporary barriers or delineators; however, no off-site detours are anticipated.

Chapter 5

Environmental Effects of Proposed Action

5.0 ENVIRONMENTAL EFFECTS OF PROPOSED ACTION

The environmental effects described below include the potential impacts on the existing human, physical, and natural environments. The inventory of existing conditions are based on information currently available from federal, state, and local agencies; field observations; and meetings with local officials and citizens. Reference is made to the PSA, shown in red on Figure 1-2, and to the preliminary design plans for the seven Detailed Study Alternatives described in Chapter 3 and shown in Figures 5-1 through 5-7.

5.1 Natural Resources

5.1.1 Biotic Resources

5.1.1.1 Terrestrial Communities

Five terrestrial communities were identified in the PSA: maintained-disturbed, maritime evergreen forest, mesic mixed hardwood forest (coastal plain subtype), salt marsh, and pine flatwoods. Table 5-1 summarizes the coverage areas and Figure 5-8 graphically displays the location of these terrestrial communities. A brief description of each community is provided below.

Table 5-1: Terrestrial Communities

Terrestrial Community Name	Coverage Area (acres)
Maintained-Disturbed	229.51
Maritime Evergreen Forest	9.89
Mesic Mixed Hardwood Forest (Coastal Plain Subtype)	43.66
Salt Marsh	153.22
Pine Flatwoods	68.50
Total	**504.78**

Maintained-Disturbed

Maintained-disturbed areas are scattered throughout the PSA in places where the vegetation is periodically mowed, such as roadside shoulder, utility rights-of-way, and residential areas. The vegetation in this community is comprised of low growing grasses and herbs, including Bahia grass, centipede grass, clover, wild onion, chalky bluestem, sawtooth blackberry, and pennywort. There are also scattered trees, including loblolly pine, black willow, and eastern red cedar; shrubs include wax myrtle, eastern baccharis, and winged sumac; and vines, such as Japanese honeysuckle, poison ivy, muscadine, and trumpet creeper.

Maritime Evergreen Forest

The maritime evergreen forest occurs on the spoil islands in Intracoastal Waterway (Topsail Sound). This upland community is bordered by salt marsh and comprised of a canopy of loblolly pine and live oak, with an understory of wax myrtle, eastern baccharis, gallberry, and red cedar. Vines present include poison ivy and greenbrier.

Mesic Mixed Hardwood Forest

This community is dominated by sweetgum, tulip poplar, red maple, and loblolly pine. The understory is dominated by saplings and shrubs, such as sweetgum, devil's walking stick, wax myrtle, and red maple. The herbaceous layer is dominated by bracken fern; vines found throughout include greenbrier and Japanese honeysuckle.

Salt Marsh

This wetland community within the PSA is predominately vegetated with smooth cordgrass, black needlerush, big cordgrass, and saltmeadow cordgrass. Other species that were observed include saltgrass, Virginia glasswort, and sea lavender. This community grades to an upland fringe and is characterized as a salt scrub community. This community is dominated by shrubs, including wax myrtle, eastern baccharis, Jesuit's bark, yaupon, and eastern red cedar. Bushy seaside tansy, switchgrass, and seaside goldenrod are also present.

Pine Flatwoods

This community occurs inland of the salt marsh and its canopy is dominated by loblolly pine. Due to the absence of fire, it has a well-developed midstory of red maple, redbay, loblolly bay, sweet bay, and horse sugar; and an understory dominated by shrubs, such as wax myrtle, gallberry, and fetterbush. The herbaceous layer, where present, is dominated by giant cane, cinnamon fern, royal fern, and Virginia chain fern; vines found throughout include greenbrier, poison ivy, and muscadine.

5.1.1.2 Terrestrial Community Impacts

Table 5-2 summarizes the acreage of terrestrial community impacts under each Detailed Study Alternative. Alternative 6 would have the least impacts – approximately 7.2 acres, while Alternative 4 would result in the highest impacts – approximately 11.4 acres. Terrestrial community impacts for the remaining five alternatives would range between 7.6 and 11.3 acres.

Table 5-2: Impacts to Terrestrial Communities

Alternative No.	Terrestrial Community Impact Area (acres)					
	Maintained Disturbed	Maritime Evergreen Forest	Mesic Mixed Hardwood Forest	Salt Marsh	Pine Flatwoods	Total Impacts
4	9.0	-	0.1	-	2.3	11.4
5	8.1	-	0.1	-	2.3	10.5
5R	8.0	-	0.1	-	2.3	10.4
6	7.0*	-	-	0.2	-	7.2
7	7.5*	-	-	0.1	-	7.6
11	7.7	-	1.5	-	2.1	11.3
17	8.6	-	-	0.3	0.8	9.7

* Includes approximately 0.5 acres of temporary impacts caused by detour bridge

5.1.1.3 Terrestrial Wildlife

Terrestrial wildlife in the PSA is comprised of both natural and disturbed habitats that may support a diversity of wildlife species. Mammal species that commonly exploit forested habitats and stream corridors found within the PSA include the eastern cottontail, raccoon, Virginia opossum, and white-tailed deer. Birds that commonly use forest and forest edge habitats include the American crow, blue jay, Carolina chickadee, tufted titmouse, and yellow-rumped warbler. Birds that may use the open habitat or water bodies within the PSA include the brown pelican, least tern, willet, indigo bunting, boat-tailed grackle, northern cardinal, great egret, and laughing gull. Reptile species that may use terrestrial communities located in the PSA include the corn snake, eastern box turtle, five-lined skink, anole, and rat snake. Invertebrates, such as fiddler crab and marsh periwinkle, are common in the salt marsh community.

5.1.1.4 Aquatic Communities

Aquatic communities in the PSA consist of those found in Topsail Sound and tidal pools in the marsh. These communities could support fish and shellfish, such as the Atlantic silverside, spot, Atlantic croaker, flounder, menhaden, shrimp, blue crab, eastern oyster, and clams, as well as various benthic macroinvertebrates.

5.1.1.5 Invasive Communities

Three species from the NCDOT Invasive Exotic Plant list are present in the PSA. The species identified were Chinese privet (Threat level 1), common reed (Threat level 1), and Japanese honeysuckle (Threat level 2). NCDOT will manage invasive plant species in accordance with their standard guidelines.

5.1.2 Waters of the United States

5.1.2.1 Ponds

Two ponds with a combined area of 2.7 acres are located within the PSA. These ponds consist of artificially excavated pits that are sustained by high groundwater levels and have no surface water connection to jurisdictional stream features. None of the seven Detailed Study Alternatives would result in direct impacts to the ponds.

5.1.2.2 Streams

As shown in Table 5-3, two jurisdictional streams were identified in the PSA: Topsail Sound and an unnamed tributary to Topsail Sound. Both streams are within the Cape Fear River basin (USGS Hydrologic Unit 03030001).

Topsail Sound is classified as High Quality Waters (HQW). Topsail Sound's Stream Index Number is 18-87-10 and Best Usage Classification is SA; HQW. No waters classified as Water Supplies (WS-I: undeveloped watersheds or WS-II: predominately undeveloped watersheds) or Outstanding Resource Waters (ORW) occur within 1.0 mile of the PSA. No waters listed on the North Carolina 2010 Final 303(d) list of impaired waters for sedimentation or turbidity occur within 1.0 mile of the PSA.

All seven Detailed Study Alternatives would span over the Topsail Sound. Similarly, three of the seven Detailed Study Alternatives (4, 5, and 5R) would span over the unnamed stream. The remaining four Detailed Study Alternatives are located south of the unnamed stream with no impacts.

Table 5-3: Jurisdictional Streams

Map ID	Length (feet)	Classification	Compensatory Mitigation Required (if impacted)	River Basin Buffer
Topsail Sound	5,350	Perennial	Yes	Not Applicable
SA	1,385	Perennial	Yes	Not Applicable

5.1.2.3 Wetlands

Four jurisdictional wetlands were identified within the PSA. Wetland classification and North Carolina Department of Water Quality's (NCDWQ) quality rating data are presented in Table 5-4. All wetlands are within the Cape Fear River basin (USGS Hydrologic Unit 03030001). Figures 5-1 through 5-7 graphically show the location of these three wetlands.

Table 5-4: Jurisdictional Wetlands

Map ID	NCWAM Classification	Hydrologic Classification	NCDWQ Wetland Rating	Area (acres)
WA	Pine Flat	Non-Riparian	55	9.6
WB	Headwater Forest	Riparian	47	0.6
WC	Estuarine Woody Wetland	Riparian	60	2.1
WD	Salt/Brackish Marsh	Tidal/CAMA	Not Applicable	89.4
Total				101.7

None of the Detailed Study Alternatives would result in impacts to riparian wetlands. All seven Detailed Study Alternatives would result in impacts to CAMA and/or non-riparian wetlands. Table 5-5 provides a listing of potential direct impacts to wetlands. These impacts are calculated from slope stake to slope stake, plus an additional 25 feet outside of each limit as determined from the May 2011 preliminary design plans for each alternative. The totals are rounded to the nearest 0.1 acre.

Table 5-5: Impacts to Jurisdictional Wetlands

Detailed Study Alternative No.	CAMA Wetland Impacts (acres)	Non-Riparian Wetland Impacts (acres)
Alt 4	-	1.1
Alt 5	-	1.1
Alt 5R	-	1.1
Alt 6	0.3	-
Alt 7	0.1	-
Alt 11	-	1.0
Alt 17	0.4	0.8

5.1.2.4 Avoidance, Minimization, and Mitigation

Mitigation is defined in NEPA regulations (40 CFR Section 1508.20 and 40 CFR Part 230) as efforts that a) avoid, b) minimize, c) rectify, d) reduce or eliminate, or e) compensate for adverse impacts to the environment. Mitigation of wetland impacts is recommended in accordance with Clean Water Act Section 404(b)(1) Guidelines (40 CFR Part 230); FHWA step down procedures (23 CFR Sections 777.1 et seq.); mitigation policy mandates articulated in the United States Army Corps Engineers (USACE) / United States Environmental Protection Agency (USEPA) Memorandum of Agreement (MOA; Page and Wilcher 1990); Executive Order 11990 (42 FR 26961 [1977]); and US Fish and Wildlife Service (USFWS) mitigation policy directives (46 FR 7644-7663 [1981]).

Section 404(b)(1) Guidelines, the USACE/USEPA MOA, and Executive Order 11990 stress avoidance and minimization as primary considerations for protection of Waters of the United States. Practical avoidance alternatives analyses must be fully evaluated before compensatory mitigation can be discussed.

The FHWA policy stresses that all practicable measures should be taken to avoid or minimize harm to wetlands affected by federally funded highway construction. A sequencing (step-down) procedure is recommended in the event that avoidance is not practicable. Mitigation employed outside of the highway right-of-way must be reviewed and approved on a case-by-case basis.

Avoidance, minimization, and mitigation measures that may be implemented later in the design process in consultation with the USACE are described below.

Avoidance and Minimization

Due to the location of wetlands, streams, and surface waters within the PSA, avoidance of all jurisdictional impacts is not possible. As mentioned in Chapter 3, alternatives with higher impacts to jurisdictional waters were eliminated (in specific, Alternatives 1 and 2) during or before Concurrence Point 2 meeting. During preliminary design, NCDOT has implemented best efforts to avoid and minimize impacts to several wetlands. Wherever possible, wetlands were bridged and the alignments were shifted to minimize impacts, including the CAMA wetlands located on the mainland and south of the bridge near Little Kinston Road and on the island side near Kinston Avenue.

The approved jurisdictional delineation would be utilized to minimize wetland impacts of the preferred alternative during final design. Utilization of BMP would be coordinated in an effort to minimize impacts, including avoidance of construction staging areas within wetlands.

Compensatory Mitigation of Impacts

The purpose of compensatory mitigation is to replace the lost functions and values to Waters of the United States. Mitigation could include restoration, creation, enhancement, or preservation of Jurisdictional Waters. A specific mitigation plan would be dependent upon the LEDPA/Preferred Alternative selected by the NCDOT and the reviewing agencies.

Mitigation should be implemented as close to the impacts as possible. The amount of mitigation required is determined on a case-by-case basis. Typical mitigation ratios (amount of mitigation required compared to amount impacted) for wetland mitigation are 2:1 for restoration (two acres must be restored for every one acre impacted), 3:1 for creation, 4:1 for enhancement, and 10:1 for preservation.

If on-site opportunities are not sufficient to mitigate for potential wetland and stream impacts, or are not available for mitigation, off-site compensatory mitigation would be accomplished through coordination with the North Carolina Ecosystem Enhancement Program (NCEEP). In accordance with the "Memorandum of Agreement, agreed to by the USACE, USEPA, USFWS, North Carolina Wildlife Resource Commission (NCWRC), and North Carolina Department of Environment and Natural Resources (NCDENR)," NCEEP, upon request, will provide off-site mitigation to satisfy the federal Clean Water Act compensatory mitigation requirements.

5.1.2.5 Anticipated Permit Requirements

A list of permits that may be required is provided below.

- **Section 404 (Impacts to Waters of the United States - Clean Water Act)** – Impacts to Waters of the United States are regulated by USACE. Discharges of dredge or fill material into jurisdictional wetlands, streams, or open waters associated with the construction of the proposed bridge or other roadway improvements will require a Section 404 permit from USACE. A Nationwide Permit (NWP) 14 may be applicable to cover the impacts to the jurisdictional wetlands and streams within the PSA. A Section 404 Individual Permit would be required if the project impacts exceed the NWP impact thresholds (300 linear feet of single jurisdictional stream and/or 0.5 acres of jurisdictional features). Any required compensatory mitigation would be coordinated with NCEEP.

- **Section 401 General Water Quality Certification (Clean Water Act)** – A Section 401 General Water Quality Certification (WQC) will be required for any activity that may result in a discharge into Waters of the United States or for which an issuance of a federal permit is required. The issuance of a Section 401 certification is a prerequisite to the issuance of a Section 404 permit. A NCDWQ WQC that corresponds to NWP 14 is General Certification (GC) No. 3820. If the project impacts exceed the NWP impact thresholds stated in the above section, a Section 401 Individual WQC would be required.

- **Section 9 (Bridge Permit)** – The Intracoastal Waterway is considered navigable waters of the United States. USCG has jurisdiction over bridge construction spanning navigable waters. A Section 9 permit from the USCG will most likely be required for the construction of the proposed bridge. This permit would cover both the bridge structure and fender system, as required.

- **Section 10 (Permit for Work in Navigable Waters - Rivers and Harbors Act)** – USACE requires a Section 10 permit for the construction of any structure in, over, or under a navigable water of the United States. Overhead utility lines spanning navigable waters and utility lines that are constructed in or under navigable waters require a Section 10 permit. A Section 10 permit will likely be required for the project's anticipated utility relocations.

- **CAMA Major Development Permit** – The Topsail Sound is designated as Estuarine Waters by the NCDCM and regulated as an Area of Environmental Concern (AEC). The proposed project would impact coastal wetlands and Estuarine Waters; therefore, a CAMA major development permit would be required for impacts to designated AECs.

- **USCG Bridge Closure Permit** – Well in advance of establishing a channel closing schedule, a permit would be required from USCG.

- **State Stormwater Permit** – A Stormwater Management Plan will be prepared using NCDOT's Stormwater BMP Toolbox dated March 2008. Stormwater control measures will conform to the bridge and roadway approach layout, as well as the surrounding environmental context.

- **Public Water Supply** – Public water supply relocations and impacts would require coordination with the Town of Surf City and possibly NCDENR.

Final determination of permit applicability lies with the regulatory agencies. Throughout project development process, NCDOT will coordinate with the regulatory agencies to obtain the necessary permits.

5.1.3 Rare and Protected Species

5.1.3.1 Federally Protected Species

As of September 22, 2010, USFWS lists 12 federally protected species for Pender County. A brief description of each species' habitat requirements, along with the Biological Conclusion rendered based on the PSA survey results is provided below. Habitat requirements for each species are based on the current best available information as per referenced literature and USFWS correspondence. Table 5-6 lists the 12 federally protected species and the associated survey results.

American alligator

In North Carolina, alligators have been recorded in nearly every coastal county and many inland counties. The alligator is found in rivers, streams, canals, lakes, swamps, and coastal marshes. Adult animals are highly tolerant of salt water, but the young are apparently more sensitive, with salinities greater than five parts per thousand considered harmful. USFWS's optimal survey window for American alligator is year-round (only warm days in winter).

Biological Conclusion: No Survey Required

Table 5-6: Federally Protected Species Listed for Pender County

Scientific Name	Common Name	Federal Status*	Habitat Present	Biological Conclusion**
Alligator mississippiensis	American alligator	T (S/A)	Yes	Not Required
Charadrius melodus	Piping plover	T	No	No Effect
Picoides borealis	Red-cockaded woodpecker	E	Yes	No Effect
Acipenser brevirostrum	Shortnose sturgeon	E	No	No Effect
Trichechus manatus	West Indian manatee	E	Yes	MA/NLAA
Caretta caretta	Loggerhead sea turtle	T	Yes	MA/NLAA
Chelonia mydas	Green sea turtle	T	No	No Effect
Thalictrum cooleyi	Cooley's meadowrue	E	Yes	No Effect
Carex lutea	Golden sedge	E	Yes	No Effect
Schwalbea americana[+]	American chaffseed	E	Yes	No Effect
Amaranthus pumilus	Seabeach amaranth	T	No	No Effect
Lysimachia asperulaefolia	Rough-leaved loosestrife	E	Yes	No Effect

* E – Endangered; T – Threatened; T(S/A) – Threatened due to similarity of appearance

** MA/NLAA – May Affect/Not Likely to Adversely Affect

[+] Historic record (the species was last observed in the county more than 50 years ago)

Piping plover

The piping plover breeds along the entire eastern coast of the United States. North Carolina is uniquely positioned in the species' range, being the only state where the piping plover's breeding and wintering ranges overlap and the birds are present year-round. Most commonly, they nest where there is little or no vegetation, but some may nest in stands of beach grass. The nest is a shallow depression in the sand that is usually lined with shell fragments and light-colored pebbles. USFWS's optimal survey window is year-round.

Suitable habitat for the piping plover does not exist in the PSA. A review of North Carolina Natural Heritage Program (NCNHP) records, updated August 2011, indicates there are no known piping plover occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

Red cockaded woodpecker

The red-cockaded woodpecker (RCW) typically occupies open, mature stands of southern pines, particularly longleaf pine, for foraging and nesting/roosting habitat. The RCW excavates cavities for nesting and roosting in living pine trees, aged 60 years or older, that are contiguous with pine stands at least 30 years of age to provide foraging habitat. The foraging range of the RCW is normally no more than 0.5 miles. USFWS's optimal survey window is November through early March.

During a field survey on March 15, 2011, the closest "known" active cluster was found approximately five miles from the PSA. No suitable nesting habitat was identified within a 0.5 miles of the PSA.

Biological Conclusion: No Effect

Shortnose sturgeon
The short-nosed sturgeon occurs in the lower sections of large rivers and in coastal marine habitats. The short-nosed sturgeon prefers deep channels with a lower salinity than seawater. It feeds benthicly on invertebrates and plant material, and is most active at night. The short-nosed sturgeon requires large fresh water rivers that are unobstructed by dams or pollutants to reproduce successfully. An anadromous species that spawns upstream in the spring, it spends most of its life within close proximity of the rivers mouth. At least two entirely freshwater populations have been recorded in South Carolina and Massachusetts. Generally, surveys are not required, as this species is assumed present in appropriate waters

Based on coordination with the North Carolina Division of Marine Fisheries [NCDMF] on August 18, 2010, suitable habitat for shortnose sturgeon does not exist in the PSA. A review of NCNHP records, updated August 2011, indicates there are no known shortnose sturgeon occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

West Indian manatee
West Indian manatees have been observed in all the North Carolina coastal counties. West Indian manatees are found in canals, sluggish rivers, estuarine habitats, salt water bays, and as far off shore as 3.7 miles. They utilize freshwater and marine habitats at shallow depths of 5 to 20 feet. Mantees concentrate in areas with warm water in the winter (between October and April). During other times of the year, habitats appropriate for the West Indian manatee are those with sufficient water depth, an adequate food supply, and in proximity to freshwater. West Indian manatees require a source of freshwater to drink. West Indian manatees are primarily herbivorous, feeding on any aquatic vegetation present, but they may occasionally feed on fish. USFWS's optimal survey window is year-round.

Suitable habitat for West Indian manatee does exist in the PSA. Topsail Sound is of sufficient size to support West Indian manatee. A review of NCNHP records, updated August 2011, indicates there are no known West Indian manatee occurrences within 1.0 mile of the PSA. Construction activities will adhere to the guidelines outlined in Precautions for Construction in Areas which May be Used by the West Indian Manatee in North Carolina (2003 USFWS).

Biological Conclusion: May Affect/Not Likely to Adversely Affect

Loggerhead turtle
The loggerhead turtle is widely distributed within its range and is found in three distinct

habitats during their lives. These turtles may be found hundreds of miles out in the open ocean, in neritic (near shore) areas, or on coastal beaches. In North Carolina, this species has been observed in every coastal county. Loggerheads occasionally nest on North Carolina beaches and are the most common of all the sea turtles that visit the North Carolina coast. They nest nocturnally, at two to three year intervals and between May and September, on isolated beaches that are characterized by fine-grained sediments. In near shore areas, loggerheads have been observed in bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and shipwrecks are often used as foraging areas. USFWS's optimal survey window is April through August.

Suitable habitat for the loggerhead turtle does exist in the PSA. However, a review of NCNHP records, updated August 2011, indicates there are no known loggerhead turtle occurrences within 1.0 mile of the PSA.

Biological Conclusion: May Affect/Not Likely to Adversely Affect

Green sea turtle

The green sea turtle is found in temperate and tropical oceans and seas. Nesting in North America is limited to small communities on the east coast of Florida, requiring beaches with minimal disturbances and a sloping platform for nesting (they do not nest in North Carolina). The green sea turtle can be found in shallow waters. They are attracted to lagoons, reefs, bays, mangrove swamps, and inlets where an abundance of marine grasses can be found, as this is the principle food source for the green turtle. USFWS's optimal survey window is April through August.

Suitable habitat for the green sea turtle does not exist in the PSA. A review of NCNHP records, updated August 2011, indicates there are no known green sea turtle occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

Cooley's meadowrue

Cooley's meadowrue occurs on circumneutral soils in grass-sedge bogs and wet pine savannahs and savannah-like areas. It may also grow along fire plow lines, in roadside ditches, woodland clearings, and powerline rights-of-way. Cooley's meadowrue needs some type of disturbance, such as fire or mowing, to maintain its open habitat.

Suitable habitat for Cooley's meadowrue does exist in the PSA; however, a survey conducted on June 28, 2010, concluded Cooley's meadowrue is not present within the PSA. In addition, a review of NCNHP records, updated August 2011, indicates there are no known Cooley's meadowrue occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

Golden sedge

Golden sedge grows in sandy soils overlying coquina limestone deposits, where the soil pH is unusually high for this region, typically between 5.5 and 7.2. Soils supporting the species are very wet to periodically shallowly inundated. The species prefers the ecotone between pine savanna and adjacent wet hardwood or hardwood/conifer forest. Most plants occur in the partially shaded savanna/swamp where occasional to frequent fires favor an herbaceous ground layer and suppress shrub dominance.

Suitable habitat for golden sedge does exist in the PSA; however, a survey conducted on June 28, 2010, concluded golden sedge is not present within the PSA. In addition, a review of NCNHP records, updated August 2011, indicates there are no known golden sedge occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

American chaffseed

American chaffseed generally occurs in habitats described as open, moist to dryish mesic pine flatwoods and longleaf pine flatlands, pine savannas, pine/scrub oak sandhills, sandhill seeps, and other open grass/sedge-dominated communities. This herb also occurs in the ecotonal areas between peaty wetlands and xeric sandy soils and on the upper ecotones of, or sites close, to Streamhead Pocosins. The species prefers sandy peat or sandy loam, acidic, seasonally moist to dry soils in sunny or partly sunny areas that are subject to frequent fires in the growing season. The plant is dependent on factors such as fire, mowing, or fluctuating water tables to maintain its required open to partly open habitat. Most extant populations, and all of the most vigorous populations, are in areas subject to frequent fire. This species is also known to occur on road cuts and power line rights-of-way that experience frequent mowing or clearing. Soil series that it is found on include Blaney, Candor, Gilead, Fuquay, Lakeland, and Vaucluse.

Suitable habitat for American chaffseed does exist in the PSA; however, a survey conducted on June 28, 2010, concluded American chaffseed is not present within the PSA, and no recent fires have occurred. In addition, a review of NCNHP records, updated August 2011, indicates there are no known American chaffseed occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

Seabeach amaranth

Seabeach amaranth occurs on barrier island beaches where its primary habitat consists of overwash flats at accreting ends of islands, lower foredunes, and upper strands of noneroding beaches (landward of the wrack line). In rare situations, this annual is found on sand spits 160 feet or more from the base of the nearest foredune. It occasionally establishes small temporary populations in other habitats, including sound-side beaches, blowouts in foredunes, interdunal areas, and on sand and shell material deposited for beach replenishment or as dredge spoil. The plant's habitat is sparsely vegetated with annual herbs

(forbs) and, less commonly, perennial herbs (mostly grasses) and scattered shrubs. It is, however, intolerant of vegetative competition and does not occur on well-vegetated sites. The species usually is found growing on a nearly pure silica sand substrate, occasionally with shell fragments mixed in. Seabeach amaranth appears to require extensive areas of barrier island beaches and inlets that function in a relatively natural and dynamic manner. These characteristics allow it to move around in the landscape, occupying suitable habitat as it becomes available. USFWS's optimal survey window is July through October.

Suitable habitat for seabeach amaranth does not exist in the PSA. A review of NCNHP records, updated August 2011, indicates there are no known seabeach amaranth occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

Rough-leaved loosestrife

Rough-leaved loosestrife, endemic to the coastal plain and sandhills of North and South Carolina, generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins in dense shrub and vine growth on moist to seasonally saturated sands and on shallow organic soils overlaying sand (spodosolic soils). This perennial herb specifically occurs in the ecotones between the following habitats: longleaf pine savanna and pocosin, longleaf pine flatwood and pocosin, longleaf pine savanna and mixed herb, longleaf pine/pond pine and evergreen shrub, longleaf pine/wiregrass savanna and Carolina bay pocosin, streamhead pocosin and pine/scrub oak sandhill, and sandhill seep and pine/scrub oak sandhill. Occurrences are also found in the following natural habitats: low pocosins, high pocosins, wet pine flatwoods, pine savannas, streamhead pocosins, sandhill seeps, riparian floodplains, boggy seeps and meadows, on deep peat in the middle of the low shrub community of large Carolina bays, and at the peaty margins of ponds and lakes. Occurrences are found in disturbed habitats, such as roadside depressions, maintained power and utility line rights-of-way, firebreaks, and trails. The species prefers full sunlight, is shade intolerant, and requires areas of disturbance (e.g., clearing, mowing, and periodic burning) where the overstory is minimal. However, it can persist vegetatively for many years in overgrown, fire-suppressed areas. Blaney, Gilead, Johnston, Kalmia, Leon, Mandarin, Murville, Torhunta, and Vaucluse are some of the soil series that occurrences have been found on. USFWS's optimal survey window is mid May through June.

Suitable habitat for rough-leaved loosestrife does exist in the PSA; however, a survey conducted on June 28, 2010, concluded rough-leaved loosestrife is not present within the PSA, and no recent fires have occurred. In addition, a review of NCNHP records, updated August 2011, indicates there are no known rough-leaved loosestrife occurrences within 1.0 mile of the PSA.

Biological Conclusion: No Effect

5.1.3.2 Bald and Golden Eagle Protection Act

Bald and golden eagles are not listed as a federally protected species; however, they are afforded protection under the Bald and Golden Eagle Protection Act. Golden eagles are not present in North Carolina. Habitat for the bald eagle primarily consists of mature forest in close proximity to large bodies of water for foraging. Large, dominant trees are utilized for nesting sites, typically within 1.0 mile of open water. Suitable nesting and foraging habitat for the bald eagle is present within 1.0 mile of the PSA; however, during a March 16, 2010, survey, no bald eagles or nests were observed within the PSA or within 660 feet on all sides of the PSA.

5.1.3.3 Endangered Species Act Candidate Species

As of September 22, 2010, USFWS lists no candidate species for Pender County.

5.1.3.4 Essential Fish Habitat

NMFS has identified Intracoastal Waterway (Topsail Sound) as an Essential Fish Habitat. Table 5-7 lists the fish species and corresponding life stages that may occur in the PSA and are managed by NMFS.

Under the proposed project, Bridge No. 16 would be replaced with a 500 feet to 4,000 foot-long bridge either in the same location, to the north, or to the south. The new structure would only require footings to be placed within the Intracoastal Waterway (Topsail Sound). Given this limited in-water construction work, the proposed project would most likely result in a negligible net effect on available Essential Fish Habitat.

5.1.4 Topography and Soils

The PSA lies in the coastal plain physiographic region of North Carolina. Topography in the project vicinity is nearly level to gently rolling. Elevations in the PSA range from 5 to 30 feet above sea level. Land use in the project vicinity consists primarily of forest, commercial, and residential development. As shown in Table 5-8, the Pender County Soil Survey identifies ten soil types within the PSA.

Table 5-7: Commercial Fish Species

Species	Life Stage
Red Drum	Eggs, Larval, Juvenile, Adult
Bluefish	Juvenile, Adult
Summer Flounder	Larval, Juvenile, Adult
Brown Shrimp	Larval, Juvenile, Adult
Pink Shrimp	Larval, Juvenile, Adult
White Shrimp	Larval, Juvenile, Adult
Cobia	Juvenile, Adult
King Mackerel	Juvenile
Spanish Mackerel	Juvenile, Adult
Smooth Dogfish	Juvenile
Small Coastal Sharks	Juvenile, Adult
Black Sea Bass	Larval, Juvenile, Adult
Rock Sea Bass	Juvenile
Gag	Juvenile
Gray Snapper	Juvenile
Yellow Jack	Juvenile
Blue Runner	Juvenile
Crevalle Jack	Juvenile
Bar Jack	Juvenile
Sheepshead	Juvenile, Adult

Table 5-8: Soils

Soil Series	Mapping Unit	Drainage Class	Hydric Status
Alpin fine sand	AnB	Excessively drained	Hydric*
Bohicket silty clay loam	Bo	Very poorly drained	Hydric
Carteret fine sand	Ca	Very poorly drained	Hydric
Leon fine sand	LnA	Poorly drained	Hydric
Murville muck	Mu	Very poorly drained	Hydric
Newhan fine sand	NhC	Excessively drained	Hydric*
Newhan-Corolla complex	NkE	Excessively drained	Hydric*
Newhan-Corolla-Urban land complex	NmE	Excessively drained	Hydric*
Pender loamy fine sand	On	Moderately well drained	Hydric*
Pactolus fine sand	PaA	Moderately well drained	Hydric*

* Soils which are primarily nonhydric, but which contain hydric inclusions

5.2 Cultural Resources

5.2.1 Compliance

This project is subject to compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and implemented by the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106, codified at 36 CFR Part 800. Section 106 requires Federal agencies to take into account the effect of their undertakings (federally-funded, licensed, or permitted) on properties included in or eligible for inclusion in the National Register of Historic Places and to afford the Advisory Council a reasonable opportunity to comment on such undertakings.

The project is also subject to compliance with Section 4(f) of the United States Department of Transportation Act of 1966, as amended, codified at 49 U.S.C. Section 303. Section 4(f) states that FHWA and other DOT agencies cannot approve the use of land from a significant publicly owned public park, recreation area, wildlife or waterfowl refuge, or any significant historic site unless there is no feasible and prudent alternative to the use of land and the action includes all possible planning to minimize harm to the property resulting from use.

5.2.2 Historic Architectural Resources

The North Carolina State Historic Preservation Office (NC HPO) requested additional coordination with their office for impacts to historic structures in their memo to NCDOT dated September 11, 2007. A field survey of the Area of Potential Effects (APE) was conducted in February 2010 by an NCDOT architectural historian and eighty-two structures over fifty years of age within the APE were recorded and evaluated according the National Register criteria. The photographs of these properties along with their National Register eligibility evaluations were shown to the NC HPO in a meeting on March 19, 2010. It was decided that a report would be needed to further evaluate the following two properties:

- Ward Realty Corporation, 116 South Topsail Drive, Surf City, Pender County
- Bridge No. 16, Surf City, Pender County

A report was prepared by NCDOT architectural historians in October 2010 which stated that Ward Realty was not eligible, but Pender County Bridge No. 16 remains eligible for the National Register. The report was forwarded to NC HPO for their concurrence and they concurred with the findings in a memorandum dated December 28, 2010, a copy of which is located in the Appendix C.

Bridge No. 16 was previously determined eligible for the National Register of Historic Places as part of the NCDOT's 1995 Historic Bridge Inventory Report as an early and intact example of a riveted Warren through truss, swing span bridge. Although moved from Sunset Beach to its current location in 1954, Pender County Bridge No. 16 remains in operable condition and retains c. 1930 gearing and mechanical systems. The historic boundary for the bridge includes the 254-foot long Warren through truss, operator's house, and concrete tee beam approach spans.

In a meeting between NCDOT and NC HPO on April 5, 2011 it was determined that all of the detailed study alternatives would have an adverse effect on Bridge No. 16 because it would be removed from its existing location. A copy of the concurrence form signed during the meeting is included in the Appendix C. Construction of any of the proposed alternatives would also require NCDOT to complete a Section 4(f) evaluation since it necessitates the use of land from the historic boundary associated with Pender County Bridge No. 16. These impacts, mitigation measures and associated coordination efforts are described in Section 5.3.1.

5.2.3 Archaeological Resources

In a letter dated September 11, 2007, the North Carolina Department of Cultural Resources (NCDCR) stated that there were no known archaeological sites within the PSA. Therefore, no archaeological investigations were conducted for this project.

5.3 Section 4(f) Resources

Section 4(f) of the Department of Transportation Act of 1966, as amended, (23 U.S.C. 138) states that the United States Department of Transportation (USDOT) "may not approve the use of land from a significant publicly-owned park, recreation area, or wildlife and waterfowl refuge, or any significant historic site unless a determination is made that: (1) there is no feasible and prudent alternative to the use of land from the property and (2) the action includes all possible planning to minimize harm to the property resulting from such use."

For Section 4(f), a "use" is defined as one of the following:

- A direct use – property is permanently incorporated into the right-of-way of the transportation project
- A temporary use – property is temporarily occupied in a way that is adverse to the property's purpose
- A constructive use – a use that occurs when "the transportation project does not incorporate land from a Section 4(f) property, but the project's proximity impacts are so severe that the property activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes of the property are substantially diminished." (23 CFR 774.15(a))

Two Section 4(f) properties exist within the PSA, including Bridge No. 16 and Soundside Park (owned and maintained by the Town of Surf City). All seven Detailed Study Alternatives would replace Bridge No. 16. These impacts, mitigation measures and associated coordination efforts are described in Section 5.3.1 below. Three of the seven Detailed Study Alternatives (6, 7, and 17) would result in temporary and/or permanent impacts to the Soundside Park. The corresponding impacts to Soundside Park and associated coordination efforts are described in Section 5.3.2 below.

5.3.1 Bridge No. 16

Although moved from Sunset Beach to its current location in 1954, Pender County Bridge No. 16 remains in operable condition and retains c. 1930 gearing and mechanical systems. As an early and intact example of a riveted Warren through truss, swing span bridge, Bridge No. 16 was determined eligible for the National Register of Historic Places. All seven Detailed Study Alternatives would replace this bridge.

Replacing Bridge No. 16 by all Detailed Study Alternatives is considered a Section 4(f) use as defined by section 4(f), thus requiring an evaluation. However, as an alternative to preparing an individual Section 4(f) evaluation, certain circumstances allow NCDOT/FHWA the option of preparing a programmatic evaluation; which includes the replacement of an historic bridge; however, in all cases, it is necessary to satisfy and confirm the following two Section 4(f) requirements:

i) There are no feasible and prudent alternatives to the use of the historic bridge structure to be replaced or rehabilitated with Federal funds; and

ii) The project includes all possible planning to minimize harm resulting from such use.

5.3.1.1 Avoidance Alternatives

No Build Alternative

As discussed in Section 3.1, the No Build Alternative (Do Nothing) would not meet the purpose of the proposed project to improve bridge safety.

Build on New Location Without Using the Old Bridge

All seven Detailed Study Alternatives would require replacing the existing bridge with a new bridge either to the north, to the south or in-place.

Repair and Rehabilitate Existing Bridge Alternative

As discussed in Section 3.2, repair/ rehabilitation alternative would increase the bridge's sufficiency rating only to 28 out of possible 100, which is substantially below the required 80 to qualify for Federal Highway Bridge Program funds. Even after the repairs, the rehabilitated bridge will remain "functionally obsolete" and be classified as "fracture critical" due to the condition of the truss swing span. Therefore, the repaired and rehabilitated bridge would not meet the purpose of the proposed project to improve bridge safety.

5.3.1.2 Measures to Minimize Harm

Currently, NCDOT is investigating options to reuse of the existing swing span at a different location. Resulting information on these options will be included in subsequent documentation.

5.3.1.3 Coordination

NCDOT met with NC HPO's representative on April 5, 2011, and concluded that all seven Detailed Study Alternatives would result in an "adverse effect" because the existing Bridge No. 16 would be removed. The draft programmatic Section 4(f) evaluation and concurrence form for effects to Bridge No. 16 are included in Appendix C.

5.3.2 Soundside Park

Soundside Park is a municipal park owned by the Town of Surf City and located adjacent to Bridge No. 16 in the southeast quadrant. The park has 45 parking spaces, boat access ramps, picnic facilities, a performance stage, a children's playground, bathroom facilities, and a boardwalk open to the public year-round.

5.3.2.1 Avoidance Alternatives

As previously stated, three of the seven Detailed Study Alternatives (6, 7, and 17) would cause a temporary and/or permanent impact to this park.

The remaining four Detailed Study Alternatives (4, 5, 5R, and 11) would completely avoid temporary or permanent impacts to park property.

5.3.2.2 Alternatives 6 and 7

Alternatives 6 and 7 require a temporary detour bridge, which will accommodate the bridge traffic during the construction of the permanent bridge. The detour bridge would temporarily impact approximately 0.4 acres of park land and require relocation of the performance stage and a picnic facility. Facilities currently located in the park's impacted area include picnic facilities and a performance stage. These facilities would not be available for public usage during the two-year construction period, resulting in temporary adverse impacts to Soundside Park and therefore considered a Section 4(f) use of the resource.

In addition to the temporary impacts, Alternatives 6 and 7 would result in 0.03 and 0.01 acres of permanent impacts to the park, respectively. This portion of the park land is undeveloped with no recreational facilities present.

On August 17, 2011, NCDOT met with the Town of Surf City officials to discuss Alternative 6 and 7's impacts to the Soundside Park. The Town officials agreed with NCDOT's determination of adverse impacts to Soundside Park. A summary of these meeting notes are included in Appendix D.

Figures 5-9 and 5-10 graphically show the temporary and permanent impacts of Alternatives 6 and 7 to the Soundside Park, respectively.

5.3.2.3 Alternative 17

During CIW#2, the community indicated significant support for alternatives terminating on the island at the NC 50/210 intersection. These alternatives included Alternative 5 and Alternative 10, each with over 40% support. Alternative 10 was subsequently eliminated due to Soundside Park impacts, and a replacement alternative, Alternative 17, was developed minimizing impacts to the park, while maintaining the NC 50/210 intersection location.

This alternative's footprint clips the southeastern corner of the park property resulting in 0.2 acres of permanent impacts (see Figure 5-11). The impacted area is undeveloped and marshy with no recreational facilities present. Park access would remain unchanged under Alternative 17. This Alternative would result in no temporary or permanent impacts to the park facilities.

Surf City Town Officials indicated at a meeting held August 17, 2011 that the impacts associated with Alternative 17 would be minimal (Appendix D). Currently, Alternative 17 is anticipated to have a *de minimis* impact as defined by section 4(f) regulations (23 CFR 774.17). Section 5.3.2.4 discusses regulations regarding *de minimis* impacts to section 4(f) resources. Following public review of the Environmental Assessment and further public involvement, a *de minimis* impact determination will be made for Alternative 17 and will be discussed in subsequent documentation.

5.3.2.4 Section 4(f) *De Minimis* Impact Background

In 2005, Congress amended Section 4(f) in its passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), specifically in Section 6009(a). An important change was the introduction of the *de minimis* procedures for processing minor impacts to Section 4(f) resources. Subsequent to the passage of SAFETEA-LU, FHWA amended the Section 4(f) regulations (23 CFR 774.3(b), 23 CFR 774.5(b) and 23 CFR 774.17) and issued guidance for determining *de minimis* findings (*Guidance for Determining De Minimis Impacts for Section 4(f) Resources)*.

Based on these regulations and guidance documents, the use of land from a publicly owned park, recreation area, or wildlife and waterfowl refuge may be determined to be *de minimis* if:

1. The transportation use of the park, together with any impact, avoidance, minimization, and mitigation or enhancement measures do not adversely affect the activities, features, and attributes that qualify the resource for protection under Section 4(f)
2. The official(s) with jurisdiction over the property is informed of FHWA's intent to make the *de minimis* impact finding, based on his/her written concurrence that the project will not adversely affect the activities, features, and attributes that qualify the property for protection under Section 4(f)
3. The public has been afforded an opportunity to review and comment on the affects of the project on the proposed activities, features, and attributes of the Section 4(f) resource

According to the provisions set forth in Section 6009(a) of SAFETEA-LU, once the USDOT determines that a transportation use of property from a Section 4(f) resource constitutes a *de minimis* impact, analysis of avoidance alternatives is not required and the Section 4(f) evaluation process is complete.

5.4 Farmland

North Carolina Executive Order Number 96, Preservation of Prime Agricultural and Forest Lands requires all state agencies to consider the impact of land acquisition and construction projects on prime farmland soils, as designated by the Natural Resources Conservation Service (NRCS). These soils are determined by the Soil Conservation Service and based on criteria, such as crop yield and level of input of economic resources. The Farmland Protection Policy Act (FPPA) requires that applicable environmental documents evaluate farmland impacts and comply with FPPA impact minimization guidelines.

Several properties are currently zoned as agricultural land use within the PSA; however, none of these properties are impacted by the seven Detailed Study Alternatives.

The NCDOT GIS Unit identified a Farmland of Unique Importance area (Figure 5-12) that may be impacted by four of the seven Detailed Study Alternatives (Alternatives 4, 5, 5R, and 11). Although identified as a GIS farmland, this area is zoned as Extended Commercial (C-3) by Surf City. During an October 9, 2011 discussion with the Planning Director, Town of Surf City, who indicated that this area had not been farmed in the last 30 years and was classified as C-3 since 1999 when it was originally annexed by Surf City.

As is required by the Farmland Protection Policy Act, Parts III and VI of the NRCS-CPA-106 form (for corridor projects) have been completed (included in Appendix E) according to FHWA guidelines. Since each of the four alternatives mentioned (4, 5, 5R, and 11) individually received total point values of less than 60 points, this site falls below the NRCS minimal criteria and will not be submitted to the NRCS and will not be evaluated further for farmland impacts. No other alternatives other than those already discussed in this document will be considered without a re-evaluation of the project's potential impacts upon farmland. This project will not have a significant impact to farmland.

5.5 Social Effects

5.5.1 Neighborhoods/Communities

As described in Chapter 2, the Demographic Study Area includes the entire 26-mile long Topsail Island, as well as Surf City's mainland limits extending west from the Intracoastal Waterway to US 17. The Town of Topsail Beach is located on the south end of Topsail Island extending approximately four miles north from the southern tip. Surf City abuts the north end of Topsail Beach and extends another five miles north to the Town of North Topsail Beach. North Topsail Beach town limits include the remaining northern part of the island.

5.5.2 Community Demographics

The population of the Demographic Study Area may be characterized as an aging, affluent, predominantly white population. The area's younger workforce is more likely to live on the mainland in Surf City, Holly Ridge, or Jacksonville, where more affordable housing is available.

According to local planners, affordable housing is scarce on Topsail Island. One affordable apartment complex was identified, Topsail Reef in North Topsail Beach. On the mainland, a number of manufactured housing parks offer affordability.

A summary of the Demographic Study Area's demographic data is provided below. Additional demographic details are provided in the project's Community Characteristics Report, dated February 2011.

- The 2007 United States Census estimates the permanent resident population of Surf City as 1,912; North Topsail Beach as 960; and Topsail Beach as 573. Between 2000 and 2007, the population growth for Surf City was 3.7%; Topsail Beach was 2.2%; and North Topsail Beach was 1.4%.

- The future population between 2010 and 2030 is estimated to grow at 2.4% per year for the three towns, while the state of North Carolina is estimated to grow at a rate of approximately 1.5% per year.

- The age profile reflects the increasing popularity of Topsail Island as a retirement community. The proportion of the population aged 65 and older is significantly higher for Topsail Island, ranging between 16.3% and 26.8% for the three towns, compared with Pender County at 5.1%, and the state at 12.0%.

- The minority population within the Demographic Study Area is small at 7.4%, and well below the county and state averages of 27.3% and 27.9%, respectively.

- The hispanic population within the Demographic Study Area is also small at 1.1%, and well below the Pender County (3.6%), Onslow County (7.2%) and state (4.7%) averages.

- Much of the Topsail Island's economy is based on leisure and development. Most retirees, seasonal residents, and vacationers are not locally employed. The majority of the island's workforce does not reside on the island. Island residents and visitors travel to the mainland for many goods and services. Similarly, many island workers travel from the mainland for retail, restaurant, and construction jobs.

- Generally, the households in the Demographic Study Area are more affluent than Pender/Onslow counties and the state overall. The median income for households in the Demographic Study Area is above county and state averages.

5.5.3 Relocation of Residences and Businesses

As shown in Table 5-9, Alternative 5R would impact highest number of properties (13 residences and seven businesses), whereas Alternative 6 would impact the least number of properties (zero residences and one business). This project would have no low income or minority property impacts. NCDOT's relocation reports are included in Appendix F.

Table 5-9: Residential and Business Relocations

Alternative No.	Residential Relocations	Business Relocations	Low Income / Minority Residential / Business Relocations
4	4	5	-
5	2	4	-
5R	13	7	-
6	-	1	-
7	-	3	-
11	4	1	-
17	1	3	-

5.5.4 Environmental Justice

Title VI of the Civil Rights Act of 1964 protects individuals from discrimination on the grounds of race, age, color, religion, disability, sex, and national origin. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," provides that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations. Special populations may include the elderly, children, the disabled, low-income areas, American Indians, and other minority groups. Executive Order 12898 requires that Environmental Justice principles be incorporated into all transportation studies, programs, policies, and activities. The three environmental principles are:

1) Ensure the full and fair participation of all potentially affected communities in the transportation decision-making process
2) Avoid, minimize, or mitigate disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority or low income populations
3) Fully evaluate the benefits and burdens of transportation programs, policies, and activities upon low-income and minority populations

5.5.4.1 Environmental Justice Impacts

As defined by NCDOT, an Environmental Justice population is present whenever the following criteria are met:

- The non-white population or low income population is 10 percentage points higher than the county average OR;
- When either population exceeds 50 percent.

No notably adverse community impacts are anticipated with this project and no Environmental Justice populations appear to be affected; thus, impacts to minority and low income populations do not appear to be disproportionately high and adverse. Benefits and burdens resulting from the project are anticipated to be equitably distributed throughout the community, and no denial of benefit is expected. Public involvement and outreach activities must ensure full and fair participation of all potentially affected communities in the transportation decision-making process.

5.5.4.2 Other Populations

The Demographic Study Area analysis identified only the elderly as a special population area of concern with a higher than average concentration. Therefore, this population should be given special consideration during the environmental review process. To accommodate this elderly population, NCDOT scheduled the CIWs for longer periods and earlier in the day, beginning at 2:30 p.m./3:00 p.m. and ending at 7:00 p.m./7:30 p.m. In addition, NCDOT offered auxiliary aids and services for disabled persons who wish to participate in these workshops.

None of the Detailed Study Alternatives impact a senior housing community or an elderly assisted living facility. Residents, elderly or otherwise, of the few homes impacted can easily find replacement housing nearby. NCDOT's standard practice is to provide assistance with relocation. NCDOT also offers programs to assist with relocation moving expenses and replacement housing.

5.5.5 Bicycle and Pedestrian Facilities

The proposed project will accommodate bicycle lanes and/or sidewalks along the new bridge and roadway approach segments.

5.5.6 Recreational Facilities

Alternatives 6, 7, and 17 would impact the Soundside Park, as described in Section 5.3. No other recreational facilities would be impacted by the project alternatives.

5.5.7 Other Public Facilities and Services

Other public facilities and services include educational facilities, religious institutions, health care facilities, government offices and public safety facilities (police, fire, and rescue), cultural facilities (e.g., libraries, museums, historic sites, etc.), and parks/recreational and community center facilities. Several of these types of facilities are located throughout the Demographic Study Area, as indicated in Figures 5-1 through 5-7 and listed in Table 5-10.

None of the Detailed Study Alternatives would require relocation of any community facilities in the PSA. Four of the seven Detailed Study Alternatives would result in property impacts to the front parking area and change in access to Faith Harbor United Methodist Church. As there appears to be enough remaining parking in the property, this church would not need to be relocated.

Table 5-10: Community Facilities

Facility	Name	Location
Places of Worship	Faith Harbor United Methodist Church St. Marys Gate of Heaven Church	14201 NC 50, Surf City 420 N. Topsail Dr., Surf City
Local Historical Landmark	Topsail Island Bridge	NC 50/210, Surf City
Parks and Recreation	Soundside Park Surf City Fishing Pier	517 Roland Ave. Surf City 112 S. Shore Dr., surf City
Medical Facility	Surf City Urgent Care Facility Beach Care PA	1350 US 50, Surf City Treasure Coast Square, Surf City
Police Department	Topsail Beach Police Department Surf City Police Department	812 S Anderson Blvd. Topsail Beach 211 North Topsail Drive, Surf City
Fire Station	Surf City Fire Station Surf City Volunteer Fire Department	NC 210 at Empire N., Surf City NC 210 at Deer Run Rd., Surf City
Government Facility	Surf City Town Hall	214 N New River Dr., Surf City

Source: Field observation and discussions with local municipalities fall 2008.

5.6 Economic Effects

Businesses on the island consist of a grocery store and other local retail and restaurant businesses. These establishments service mostly the recreational beach population. Many more businesses are located on the mainland within the Demographic Study Area and include nationally recognized restaurants, pharmacies, hardware stores, grocery stores, and other businesses.

Potential economic impacts to the community include disturbance of commercial properties, increased traffic delays, interruption of economic activity/operations between the mainland and the island, and interruption of utility services. Section 5.5.3 provides a summary of the commercial property impacts.

Under the high-level fixed bridge alternatives (4, 5, 5R, 11, and 17), the existing Roland Avenue would terminate at each bridge end, serving only as a local road to area residents and businesses. This change in travel patterns could result in a loss of drive-by traffic to the existing businesses along Roland Avenue, potentially resulting in a corresponding loss of business. However, under these alternatives the new bridge would reduce the traffic delays in the area, thereby potentially improving the overall local economic activity. In addition, these alternatives would result in new development opportunities along existing Roland Avenue and adjacent bridge terminus locations.

Under Alternatives 6 and 7, the existing bridge would be replaced in place. Impacts under these alternatives include property takings and changes to the existing access; however, these two alternatives would most likely result in minimal permanent economic impacts to businesses along Roland Avenue, with only temporary impacts during construction.

5.7 Land Use

5.7.1 Existing Land Use and Zoning

The land use is generally retail/commercial development near Bridge No. 16 and mostly residential development farther from the PSA. Within the PSA, a general description of the land use is a residential townhome subdivision in the northwest quadrant; power lines in the southwest quadrant; Soundside Park in the southeast quadrant; and a seasonal manufactured housing park with adjacent restaurants in the northeast quadrant.

The Towns of Surf City and Topsail Beach completed land use plans in 2005, with the Town of North Topsail Beach's completed in 2010.

5.7.2 Future Land Use and Zoning

Future development in Surf City would be limited to redevelopment with no increase in density expected for the island. Island zoning regulations limit lot coverage to 12% of area and replacement housing to single-family dwellings no more than 48 feet in height. The zoning permits larger single-family homes, but eliminates any higher density multifamily development. On the mainland, new commercial development is occurring near the intersection of US 17 with NC 210 and at the NC 50/210 junction. No manufacturing or industrial development exists within the town.

In Topsail Beach, development over the next 20 years would be limited to in-fill housing, redevelopment of existing homes, and the re-subdividing of existing lots. Current zoning requires a minimum lot size of 5,000 square feet and height restrictions of 38 feet. The lack of sanitary sewer infrastructure would limit growth.

North Topsail Beach is more sparsely developed than the two towns to the south. Unlike the other towns, North Topsail Beach is encouraging higher density development exemplified by the vacation properties of St. Regis Resort, Villa Capriani, and Capri Isle. The 2010 "Build-Out and Non-Conforming Lot Study" counted 850 undeveloped residential lots and 24 undeveloped commercial lots in North

Topsail Beach. Zoning policy and available utility capacity encourage growth. Future land use is expected to include redevelopment of older housing and development of additional higher-density residential communities.

5.7.3 Community Character

Many of the island's residents and visitors consider the existing swing bridge an important part of the Topsail Island's character, generating social and economic activity for the area. Many citizens, along with the Town of Surf City, have requested that an in-place moveable bridge alternative of similar type be constructed to maintain the island's charm.

During the June 2009 CIW #1, several local residents expressed their concern that a high-level fixed bridge would result in substantial commercial development, changing the island's character and life style permanently. It should be noted that local zoning laws would most likely control growth potential. Results from CIW #1 indicate that over one-third of the attendees prefer for a high-level fixed bridge, citing emergency access and traffic delay reasons.

5.7.4 Visual Impacts

Directly related to the community character are the resulting visual impacts of the proposed bridge replacement. Potential visual impacts were presented at the October 2010 CIW #2 with artistic renderings. These renderings are included in Appendix G and show significant community and business features. Below is a summary of visual impacts for each Detailed Study Alternative:

5.7.4.1 Alternative 4

Alternative 4 would have a visual impact at the entrance to the Atkinson Point community, where the new structure would cross over Atkinson Point Road and to the adjacent waterfront community as it crosses the Intracoastal Waterway.

On the mainland at Atkinson Point Road, the bridge approach would form a visual barrier into the neighborhood create a short tunnel-like entranceway to the neighborhood. For the Sea Manor Drive, Harbor Sound Townhomes, and Atkinson Point communities, the high-level fixed bridge would be a distinctive addition to the viewscape; however, because the views from these neighborhoods are so expansive, the effect should be minimal except for properties directly adjacent to the structure.

The impacts to waterfront communities on Topsail Island would be minimal, as no residential community is located in the immediate vicinity of the proposed alignment.

5.7.4.2 Alternative 5

On the mainland side, the visual impacts for Alternative 5 would be similar to Alternative 4, with one exception. The exception would be a distinctive addition to the viewscape for the Harbor

Sound Townhomes and Sears Landing Grill properties, as they are located closer to the structure than under the Alternative 4.

On Topsail Island, the visual impacts on several businesses along Roland Avenue would be moderately high, as views are cut off from an RV park/campground, one waterfront restaurant, and other businesses.

5.7.4.3 Alternative 5R

Visual impacts for Alternative 5R would be similar to the Alternative 5 on the mainland and island side.

5.7.4.4 Alternative 6

Alternative 6 would have little visual impact on surrounding communities since the proposed structure is only about five feet higher than the existing bridge and is in the same location.

5.7.4.5 Alternative 7

Under Alternative 7, the proposed structure is about 15 feet higher than the existing bridge and is in the same location. This higher structure would have a visual impact to the Harbor Pointe Townhomes, RV park/campground, and other adjacent businesses relative to the height increase.

5.7.4.6 Alternative 11

Alternative 11 would have a visual impact at the Little Kinston Road, Diamond Point, and other waterfront communities, as the new structure crosses over Little Kinston Road and the Intracoastal Waterway to the south of the existing bridge.

On the mainland at Little Kinston Road, the bridge approach would form a visual barrier into the neighborhood and the structure would create a short tunnel-like entranceway. For the Diamond Point community, the high-level fixed bridge would be a distinctive addition to the landscape; however, because the views from these neighborhoods are so expansive, the effect should be minimal except for the properties directly adjacent to the structure.

The impacts to waterfront communities on Topsail Island should be minimal, as no residential community is located in the immediate vicinity of the proposed bridge approach.

5.7.4.7 Alternative 17

Alternative 17 would have a minor visual impact at the waterfront communities where the new structure crosses over the Intracoastal Waterway to the south of the existing bridge.

On the mainland along Roland Avenue at Little Kinston Road, the alignment would have a minimal effect as the approach and structure would be behind businesses and on vacant property. Because the views from these neighborhoods are so expansive, the effect should be minimal except for the properties directly adjacent to the structure.

The impacts to waterfront communities on Topsail Island should be minimal, as no residential community is located in the immediate vicinity of the proposed bridge approach.

The view from Soundside Park would be affected by the proximity of the structure at the back of the park; however, impacts to the park are considered minimal because of the expansive views in the area.

5.7.5 Project Compatibility with Local Plans

NCDOT's Transportation Planning Branch developed the Topsail Area CTP. The CTP, adopted by the NCDOT Board of Transportation in November 2009, lists replacement of Bridge No. 16 as an important element in meeting transportation needs and providing access for the area residents.

Roadway improvement projects shown in the CTP do not conflict with any of the seven Detailed Study Alternatives under study.

5.8 Indirect and Cumulative Effects

The indirect effects of the proposed project on future land use were determined using NCDOT pre-screening methodology. The categories listed in the Indirect and Cumulative Effects (ICE) Screening Tool have been shown to influence land development decisions in numerous areas statewide and nationally. Each characteristic is assessed individually and the results are reviewed collectively to determine the potential indirect and cumulative effects of the proposed project. Each of the following categories is weighted according to its importance in affecting land use changes: project scope and changes in accessibility are highly influential; public policy and environmental features moderately influential; and population and employment growth, available land, water/sewer availability and market for development have the least influence.

5.8.1 Indirect Summary Statement

All seven Detailed Study Alternatives have been assessed as "Not Likely," reflecting the fact that the project replaces an existing structure close to its existing location, which is unlikely to significantly affect the surrounding community beyond the project limits.

The proposed project is expected to have an insignificant effect on forecasted population and employment growth. In addition, given the limited land for development and public policies/environmental regulations limiting growth, the proposed bridge replacement project would have limited effects on the Topsail Island development. The following are the factors expected to be

affected by the proposed project and their degree of impact. More detailed analysis is provided in the project's Indirect Land Use Screening Report, dated August 2011.

5.8.2 Alternatives 4, 5, and 5R

Indirect Land Use impacts for Alternatives 4, 5, and 5R (Northern Alternatives Group) are rated as "Not Likely."

5.8.2.1 Scope of Project

The project is a minor bridge replacement project and is expected to have a minor impact on development potential only near the bridge approaches.

5.8.2.2 Change in Accessibility

A high-level fixed bridge would reduce travel times by an average of two to three minutes for most of the motorists and about five minutes for some motorists, who are delayed for bridge openings today.

5.8.2.3 Available Land

Undeveloped land is available in Surf City (on the mainland) and North Topsail Beach that may benefit from the proposed bridge replacement project.

5.8.2.4 Water/Sewer Availability

Surf City and North Topsail Beach have sufficient sewer capacity to support additional development.

5.8.2.5 Market for Development

Current development is occurring in the northern part of Topsail Island closer to the North Topsail Beach Bridge. On the mainland, development is occurring along NC 50/210 away from Bridge No. 16.

5.8.2.6 Public Policy

The Town of North Topsail Beach encourages development with its policies. Surf City encourages development on the mainland. Topsail Beach discourages new development.

5.8.2.7 Environmental Features

Although no targeted or threatened resources would be impacted by these alternatives, the project crosses wetlands and a high quality water zone.

5.8.3 Alternatives 6 and 7

Indirect Land Use impacts for the Alternatives 6 and 7 (Central Alternatives Group) are rated as "Not Likely."

5.8.3.1 Scope of Project

The project is a minor bridge replacement project and is expected to have little impact on surrounding development potential.

5.8.3.2 Change in Accessibility

As the vertical navigational clearance is increased under these alternatives, travel times would be slightly reduced for some motorists, who are delayed for bridge openings today.

5.8.3.3 Available Land

Undeveloped land is available in Surf City on the mainland that may benefit slightly from the Central Alternatives Group.

5.8.3.4 Water/Sewer Availability

Surf City has sufficient sewer capacity to support additional development.

5.8.3.5 Market for Development

There is a limited market for development in Surf City on Topsail Island. On the mainland, development is occurring along NC 50/210 away from Bridge No. 16.

5.8.3.6 Public Policy

Surf City encourages development on the mainland.

5.8.3.7 Environmental Features

Although no targeted or threatened resources would be impacted by these alternatives, the project crosses wetlands and a high quality water zone.

5.8.4 Alternatives 11 and 17

Indirect Land Use impacts for the Alternatives 11 and 17 (Southern Alternatives Group) are rated as "Not Likely."

5.8.4.1 Scope of Project

The project is a minor bridge replacement project and is expected to have a minor impact on development potential near the bridge approaches.

5.8.4.2 Change in Accessibility

A high-level fixed bridge would reduce travel times by an average of two to three minutes for most of the motorists and about five minutes for some motorists, who are delayed for bridge openings today.

5.8.4.3 Available Land

There is little undeveloped land near the bridge approaches on Topsail Island and some available land on the mainland.

5.8.4.4 Water/Sewer Availability

Surf City has sufficient sewer capacity to support additional development; Topsail Beach has limited capacity.

5.8.4.5 Market for Development

Little or no vacant land is available for development in the southern part of Topsail Island. On the mainland, land is available for development along NC 50/210. However, current development is occurring along NC 50/210 farther from Bridge No. 16.

5.8.4.6 Public Policy

Surf City encourages development on the mainland; Topsail Beach discourages development.

5.8.4.7 Environmental Features

Although no targeted or threatened resources would be impacted by these alternatives, the project crosses wetlands and a high quality water zone.

5.8.5 Cumulative Effects Summary Statement

Over the past decade, there has been limited public and private activity, including transportation and other infrastructure improvements, in the Future Land Use Study Area (FLUSA). The FLUSA study is the area surrounding the project that could be indirectly affected as a result of the proposed project and other actions. This study area encompasses all of the areas examined for potential increases in development pressure as a result of project construction. Although it is the focus for data collection and analysis contained within this report, it is not meant to infer that land use effects will be felt throughout the FLUSA (See Figure 5-13).

Past Transportation Projects: Recent transportation activity including upgrading US 17 and the opening of segments of Interstate 140 in Wilmington have reduced travel time between Topsail Island and Wilmington to less than an hour. No other roadway improvement project has occurred within the FLUSA in the last five years.

Future Transportation Projects: The NCDOT 2011-2020 STIP lists the proposed Bridge No. 16 replacement project (B-4929) as the only funded major highway project in the PSA. One feasibility study (FS-0703A) is listed in the STIP and consists of the widening of a 5.3-mile section of NC 210 from US 17 to Bridge No. 16. The nearest funded major STIP project is Hampstead Bypass (R-3300), which proposes construction of a fourteen-mile bypass from US 17 in New Hanover County to US 17 north of Hampstead in Pender County.

5.8.5.1 Past Development Projects

In Surf City, several development projects on the mainland that were approved earlier were under construction in 2011 or completed. The Promenade, an entertainment complex with 83,000 square feet of retail/ commercial space located at the intersection of NC 50 and NC 210, is under construction. On NC 210 near US 17, a new Harris Teeter supermarket opened recently and the Cape Fear Community College is planning to break ground on an extension in 2012. Several housing developments whose construction stalled during the recession have restarted construction, including Dogwood Lakes (about 50% of 130 lots vacant) and Turtle Creek (about 390 of 422 lots vacant). A new turtle rescue center and a 144- unit multi-family housing development are planned for construction on Charlie Medlin Drive on the mainland.

In the Town of Topsail Beach, development has been limited to in-fill housing, redevelopment of existing homes and the re-subdividing of existing lots.

Recent development in North Topsail Beach includes the higher density residential projects of St. Regis Resort, Villa Capriani, and Capri Isle. In 2010 the only new development projects were permits issued for 15 individual homes scattered throughout the Town.

5.8.5.2 Future Development Projects

Future growth is expected to remain sporadic. The amount of development is not expected to be affected by any of the proposed bridge replacement alignments; rather some vacation-oriented commercial development may choose to locate in the vicinity of the proposed project.

5.8.5.3 Notable Environmental Resources

The study area lies in the coastal plain physiographic region of North Carolina. Topography in the project vicinity varies from nearly level to gently rolling. Elevations in the study area range from 5' to 30' above sea level. Two ponds with a combined area of 2.7 acres are located within the immediate vicinity of the study bridge. Water resources in the study area are part of the Lower Cape Fear River Basin. The DWQ's maps for this area show three jurisdictional streams, Topsail Sound, Old Mill Creek, and one unnamed tributary to Topsail Sound. Topsail Sound and Old Mill Creek are classified as High Quality Waters (HQW). These maps show occurrences of impaired waters in FLUSA. Majority of the FLUSA is located in No Discharge Zone. No waters classified as Water Supply Watershed Critical/Protected Areas or ORW exist in the FLUSA. There are several wetlands associated with these surface waters in the FLUSA.

5.8.5.4 Impacts on Environmental Resources

Due to the location of wetlands, streams, and surface waters within the FLUSA, avoidance of all jurisdictional impacts is not possible. During preliminary design, NCDOT has implemented best efforts to avoid and minimize impacts to several wetlands. Wherever possible, wetlands were bridged and the alignments were shifted to minimize impacts. The approved jurisdictional delineation would be utilized to minimize wetland impacts of the preferred alternative during final design. Utilization of BMP's would be coordinated in an effort to minimize impacts, including avoidance of construction staging areas within wetlands. Avoidance, minimization, and mitigation measures that may be implemented later in the design process in consultation with the USACE are described in Section 5.1.2.4 of this document.

Twelve federally protected species were identified in Pender County. The biological conclusion for all twelve species were categorized as not required, no effect, may affect- "Not Likely" to adversely affect. The National Marine Fisheries Service has identified Topsail Sound as an Essential Fish Habitat but the proposed project is likely to result in negligible net effect on the habitat.

5.8.5.5 Cumulative Effects Summary

The amount of development is not expected to be affected by any of the proposed bridge replacement alignments; rather some vacation-oriented commercial development may choose to locate in the vicinity of the proposed project rather than near the current alignment. The project will not contribute to cumulative impacts to any transportation or land use development project.

Direct project impacts to environmental resources will be addressed programmatically later in the merger and permitting processes in consultation with the natural resource agencies. This project is not expected to notably contribute to indirect or change in land use effects, and therefore should not result in notable cumulative impacts to threatened, impaired, or endangered natural resources in the context of all other past, present, and future actions by all parties. The direct natural environmental impacts by NCDOT projects would be addressed by avoidance, minimization, or mitigation, consistent with programmatic agreements with the natural resource agencies during the Merger and Permitting processes.

5.9 Flood Hazard Evaluation

The state of North Carolina, through the Federal Emergency Management Agency's (FEMA's) Cooperating Technical Community partnership initiative, was designated as the first Cooperating Technical State (CTS). As a CTS, the state has assumed primary ownership and responsibility of the Flood Insurance Rate Maps (FIRM) for all North Carolina communities (except Mecklenburg County) as part of the National Flood Insurance Program (NFIP). This effort includes conducting flood hazard analyses and producing updated, digital FIRMs (DFIRM). DFIRM data for Topsail Island area was downloaded from the North Carolina Floodplain Mapping Program (NCFMP) website and is shown in Figure 5-14. This data defines floodway boundaries as a tool for floodplain management. Based on this data, the entire PSA is in either a 100-year floodplain (Zone AE), an outside 500-year floodplain (Zone X), or a Coastal Base flood zone (Zone VE).

The new structure would only require footings to be placed within the Intracoastal Waterway (Topsail Sound). Given this limited in-water construction work, the proposed project would most likely result in a negligible net effect on these flood hazard zones. A more detailed impact analysis will be performed during the project's final hydraulic design. NCDOT will coordinate with FEMA and local authorities to ensure compliance with applicable floodplain ordinances.

5.10 Traffic Operations Analysis

This traffic operations analysis included capacity analysis of 14 study intersections under all seven Detailed Study Alternatives (4, 5, 5R, 6, 7, 11, and 17). The traffic operations analysis report documents the future traffic flow conditions to determine if there is sufficient capacity to meet the existing and future travel demand and further recommends improvements to the area roads as warranted by the proposed bridge replacement.

As indicated in Chapter 2 of this document, the project-specific traffic forecasts (dated November 2010) indicated that the traffic demand along the Bridge No. 16 would increase from 12,000 vpd (2010 Existing Conditions) to 29,100 vpd (2035 Future Conditions), increasing at a rate of approximately 6% per year.

In general, two-lane roadways with similar geometry and land use conditions have a capacity of approximately 18,000 to 20,000 vpd. Therefore, the 2035 Future Conditions forecasted traffic demand would be almost 150% of the existing roadway capacity. However, based on preliminary evaluations of environmental impacts and construction costs, NCDOT recommends a two-lane bridge only (one lane in each direction). This two-lane typical section would result in several intersections in the PSA experiencing congestion during peak hours. It should also be noted that congestion would be most prevalent during Topsail Island's peak vacation months of May through September.

Alternatives 6 and 7 would exceed the existing 13 feet VNC. The additional VNC would allow more vessels to pass underneath with fewer bridge openings, thereby improving overall vehicular traffic flow conditions in the Demographic Study Area.

Alternatives 4, 5, 5R, 11, and 17 would replace the existing bridge with a new high-level fixed bridge with 65 feet of VNC. For these high-level alternatives, all vessels would pass unimpeded with no bridge openings, thereby improving overall traffic flow conditions when compared with the existing swing bridge conditions or the other moveable bridge alternatives. The alignments of Alternatives 4 and 11 terminate at new locations on the island and are located approximately 1,100 feet north and 1,500 feet south of existing Roland Avenue, respectively. These new island terminus intersections result in changes in travel patterns between existing Roland Avenue and the new intersections. Alternative 5, 5R, and 17 each tie to existing Roland Avenue on the island and have been designed with a roundabout terminus intersection to improve traffic flow. Specifically, Alternative 17 would simplify the travel patterns on the island side by connecting the new bridge, NC 210, and Topsail Drive approaches to one roundabout intersection location.

Table 5-11 presents a summary of the overall intersection Level of Service under each Detailed Study Alternative. All seven Detailed Study Alternatives would result in similar traffic flow conditions during peak hours.

Figures 5-15 through 5-19 show the peak hour intersection traffic volumes and Level of Service for all seven Detailed Study Alternatives, respectively. More detailed traffic operations analysis is provided in the project's Traffic Operations Analysis Report, dated June 2011.

Table 5-11: 2035 Intersection Level of Service Summary

Intersection	Node ID*	Traffic Controller	2035 Intersection Level of Service (AM/PM Peak Hour)				
			Alt 4	Alt 5&5R	Alt 6&7	Alt 11	Alt 17
NC 50/Roland Avenue at NC 210/Belt Road	100	Signal	**F/F**	**F/F**	**F/F**	**F/F**	**F/F**
NC 50/210 at J H Batts Road	200	Stop Sign	**F/F**	**F/F**	**F/F**	**F/F**	**F/F**
NC 50/210 at Roland Avenue (new tie-in)	301	Stop Sign	**F/F**	**F/F**	--	**F/F**	A/A
Roland Avenue at Little Kinston Road	300	Stop Sign	B/B	B/B	**F/F**	B/B	**F/F**
Roland Avenue at New River Drive/NC 210	400	Stop Sign	**F/F**	--	**F/F**	**F/F**	C/C
		Roundabout	--	**F/E**	--	--	--
NC 50/210 at New River Drive/Topsail Drive	401	Roundabout[+]	--	**--**	--	--	**F/F**
Roland Avenue at Topsail Drive/NC 50	500	Signal	C/C	**E/E**	**F/F**	C/C	C/C
New River Drive at Greensboro Avenue	600	Stop Sign	**E/E**	B/B	B/B	B/B	B/B
New River Drive at Goldsboro Avenue	700	Stop Sign	--	C/C	C/C	C/B	C/C
		Signal	**F/F**	--	--	--	--
New River Drive at New Bern Avenue	800	Stop Sign	B/B	B/B	B/B	B/B	B/B
Topsail Drive at Greensboro Avenue	900	Stop Sign	B/B	B/B	B/B	B/B	B/B
Topsail Drive at Goldsboro Avenue	1000	Stop Sign	B/B	B/B	B/B	B/B	B/B
Topsail Drive at New Bern Avenue	1100	Stop Sign	B/B	B/B	B/B	B/B	B/B
Topsail Drive at Kinston Avenue	1200	Stop Sign	**F/F**	**F/F**	**F/F**	**F/F**	**F/F**
Topsail Drive at Raleigh Avenue	1300	Stop Sign	D/C	D/C	D/C	**F/F**	D/C
NC 50/210 at Topsail Drive	1301	Signal[++]	--	--	--	**E/D**	--
Topsail Drive at Charlotte Avenue	1400	Stop Sign	D/C	D/C	D/C	D/D	D/C

*ID used in figures 5-15 through 5-19

[+] Node 401 represents a new roundabout under Alternative 17. This intersection would not exist under other alternatives.

[++] Node 1301 represents a new signal under Alternative 11. This intersection would not exist under other alternatives.

5.11 Traffic Noise Analysis

5.11.1 Title 23 Code of Federal Regulations, Part 772 (23 CFR 772)

FHWA has developed Noise Abatement Criteria (NAC) and procedures for the planning and design of highways. The purpose of 23 CFR, Part 772 is:

> "…to provide procedures for noise studies and noise abatement measures to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to Title 23 United States Code."

The abatement criteria and procedures are set forth in Title 23 CFR Part 772, which also states:

> "…in determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit."

5.11.2 NCDOT Traffic Noise Abatement Policy

The NCDOT Traffic Noise Abatement Policy, effective July 13, 2011, establishes official policy on highway noise. This policy describes the NCDOT process that is used in determining traffic noise impacts and abatement measures, as well as the equitable and cost-effective expenditure of public funds for traffic noise abatement. This policy applies to all Type I (new location or substantial horizontal/vertical alteration) federal, state, or federal-aid highway projects in the state of North Carolina, including federal projects that are administered by local public agencies. NCDOT does not participate in, nor fund, Type II (retrofit) projects. Noise analyses are not required for Type III (federal or federal-aid highway projects that do not meet the classifications of Type I or Type II) projects.

5.11.3 Ambient Noise Levels

Ambient noise is sound that is considered typically present in a particular area and that is all around us caused by natural and manmade events. Ambient noise includes household devices, commercial operations, grass mowing, and natural events, such as wind and thunderstorms. Traffic noise from NC 50/210 is the dominant noise source for receptors in the PSA.

For this traffic noise analysis, ambient noise monitoring data was collected at nine receptor locations in three noise sensitive areas. Loudest-hour existing noise levels were assessed to be either the Traffic Noise Model software (TNM)-predicted loudest-hour traffic noise levels or the ambient noise levels obtained at representative locations in the field.

5.11.4 Predicting Future Noise Levels

In accordance with industry standards and accepted best practices, detailed computer models were created using the FHWA Traffic Noise Model® (TNM v.2.5). Predicted traffic noise levels were validated to be within ±1.7 dB(A) at four ambient noise monitoring receptor locations. The validated TNM models were used to predict traffic noise levels at 360 modeled receptor locations in the vicinity of the seven Detailed Study Alternatives.

5.11.5 Traffic Noise Impacts

The two categories of traffic noise impacts are defined as 1) those that "approach" or exceed the FHWA Noise Abetment Criteria (NAC) and 2) those that represent a "substantial increase" over existing noise levels as defined by NCDOT. An impact that represents a "substantial increase" is based on a comparison of the existing noise level ($L_{eq(h)}$) with the predicted increase with respect to a change to noise levels in the design year of between 10 and 15 dB(A) or more.

Existing traffic noise does not impact any receptors in the vicinity of the PSA. All Design Year 2035 traffic noise impacts are predicted to occur as a result of loudest-hour equivalent noise levels that will meet or exceed NCDOT NAC thresholds. There are no predicted impacts that will occur as a result of a substantial increase over existing noise levels in the 2035 Design Year. The No Build condition is predicted to impact 18 noise receptors. The seven Detailed Study Alternatives are predicted to result noise impacts as shown below and in Figure 5-20.

- Alternative 4 – 16 impacts
- Alternatives 5 and 5R – 14 impacts
- Alternatives 6 and 7 – 16 impacts
- Alternative 11 and 17 – 18 impacts

5.11.6 Potential Traffic Noise Abatement Measures

FHWA and NCDOT require that feasible and reasonable measures be considered to mitigate noise impacts at the impacted receptors. Noise abatement measures must be considered for all receptors that are predicted to experience a noise impact. Measures considered include highway alignment selection, traffic systems management, vegetation, buffer zones, proper use of land controls, noise walls, and earth berms.

The preliminary analysis indicates that noise abatement measures, such as highway alignment selection, traffic system management measures, buffer zones, vegetation, and proper use of land controls, would not be practical and/or cost-effective.

The degree to which the access to the NC 50/210 highway will be uncontrolled in the vicinity of the predicted impacted receptors will prevent any noise barriers from meeting applicable feasibility or reasonableness criteria. Further investigation of potential traffic noise mitigation measures is not warranted in conjunction with the proposed bridge replacement project.

5.11.7 Construction Noise

Generally, low-cost and easy-to-implement construction noise control measures should be incorporated into the project plans and specifications (e.g. work-hour limits, equipment exhaust muffler requirements, haul-road locations, elimination of “tail gate banging,” ambient-sensitive backup alarms, construction noise complaint mechanisms, and consistent and transparent community communication/rapport).

5.11.8 Traffic Noise Analysis Summary

The traffic noise impacts are predicted as described in Section 5.11.5 above. However, based on this study, traffic noise abatement is not recommended and no noise abatement measures are proposed. During the construction, all reasonable efforts should be made to minimize exposure of noise sensitive areas. This analysis completes the traffic noise requirements of the Title 23 CFR Part 772 and NCDOT Traffic Noise Abatement Policy. Unless modifications to presently considered alignments occur, additional alignments are considered, or changes to Design Year 2035 traffic volumes are predicted, no additional noise reports are necessary for this project. More detailed traffic noise analysis is provided in the project’s Traffic Noise Analysis Report, dated July 2011.

5.12 Air Quality Analysis

Air pollution originates from various sources, with emissions from industry and internal combustion engines being the most prevalent sources. The impact from highway construction ranges from intensifying existing air pollution problems to improving the ambient air quality. Changing traffic patterns are a primary concern when determining the impact of a new highway facility or the improvement of an existing highway facility. Motor vehicles emit carbon monoxide (CO), nitrogen oxide (NO), hydrocarbons (HC), particulate matter (PM), sulfur dioxide (SO_2), and lead (Pb) (listed in order of decreasing emission rate).

5.12.1 Attainment Status

The proposed bridge replacement project is located in Pender County, which has been determined to comply with the National Ambient Air Quality Standards (NAAQS). This project is located in an attainment area; therefore, 40 CFR Parts 51 and 93 are not applicable. This project is not anticipated to create any adverse effects on the air quality of this attainment area.

5.12.2 Carbon Monoxide

Automobiles are considered the major source of CO in the PSA. To determine the ambient CO concentration at a receptor near a highway, two concentration components are used: local and background. The local concentration is defined as the CO emissions from cars operating on highways in the near vicinity (i.e., distances within 400 feet) of the receptor location. The background concentration is defined by the NCDENR as "the concentration of a pollutant at a point that is the result of emissions

outside the local vicinity; that is, the concentration at the upwind edge of the local sources." A microscale air quality analysis is performed to determine future CO concentrations resulting from the proposed highway improvements. "CAL3QHC – A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections" is used to predict the CO concentration near sensitive receptors. In accordance with 40 CFR 93.126, this project is an air quality neutral project. It is not required to be included in the regional emissions analysis (if applicable) and a project level CO analysis is not required.

5.12.3 Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/ncea/iris/index.html). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1, 3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA rule mentioned above requires controls that will dramatically decrease Mobile Source Air Toxics (MSAT) emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE 6.2 model, even if vehicle activity in vehicle-miles travelled (VMT) increases by 145% as assumed, a combined reduction of 72% in the total annual emission rate for the priority MSAT is projected from 1999 to 2050.

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, we are duly expected by the public and other agencies to address MSAT impacts in our environmental documents. The FHWA, EPA, the Health Effects Institute (HEI), and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this emerging field.

5.12.3.1 NEPA Context

NEPA requires, to the fullest extent possible, that the policies, regulations, and laws of the Federal Government be interpreted and administered in accordance with its environmental protection goals. NEPA also requires federal agencies to use an interdisciplinary approach in planning and decision-making for any action that adversely impacts the environment. NEPA requires and FHWA is committed to the examination and avoidance of potential impacts to the natural and human environment when considering approval of proposed transportation projects. In addition to evaluating the potential environmental effects, we must also take into account the need for safe and efficient transportation in reaching a decision that is in the best overall public interest. The FHWA policies and procedures for implementing NEPA is prescribed by regulation in 23 CFR § 771.

5.12.3.2 Analysis of MSAT in NEPA Documents

FHWA developed a tiered approach for analyzing MSAT in NEPA documents, depending on specific project circumstances. FHWA has identified three levels of analysis:

1. No analysis for projects with no potential for meaningful MSAT effects
2. Qualitative analysis for projects with low potential MSAT effects
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects

For projects warranting MSAT analysis, the seven priority MSAT should be analyzed. This project is included in level 2, previously described.

5.12.3.3 Qualitative MSAT Analysis

For both No Build and Build Alternatives (seven Detailed Study Alternatives), the amount of MSAT emitted would be proportional to VMT, assuming that other variables, such as fleet mix, are the same for each alternative. Regardless of the alternative chosen, emissions will likely be lower than present levels in the design year because of EPA's national control programs that are projected to reduce annual MSAT emissions by 72% from 1999 to 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future for virtually all locations. Consequently, higher levels of MSAT are not expected from the selected Build Alternative compared to the No Build.

Certain project alternatives will move some traffic closer to nearby homes and businesses; therefore, there may be localized areas where ambient concentrations of MSAT could be higher under the Build Alternatives than the No Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the selected alternative of NC 50/210. However, the magnitude and the duration of these potential increases compared to the No

Build alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, when a highway is widened, the localized level of MSAT emissions for any of the Build Alternatives could be higher relative to the No Build Alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSAT will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

5.12.3.4 Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, www.epa.gov/ncea/iris/index.html). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including HEI. Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations or in the future as vehicle emissions substantially decrease (Sources: pubs.healtheffects.org/view.php?id=282; pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by

technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable. The results produced by the EPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and the EPA's MOVES model in forecasting MSAT emissions are highly inconsistent. Indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel particulate matter (PM) emissions and significantly overestimates benzene emissions.

Regarding air dispersion modeling, an extensive evaluation of EPA's guideline CAL3QHC model was conducted in an NCHRP study (www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at ten sites across the country - three where intensive monitoring was conducted plus an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with National Ambient Air Quality Standards for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA and the HEI have not established a basis for quantitative risk assessment of diesel PM in ambient settings (Sources: www.epa.gov/risk/basicinformation.htm#g ; pubs.healtheffects.org/getfile.php?u=395).

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine a "safe" or "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks

from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than safe or acceptable. Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

5.12.3.5 MSAT Conclusion

What we know about mobile source air toxics is still evolving. As the science progresses FHWA will continue to revise and update this guidance. To that end we expect that a number of significant improvements in model forecasting and air pollution analysis guidance with the MOVES model and the issuance of the PM 2.5 Hot Spot Modeling Guidance released by EPA.

5.12.4 Other Emissions

As a result of the recent laws/amendments or changes in auto industry technology, it is expected that this project would not cause the NO, HC, PM, SO_2, or PB to exceed NAAQS.

5.12.5 Burning of Debris

During construction of the proposed project, all materials resulting from clearing and grubbing, demolition, or other operations will be removed from the project, burned, or otherwise disposed of by the contractor. Any burning will be done in accordance with applicable local laws and ordinances, as well as regulations of the North Carolina SIP for air quality in compliance with 15 NCAC 2D.0520. Care will be taken to ensure burning will be done at the greatest distance practical from dwellings and not when atmospheric conditions are such as to create a hazard to the public. Burning will be performed under constant surveillance. During construction, measures will also be taken to reduce the dust generated by construction when the control of dust is necessary for the protection and comfort of motorists or area residents. This evaluation completes the assessment requirements for air quality of the 1990 Clean Air Act Amendments and the NEPA process, and no additional reports are necessary.

5.12.6 Air Quality Summary and Results

The proposed bridge replace project will not add substantial new capacity or create a facility that is likely to meaningfully increase emissions. Therefore, this project would not cause any adverse effects to

the air quality of this attainment area. More detailed air quality analysis is provided in the project's Air Quality Analysis Report, dated July 2011.

5.13 Utilities

NCDOT estimated that Alternatives 6 and 7 would have the highest utility relocation and construction costs ($12.8 million), and Alternative 17 would have the least utility relocation and construction costs ($1.3 million). The remaining four alternatives would result in utility relocation and construction costs ranging between $1.5 and $1.9 million. More detailed information about this is provided in the project's Utility Estimate Worksheets, dated June 2011.

5.14 Hazardous Material

NCDOT conducted a field reconnaissance survey in February 2009 to identify properties within the PSA that are or may be contaminated by hazardous materials or waste, thus resulting in increased project costs and possible future liability if acquired by NCDOT. Hazardous areas of concern may include, but are not limited to, active and abandoned underground storage tank (UST)/above ground storage tank (AST) sites, hazardous waste sites, regulated landfills, and unregulated dumpsites. Based on this field survey and Geographic Information System (GIS) information, NCDOT identified five possible sites with petroleum UST/AST in the PSA, as shown in Table 5-12.

NCDOT also performed a preliminary evaluation of the seven Detailed Study Alternatives and their impacts on the hazardous material sites in the PSA. Through this evaluation, NCDOT concluded that four of the five sites would be impacted by one or more of the Detailed Study Alternatives. However, the Detailed Study Alternatives would result in limited low monetary and project scheduling impacts. Table 5-12 provides a summary of the hazardous material impacts for each of the seven Detailed Study Alternatives. More detailed information about this is provided in the project's Geotechnical Report, dated May 2011.

Table 5-12: Hazardous Sites

No.	Facility ID	Property Name and Address	Property Owner	UST Owner	Impact Level	Impacted Detailed Study Alternatives
1	0-018732	One Stop Bait & Tackle 805 Roland Ave Surf City, NC 28445	Mary Connor	Preston Warren	Low	Alternatives 6, 7
2	N/A	Beach House Marina 412 Roland Ave Surf City, NC 28445	Beach House Marina, LLC	Beach House Marina, LLC	Low	Alternative 17
3	N/A	Batt's Grill 306 Roland Ave Surf City, NC 28445	Kenneth & Libby Batts	Marine Oil Co., Inc.	Low	Alternatives 5, 5R, 17
4	0-000121	Atlantic Food Mart 301 Roland Ave Surf City, NC 28445	David Wayne Lanier, et al	Worsley Companies, Inc.	Low	Alternatives 5R, 17
5	N/A	Hot Diggity Dogz 103 S. Shore Drive Surf City, NC 28445	Archie D. Christopher	N/A	Low	--

5.15 Summary of Environmental Effects

Table 5-13 provides a summary of the environmental effects discussed in this section.

This information will be presented to the community, as well as federal, state, and local project stakeholders at the corridor public hearing. Subsequent to the corridor public hearing, a recommended alternative will be identified based on the design information prepared and public outreach comments received. This recommended alternative will be presented to the Merger Team at the CP 3 meeting. At this meeting, the LEDPA/Preferred Alternative will be chosen.

Table 5-13: Detailed Study Alternatives Environmental Effects Summary

Category	Alt 4	Alt 5	Alt 5R	Alt 6	Alt 7	Alt 11	Alt 17
Project Description							
Project Length (miles) - including permanent bridge length	1.1	1.0	1.0	0.5	0.5	1.1	0.9
Permanent Bridge Length (ft) - fixed length/moveable length	4,250	4,076	4,054	319/201	819/201	4,180	3,725
Detour Bridge Length (ft) - fixed length/moveable length	-	-	-	1,331/156	1,331/156	-	-
Human Environment Effects							
Community Facilities Impacted	-	-	-	-	-	-	-
Church (Faith Harbor United Methodist Church - property only)	1	1	1	-	-	1	-
Total Residential Relocations (number)	4	2	13	-	-	4	1
Total Business Relocations (number)	5	4	7	1	3	1	3
Property Only (number)	32	38	32	18	18	30	43
Low Income / Minority Residential/Business Relocations	-	-	-	-	-	-	-
Physical Environment Effects							
Section 4(f) Resources Soundside Park property impacts -- permanent/temporary (acres)	-	-	-	0.03[+]/0.4[*]	0.01[+]/0.4[*]	-	0.2[++]
Bridge No. 16 (also recognized as a Historic Architecture Resource)	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect	Adverse Effect
Farmlands	-	-	-	-	-	-	-
Archaeological Sites	TBD[**]	TBD[**]	TBD[**]	TBD[**]	TBD[**]	TBD[**]	TBD[**]
Known or Potential Hazardous Material Sites (number)	-	1	2	1	1	-	3
Superfund Sites	-	-	-	-	-	-	-
Natural Environment Effects							
Ponds	-	-	-	-	-	-	-
Stream Crossings (number)[#]	2	2	2	1	1	1	1
Wetlands: non-riparian/CAMA (acres)	1.1/ -	1.1/ -	1.1/ -	- /0.3	- /0.1	1.0/-	0.8/ 0.4
Federally Protected Species	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]	MA/NLAA[***]
Costs ($M 2011)							
Construction Costs (includes relocation costs for water and sewer utilities)	$51,100,000	$48,800,000	$48,500,000	$50,200,000	$55,900,000	$50,200,000	$44,600,000
Utility Pole Relocation Costs	$939,090	$1,361,538	$1,430,662	$12,580,030	$12,580,030	$1,040,170	$1,015,778
Right-of-Way Costs	$12,625,000	$13,975,000	$22,250,000	$4,975,000	$6,875,000	$9,925,000	$8,125,000
Sub Total	$64,664,090	$64,136,538	$72,180,662	$67,755,030	$75,355,030	$61,165,170	$53,740,778
Bridge Operations and Maintenance Costs (75 Years)	$3,631,500	$3,631,500	$3,631,500	$25,964,500	$25,964,500	$3,631,500	$3,631,500
Total	$68,295,590	$67,768,038	$75,812,162	$93,719,530	$101,319,530	$64,796,670	$57,372,278

Note: Impacts are calculated from slope stake to slope stake, plus an additional 25 feet outside of each limit as determined from the May, 2011 preliminary design plans for each alternative.

[+] Represents fill slope impacts to the northern side of Soundside Park.
* Represents temporary impacts to Soundside Park as a result of the detour bridge.
[++] Represents minimal impacts to the southern end of Soundside Park.
[**] To be determined based on surveys to be completed after LEDPA/Preferred Alternative is chosen
[#] Both streams in the Project Study Area will be bridged, therefore no permanent stream impacts are anticipated.
[***] MA/NLAA – May Affect/Not Likely to Adversely Affect the following two species: West Indian manatee (Trichechus manatus) and Loggerhead sea turtle (Caretta caretta)

Chapter 6

Public Involvement and Agency Coordination

6.0 PUBLIC INVOLVEMENT AND AGENCY COORDINATION

6.1 Public Involvement

6.1.1 Mailing List and Newsletters

A mailing list of approximately 9,600 citizens and property owners; federal, state, and local environmental regulatory/resource agencies; local elected officials and governmental agencies; and interested persons was developed and continuously updated throughout the project development process. To date, NCDOT mailed four newsletters, which are included in Appendix H.

6.1.2 Phone and Email Correspondence

A project-specific toll-free hotline (1-877-392-5996) and an email address (topsailislandbridge@rsandh.com) were established at the onset of project development. To date, the dedicated phone number and email address have resulted in over 100 correspondences from the community.

6.1.3 Project Website

A project-specific public webpage was established at the onset of project development (http://www.ncdot.gov/projects/TopsailIslandBridge). This webpage provided information concerning the project's history, development process, contact information, as well as frequent updates of various public outreach activities, including information presented at CIWs.

6.1.4 Media

Notices of CIWs were posted in the local media. The project has been actively reported about by several local newspapers and television stations.

6.1.5 Citizens Informational Workshop #1

CIW #1 was conducted on June 25, 2009, in the Surf City Community Center. More than 350 citizens attended. Citizens were shown a voice-over PowerPoint presentation followed by a series of aerial mapping boards of the project site. Four stations were available and citizens interacted with NCDOT team members. Many citizens drew their alignment suggestions onto the aerial mapping. Citizens completed 170 comment cards and other comments were received via phone calls, email, or regular mail prior to and subsequent to the meeting. The comments have been categorized and tallied to provide an overall picture of the responses and the corresponding citizens' preferences.

6.1.6 Citizens Informational Workshop #2

A similar outreach location and format was chosen for CIW #2, conducted on October 21, 2010, with a Local Officials Meeting held immediately prior to the workshop. A series of maps displayed the 16 functional design alternatives with corresponding artistic renderings. For easier comparison, the study alternatives were divided into three groups, including alternatives north of existing location, at the existing location, and south of existing location.

More than 300 citizens attended CIW #2, from which over 200 questionnaire/comment cards were collected. Other comments were received via phone calls, email, or regular mail prior to and subsequent to the meeting.

6.2 Public Hearing

NCDOT will conduct a corridor public hearing following public circulation of the EA document. During this meeting, NCDOT will present the detailed designs and associated impacts for the seven Detailed Study Alternatives. The attendees will be invited to provide oral or written comments regarding the proposed project. Subsequent to the corridor public hearing, NCDOT will identify a recommended alternative based on the design information prepared and public comment.

6.3 Project Initiation

During project initiation, NCDOT provided "start of study" letters to the following federal, state and local agencies. Written comments were received and considered from agencies noted with an asterisk (*) during the preparation of this EA. These "start of study" letters, along with the agencies' initial concerns, are included in Appendix B.

- USACE
- USCG, 5th District
- USEPA
- * USFWS
- NMFS
- * NCDENR
- * NCDCM
- North Carolina State Clearing House
- * NCDCR
- North Carolina Department of Public Instruction
- * NCDWQ
- * NCWRC
- NCNHP
- Region "O" Planning Agency
- NCDOT Division 3 Board Member
- * Mayor of Town of Surf City
- Mayor of Topsail Beach
- Mayor of North Topsail Beach

6.4 Section 404/NEPA Merger Process

6.4.1 Agency Coordination

For most NCDOT projects, the Section 404/NEPA Merger Process (Merger Process) is initiated to streamline agreements between NCDOT, state and federal cooperating agencies, and local units of government. To this effect, the Merger Process provides a forum for appropriate agency representatives to discuss and reach consensus on ways to facilitate meeting the regulatory requirements of Section 404 of the Clean Water Act during the NEPA decision-making phase of transportation projects. Cooperating agencies included in the Merger Process of this project are as follows:

- USACE
- USEPA
- USCG
- USFWS
- NMFS
- FHWA
- NCDOT
- NCWRC
- NCDMF
- NCDCM
- NCDWQ
- NCDCR
- United States Forest Service (USFS)
- Cape Fear Rural Planning Organization (non-signatory)

6.4.2 Concurrence Point 1

On August 20, 2009, the Merger Team met to discuss concurrence on Purpose and Need and Study Area Defined – CP 1. During the meeting, NCDOT presented the existing conditions, PSA, project need, and project purpose to the participating environmental agencies. Subsequent to the presentation and discussion, the Merger Team reached a consensus and signed the formal Concurrence Point 1 form – Purpose and Need and Study Area Defined. The project purpose and need along with the study area, are described in Chapter 1 of this document. A copy of the CP 1 meeting minutes and signature form is included in Appendix I.

6.4.3 Concurrence Point 2

Functional design plans and preliminary impact and qualitative cost analysis was prepared for 16 feasible alternatives. A summary of this analysis was presented to the Merger Team members on December 14, 2010, at the CP 2 meeting. Based on this information, the Merger Team members eliminated nine alternatives and selected the following seven alternatives as the Detailed Study Alternatives:

- Northern Alternatives Group: Alternatives 4, 5, and 5R (high-level fixed bridges)
- Central Alternatives Group: Alternatives 6 and 7 (low-level/mid-level bridges, respectively)
- Southern Alternatives Group: Alternatives 11 and 17 (high-level fixed bridges)

A copy of the CP 2 meeting minutes and signature form is included in Appendix I.

6.4.4 Future Section 404/NEPA Merger Process and Concurrence

As project development continues, further Merger Team meetings will be held with subsequent concurrence on the following:

- CP 2A: Bridging Decisions and Alignment Review
- CP 3: LEDPA/Preferred Alternative Selection
- CP 4A: Avoidance and Minimization of Jurisdictional Waters
- CP 4B: 30% Hydraulic Review (Drainage System Layout and Cross Conveyance)
- CP 4C: Permit Drawings Review

NCDOT anticipates combining CP 2A and CP 3 meetings after the public hearing as this project involves bridging the Intracoastal Waterway (Topsail Sound) and the only other stream located in the PSA.