R-4431

ENVIRONMENTAL SCREENING REPORT

U.S. 70 FEASIBILITY ANALYSIS FROM HAVELOCK TO BEAUFORT

CRAVEN AND CARTERET COUNTIES NORTH CAROLINA

Prepared for:

The North Carolina Department of Transportation
Raleigh, North Carolina

Prepared by:

EcoScience

EcoScience, Corporation
612 Wade Avenue, Suite 200
Raleigh, North Carolina 27605

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DRAFT ENVIRONMENTAL SCREENING REPORT
U.S. 70 FEASIBILITY ANALYSIS

1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT) has contracted EcoScience Corporation (ESC) to investigate, through environmental screening, up to three potential feasible alternate roadway corridors for extension of US 70 from the southern end of TIP Project R-1015 (US 70 Bypass of Havelock), Havelock, Craven County, to the eastern terminus of R-3307 (US 70 Bypass of Beaufort), Beaufort, Carteret County. For the purposes of this analysis, the study area is defined by existing US 70 to the west, NC 101 to the north, SR 1154 (Mill Creek Road) to the south, and US 70/SR 1300 (Merrimon Road) to the east (Figure 1). The selected alternate roadway corridors resulting from this analysis are assumed to be full control of access facilities on new location. The environmental effect caused by bridging of waterways has not been considered in this analysis for selection of prepared corridors.

The investigation includes an analysis of natural features within the study area using readily-available information sources and limited field reconnaissance. This proposed effort involved the following tasks: 1) the study area was divided into three sections; 2) alternate segments across each section were generated; 3) a rating system was devised and utilized to compare intra-sectional segments; 4) segments combined into corridors were then reduced, with the use of a rating system, to three selected corridors between designated project termini; and 5) selected corridors were examined for engineering feasibility.

2.0 INFORMATION SOURCES

This analysis was planned to be conducted primarily with available information on file with the Center for Geographic Information and Analysis (CGIA), NCDOT, the Carteret County tax office, and U.S. Forest Service (USFS). CGIA digital mapping was provided and analyzed in ArcView format and included data layers concerning: 1) road network, 2) soils, 3) hydrography, 4) land cover types, 5) N.C. Natural Heritage Program (NCNHP) element occurrences and natural priority areas, 6) primary fish nursery areas, 7) anadromous fish spawning habitat, 8) national and state park lands, 9) national forest lands, 10) historic sites, and 11) hazardous material sites. NCDOT provided recent (January 1998) infra-red aerial photography (scale: 1 inch = 800 feet) obtained through the EROS Data Center of the U.S. Geological Survey (USGS). The Carteret County tax office appraisal department provided a

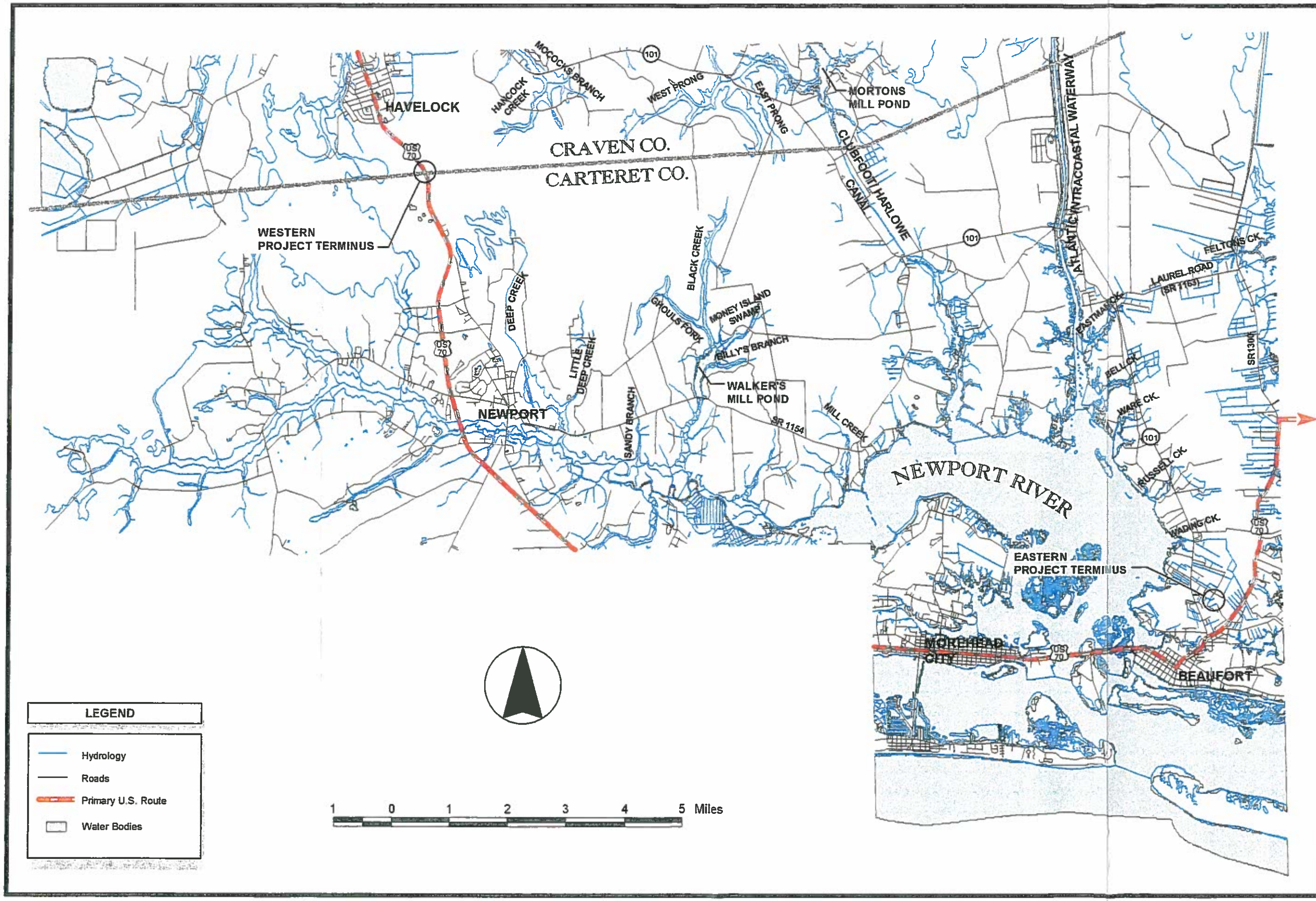


Figure 1

Date: MAY 1999
Scale: AS SHOWN
ESC Job #: 98-038

Project:
PROJECT VICINITY
U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

Client:
NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

EcoScience Corporation
612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fac: 919 828-3518

digital file of property boundaries as of November 1998. The USFS provided digital files of results of a 1998 survey of red-cockaded woodpecker (*Picoides borealis*) cavity trees, cavity clusters, and foraging territories within portions of the Croatan National Forest pertinent to this study.

Digital data were supplemented through a search of available documentation. Topographic and U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping data were obtained from USGS 7.5-minute quadrangles (Havelock, Cherry Point, Merrimon, Newport, Core Creek, and Beaufort quadrangles). Water quality data for surface waters were derived from available sources (DEM 1993, DWQ 1997, and DWQ 1998). Soils information was obtained from Natural Resources Conservation Service Craven and Carteret County soil surveys (SCS 1989 and 1978, respectively). The most current USFWS listing of federal protected species with ranges which extend into Craven and Carteret Counties (January 15, 1999) was obtained prior to initiation of the field investigation. In addition, NCNHP records documenting presence of federal- or state-listed species in the vicinity of the study area were consulted. Mapping available at the State Historic Preservation Office (SHPO) was referenced for current documentation of cultural resources.

Two meetings have been held in New Bern to discuss the project and provide a forum for comments from natural resources agencies and selected interested parties (December 11, 1998 and February 17, 1999). Entities invited to participate in these meetings include: U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS, Croatan National Forest), U.S. National Marine Fishery Service (USNMFS), N.C. Division of Coastal Management (NCDCM), N.C. Division of Water Quality (NCDWQ), N.C. Department of Cultural Resources (NCDCR), N.C. Natural Heritage Program (NCNHP), N.C. Division of Marine Fisheries, N.C. Wildlife Resources Commission, Coastal Land Trust, and Weyerhaeuser. Written comments from project participants are included in Appendix A. Comments from participating entities have been taken into consideration as part of this screening process.

3.0 ENVIRONMENTAL SETTING

3.1 Physical Resources

3.1.1 Physiography, Topography, and Land Use

The study area is located in the Outer Coastal Plain or Tidewater physiographic province, in the central portion of a broad, low peninsula separating the Neuse River (to the north) from Bogue Sound (to the south) and Core Sound (to the east). Two major, north-south oriented, open-water features divide the study area into uneven thirds: the Clubfoot-Harlowe Canal and the Atlantic Intracoastal Waterway (AIWW, Core Creek/Adams Creek) (Figure 1). The region east of the AIWW is a peninsula (the Beaufort Peninsula) which separates the Newport River (to the west) from the North River (to the east), and Taylor Creek (to the south). The county border extends from the western project terminus to the east and northeast through the study area. Craven County is north of this line, while Carteret County is south of this line. Named communities in the vicinity of the study area include: Havelock to the northwest, Newport to the west, Morehead City to the south, and Beaufort to the southeast.

Regional topography is generally flat and is transected by a network of natural streams and man-made ditches and canals. Study area maximum landscape elevations are approximately 24 feet (National Geodetic Vertical Datum (NGVD) west of the Clubfoot-Harlowe Canal, 17 feet NGVD between the Clubfoot-Harlowe Canal and the AIWW, and 13 feet NGVD east of the AIWW. Land elevations are near sea level along the Newport River and in the Clubfoot-Harlowe Canal and AIWW.

3.1.2 Soils

The project corridor is dominated by soils listed as hydric (NRCS 1996, see Section 4.1.3). The Craven County portion of the study area is mapped primarily as the Rains-Pantego-Torhunta soil association. This association is characterized by very poorly drained, and poorly drained mineral soils on broad interstream flats and depressions. Rains soils are poorly drained and occur slightly higher in the landscape and next to drainage ways, while Pantego and Torhunta soils are very poorly drained and occur in the middle of broad interstream areas.

The Carteret County portion of the study area is generally mapped as three soil associations. The region west of the Clubfoot-Harlowe Canal is primarily mapped as the previously-mentioned Rains-Pantego-Torhunta association. The central portion of this region is mapped as Croatan soils. The Croatan is characterized as nearly level, very poorly drained mucky soils on interstream divides. Most of the study area east of the Clubfoot-Harlowe Canal is mapped as the Deloss-Tomotley-Arapahoe association. This association is characterized by very poorly drained, loamy soils, on low marine and stream terraces. Deloss soils are very poorly

drained and occur on broad interstream flats and depressions. Tomotley soils are poorly drained and occur on slightly higher areas and closer to drainage ways. Arapahoe soils are very poorly drained and occur on broad interstream flats and depressions.

3.1.3 Land Use

The landscape consists primarily of pine forest, hardwood forest, emergent shrub/marsh grass complex, open water, silvicultural land, agricultural land, and residential areas. West of the Clubfoot-Harlowe Canal, and away from road corridors, land ownership is primarily split between the Croatan National Forest to the north and Weyerhaeuser to the south. Much of the land in the southern portion of this area, including portions of the Croatan National Forest are managed for silviculture by Weyerhaeuser. The landscape northeast of Newport and adjacent to NC 101 and Mill Creek Road support a mixture of residential and agricultural lands under private ownership. The portion of the study area east of the Clubfoot-Harlowe Canal is primarily characterized by larger blocks of forest and agricultural lands, rural residential areas, and developing residential subdivisions. The southern end of the Beaufort Peninsula is undergoing suburban, commercial, and light industrial development associated with the outskirts of Beaufort.

3.1.4 Water Resources

The project corridor is located within sub-basins 03-05-03 and 03-05-04 of the White Oak River Drainage Basin (DWQ 1997) and sub-basin 03-04-10 of the Neuse River Drainage Basin (DEM 1993). The northern half of the study area is part of the Neuse River Basin while the southern half is part of the White Oak River Basin. The study area is part of USGS accounting units 030201 and 030202 of the South Atlantic-Gulf Region. Table 1 lists named water bodies, best usage classifications, and state index numbers. Figure 1 indicates stream locations. No waters designated High Quality Waters (**HQW**), Water Supply I (**WS-I**), or Water Supply II (**WS-II**) occur within the study area.

Neuse River tributaries within the study area include (from west to east): Hancock Creek, Mococks Branch, the West Prong and East Prong of Morton's Mill Pond, the northern portion of the Clubfoot-Harlowe Canal (Clubfoot Creek), and the northern portion of the AIWW (Adams Creek). All Neuse River tributaries have been designated Nutrient Sensitive Waters (**NSW**). This designation is intended for waters needing nutrient management due to excessive growth of microscopic and macroscopic vegetation.

Tributaries within the White Oak River Basin portion of the study area drain into the Newport River (sub-basin 03-05-03) and the North River (sub-basin 03-05-04). Newport River tributaries include (from west to east): Deep Creek, Little Deep Creek, Walkers Mill Pond, Black Creek Main Prong, Ghouls Fork, Money Island Swamp, Billys Branch, Mill Creek, the

Table 1. Named water bodies within the study area, receiving waters, state index numbers, and best usage classifications. These systems are located in Figure 1.

System Name	Receiving Waters	State Index Numbers	Best Usage Class.[1]
Hancock Creek	Neuse River	27-115	SC sw NSW
Mococks Branch	Neuse River	27-115-1	SC sw NSW
West Prong Mortons Mill Pond	Neuse River	27-123-2-1	SA NSW
East Prong Mortons Mill Pond	Neuse River	27-123-2-2	SA NSW
Clubfoot Creek (Harlowe Canal)	Neuse River	27-123-1	SA NSW
Adams Creek Canal (AIWW[2])	Neuse River	27-128-1	SA NSW
Deep Creek	Newport River	21-11	C
Little Deep Creek	Newport River	21-11-2	C
Sandy Branch	Newport River	21-13	C
Black Creek (and Mill Pond)	Newport River	21-16	C
Money Island Swamp	Newport River	21-16-2	C
Billys Branch	Newport River	21-16-3	C
Mill Creek	Newport River	21-19	SA
Harlowe Canal	Newport River	21-22-1	SA
Core Creek (AIWW[2])	Newport River	21-24	SA
Eastman Creek	Newport River	21-24-1	SA
Bell Creek	Newport River	21-24-2	SA
Ware Creek	Newport River	21-25	SA
Russell Creek	Newport River	21-26	SA
Wading Creek	Newport River	21-27	SA
Feltons Creek	North River	21-35-1-1	SA

[1] State Best Usage Classifications

- **SC** Tidal salt waters suitable for uses such as aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Secondary recreation refers to any activity in which bodily contact with water occurs on an infrequent or incidental basis.
- **SA** Tidal salt waters used for shellfishing for market purposes, primary recreation, aquatic life propagation and survival, fishing, and wildlife. Primary recreation refers to activities involving human body contact with water on an organized and frequent basis.
- **C** Non-tidal fresh waters used for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture.
- **Sw** Supplemental designation for swamp waters which are characterized by low velocities and other natural characteristics which are different from adjacent streams.
- **NSW** Waters needing nutrient management due to excessive growth of microscopic and macroscopic vegetation.

[2] Atlantic Intracoastal Waterway

southern portion of the Clubfoot-Harlowe Canal (Harlowe Creek), the southern portion of the AIWW (Core Creek), Eastman Creek, Bell Creek, Wave Creek, Russell Creek, and Wading Creek. The only named tributary to the North River located within the study area is Feltons Creek.

3.2 Biological Resources

3.2.1 Plant Communities

The project corridor is located in a region of variable land use. CGIA digital data indicate 17 land cover types, generally based on vegetative characteristics: mixed upland hardwoods, bottomland forest/hardwood swamp, broadleaf evergreen forest, mixed hardwoods/conifers, needle-leaved deciduous forest, oak/gum/cypress forest, unmanaged herbaceous wetland assemblage, southern yellow pine, deciduous shrubland, evergreen shrubland, mixed shrubland, unmanaged herbaceous upland assemblage, cultivated land, high-intensity developed land, low-intensity developed land, managed herbaceous cover, and unconsolidated sediment.

Although the study area is characterized by several areas of localized development (agricultural, residential, and light industrial/commercial), the dominant land use is forest vegetation, primarily forests dominated by pines. Most of the study area is part of either the Croatan National Forest or Weyerhaeuser property. Weyerhaeuser manages most of its lands and a portion of the Croatan National Forest for silviculture production, primarily loblolly pine (*Pinus taeda*). Unmanaged forest areas are primarily pine-dominated (loblolly, long-leaf [*Pinus palustris*], and pond [*P. serotina*] pines); however, there are also hardwood forests on relatively undisturbed, interstream flats and mixed hardwood/cypress forests in relatively undisturbed wet bottomlands.

Agricultural lands were fallow or recently-tilled during site visits. The main crops are expected to be soybeans, corn, Irish potatoes, and tobacco. Yards around residences, light industry, and commercial development are typically maintained as grass lawns with a mixture of native and ornamental trees and shrubs.

3.2.2 Section 404 Jurisdictional Areas

Available CGIA digital data concerning jurisdictional areas were derived by NCDCM (see Section 4.1.5). These data indicate 14 types of jurisdictional areas within the study area: bottomland hardwood or riverine swamp forest, estuarine forest, estuarine shrub-scrub, salt/brackish marsh, depressional swamp forest, headwater swamp, pocosin, freshwater marsh, hardwood flat, pine flat, managed pine land, human-impacted land, maritime forest, and surface waters. NCDCM type descriptions are provided in Appendix B. The most

significant open water systems are all man-made: Walkers Mill Pond, the Clubfoot-Harlowe Canal, and the AIWW.

The landscape is dominated by wet interstream flats mapped on mineral soils supporting pine forest, most of which is managed for silvicultural production. Small, relatively undisturbed areas of these flats support mixed hardwood forest. Imbedded within the interstream flats are large expanses of organic soils supporting pine-dominated pocosin wetlands. Larger drainages and their headwaters support bottomland and swamp forest, dominated by hardwoods with scattered cypress. The fringes of the lower Newport River and its tributaries support estuarine emergent marshes with adjacent shrub thickets.

A majority of wetland areas have been subject to various degrees of human disturbance. Some of these areas are ditched, and vegetation ranges in disturbance from maintained cleared, to recently cutover, to recovering shrub assemblages, to mature secondary growth forest.

3.2.3 Wildlife

The Croatan National Forest and adjacent lands are characterized by a variety of habitats which support a rich diversity of wildlife. Local residents include game species such as white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), eastern cottontail (*Sylvilagus floridanus*), racoon (*Procyon lotor*), northern bobwhite (*Colinus virginianus*), and wild turkey (*Meleagris gallopavo*). Other notable species include: muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), river otter (*Lutra canadensis*), and a variety of reptiles and amphibians. The large expanses of forest in the study area offer habitat for species adapted for forest interiors, such as the black bear and many species of neotropical migratory birds.

Study area ponds, streams, and canals provide habitat for osprey (*Pandion haliaetus*), shorebirds, wading birds, waterfowl, and American alligator (*Alligator mississippiensis*). These waters also support both a freshwater and estuarine fishery. Resident sport fish species include: summer flounder (*Paralichthys dentatus*), large-mouth bass (*Micropterus salmoides*), red-breast sunfish (*Lepomis auritus*), bluegill (*L. macrochirus*), warmouth (*L. gulosus*), chain pickerel (*Esox niger*), yellow perch (*Perca flavescens*), and several species of catfish.

3.2.4 Protected Species

3.2.4.1 Federal Species

Species with the federal classification of Endangered (E), Threatened (T), Proposed for such listing (P), or Threatened due to Similarity of Appearance (T[S/A]) are protected under the

Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Federal Species of Concern (FSC) receive no formal protection under the ESA. Federal-protected and FSC species listed for Craven and Carteret Counties (January 15,1999 FWS list), as well as their state classifications (LeGrand and Hall 1997, Amoroso 1997), are provided in Table 2.

NCNHP records indicate occurrences of two federal-protected species within the study area: red-cockaded woodpecker (*Picoides borealis*) and American alligator. All documented occurrences of red-cockaded woodpecker are in an area between the western border of the study area and the Clubfoot-Harlowe Canal. A systematic red-cockaded woodpecker survey was conducted within Croatan National Forest land by USFS personnel during the summer of 1998. The USFS has made available the survey results, which have been use to update available CGIA data (see Section 4.6 for details of red-cockaded woodpecker locations). The alligator has been documented in Walker's Mill Pond.

NCNHP records indicate occurrences of four FSC species in the study area vicinity: Carter's noctuid moth (*Spartiniphaga carterae*), eastern woodrat (*Neotoma floridana*), spring goldenrod (*Solidago verna*), and Carolina goldenrod (*S. pulchra*). Carter's noctuid moth was documented in the vicinity of the NC 101 crossing of the Clubfoot-Harlowe Canal. Habitat for this moth includes savannas and sandhills supporting pinebarrens sandreed. The eastern woodrat was documented outside of the study area, east of NC 101 and between Wading and Gable Creeks just north of Beaufort-Morehead City (Michael J. Smith) Airport. This woodrat typically occurs in moist forests. Spring goldenrod has been documented in multiple locations in the vicinity of the headwaters of Mortons Mill Pond south of NC 101. This goldenrod typically occurs in moist pine forests, preferably along pocosin fringes. Carolina goldenrod has been documented east of Walker's Mill Pond in a large expanse of pine flatwoods, the typical habitat of this goldenrod.

3.2.4.2 State Species

NCNHP records indicate documented occurrences of 11 state-listed species within the study area. American anhinga (*Anhinga anhinga*) and West Indian meadow beauty (*Rhexia cubensis*) have been observed at Walker's Mill Pond. Carolina saltmarsh snake (*Nerodia sipedon williamengelsi*) has been observed adjacent to the west side of Merrimon Road (SR 1300, approximately 0.5 mile north of the Merrimon Road junction with US 70 (north of Beaufort). Slippery dart moth (*Euagrotis lubricans*) and Lemmer's pinion moth (*Lithophane lemmeri*) have been observed adjacent to the north side of NC 101 in the vicinity of Mortons Mill Pond. An owlet moth (*Meropleon cinnamicolor*) has been observed in the vicinity of the NC 101 bridge crossing of the AIWW. Bog bluestem (*Andropogon mohrii*), branched gerardia (*Agalinus virgata*), and the green stinkbug (*Chlorochloa dismalia*) have been observed in the headwaters of Mortons Mill Pond south of NC 101. Savanna hibiscus (*Hibiscus aculeatus*)

Table 2. Federal-protected species and Federal Species of Concern (FSC) listed for Craven (CR) and Carteret (CA) Counties (January 15, 1999 USFWS list). Species with the federal classification of Endangered (E) or Threatened (T), Proposed for such listing (P), or Threatened due to Similarity of Appearance (T[S/A]) are protected under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). FSC species receive no formal protection under the ESA. State classifications include: Endangered (E), Threatened (T), Special Concern (SC), Significantly Rare (SR), Candidate (C), Watch Category 1 (W1), and Proposed (P).

Common Name	Scientific Name	Federal Status	State Status	County
Leatherback sea turtle	*Dermochelys coriacea*	E	E	CR,CA
Hawksbill sea turtle	*Eretomochelys imbricata*	E	E	CA
Peregrine falcon	*Falco peregrinus*	E	E	CA
Eastern cougar	*Felis concolor couguar*	E	E	CA*
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	CA
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E	E	CA
Red-cockaded woodpecker	*Picoides borealis*	E	E	CR,CA
Roseate tern	*Sterna dougallii*	E	E	CA
Manatee	*Trichechus manatus*	E	E	CR,CA
Sensitive jointvetch	*Aeschynomene virginica*	T	E	CR
Seabeach amaranth	*Amaranthus pumilus*	T	T	CA
Loggerhead sea turtle	*Caretta caretta*	T	T	CA
Piping plover	*Charadrius melodus*	T	T	CA
Green sea turtle	*Chelonia mydas*	T	T	CA
Bald eagle	*Haliaeetus leucocephalus*	T	E	CR
American alligator	*Alligator mississippensis*	T(S/A)	T	CR,CA
Bachman's sparrow	*Aimophila aestivalis*	FSC	SC	CR,CA
Henslow's sparrow	*Ammodramus henslowii*	FSC	SR	CA
Arogos skipper	*Atrytone arogos arogos*	FSC	SR	CA
Carolina spleenwort	*Asplenium heteroresiliens*	FSC	E	CR
Savanna campylopus	*Campylopus carolinae*	FSC	C	CA
Chapman's sedge	*Carex chapmanii*	FSC	W1	CR*,CA
Venus flytrap	*Dionea muscipula*	FSC	C-SC	CR,CA
Venus flytrap cutworm moth	*Hemipachnobia subporphyrea*	FSC	SR	CA
Southern hognose snake	*Heterodon simus*	FSC	SR	CR,CA*
White wicky	*Kalmia cuneata*	FSC	E-SC/PC	CR*
Black rail	*Laterallus jamaicensis*	FSC	SR	CR,CA
Pondspice	*Litsea aestivalis*	FSC	C	CR,CA
Diamondback terrapin	*Malaclemys terrapin terrapin*	FSC	SC	CA
Godfrey's sandwort	*Minuartia godfreyi*	FSC	E	CR
Loose watermilfoil	*Myriophyllum laxum*	FSC	T	CR,CA
Mimic glass lizard	*Ophisaurus mimicus*	FSC	SC	CA
Savanna cowbane	*Oxypolis ternata*	FSC	E	CR,CA
Eastern painted bunting	*Passerina ciris ciris*	FSC	SR	CA*
Croatan crayfish	*Procambarus plumimanus*	FSC	SR	CR,CA
Annointed sallow moth	*Pyreferra ceromatica*	FSC	SR	CR*
Carolina gopher frog	*Rana capito capito*	FSC	SC	CA
Carolina goldenrod	*Solidago pulcra*	FSC	E	CA
Spring-flowering goldenrod	*Solidago verna*	FSC	E/PT	CR
Carter's noctuid moth	*Spartiniphaga carterae*	FSC	SR	CA
Carolina asphodel	*Tofieldia glabra*	FSC	C	CR*,CA
Dune blue curls	*Trichostema* sp.	FSC	C	CA

* Historic record - the species was last observed in the county more than 50 years ago.

has been observed in the headwaters of Sandy Branch, southwest of Walkers Mill Pond. A liverwort (*Lejeunea bermudiana*) has been documented from a wet hardwood forest approximately a mile south of the NC 101 bridge crossing of the Clubfoot-Harlow Canal.

3.2.5 Rare and Unique Natural Areas

Approximately half of the study area west of the Clubfoot-Harlowe Canal is part of the Croatan National Forest, portions of which are characterized by large, contiguous tracts of relatively undisturbed, mature coastal forests. The Croatan National Forest is also managed for public hunting, trapping, and fishing, and is designated a Game Land.

The NCNHP compiles a priority list of "Natural Heritage Areas". These areas are designated based on presence of rare plant and animal species, rare or high-quality natural communities, and geologic features. Five Natural Heritage Areas occur in the vicinity of the study area: Union Point Pocosin, Walkers Mill Pond and Black Creek, Billfinger Road, Sea Gate Woods, and North River Brackish Marshes (see Section 4.1.6).

4.0 ENVIRONMENTAL SCREENING

4.1 Assessment Themes

This analysis was planned to be conducted primarily with available CGIA data files supplemented by information from various sources (NCDOT, county tax office, USFS, USFWS, and NCNHP). CGIA digital mapping employed in the analysis includes data layers concerning: 1) road network; 2) soils; 3) hydrography; 4) land cover types; 5) NCNHP element occurrences and natural priority areas; 6) primary fish nursery areas; 7) anadromous fish spawning habitat; 8) national and state park lands; 9) national forest lands; 10) historic sites; and 11) hazardous material sites. For ease of study, these data were subdivided into six themes of like types: 1) development/-transportation corridors; 2) Croatan National Forest; 3) physiography/soils; 4) land cover; 5) coastal management wetlands; and 6) unique natural resources. Hazardous materials data were not included as a theme due to a lack of documented occurrences within the study area. According to CGIA digital files, the only documented hazardous materials site in the vicinity of the project area is approximately 2.5 miles southwest of Newport, west of US 70.

Features depicted by each theme map were ranked according to three levels of environmental value using ecological principles, best professional judgement, comments from project participants, highway constraints, and permit issues. Rankings within each theme map are depicted through the use of a "stop-light" color pattern. In general, red indicates natural features with high environmental value; yellow indicates natural features with relatively intermediate environmental value; and green and white generally indicate natural features either with low environmental values or features whose loss would be easier to mitigate. During initial phases of this study, shades of the three base colors were used to further divide features according to perceived value; however, this "splitting" threatened to require an overly-complicated comparison model, so environmental features were "lumped" back into the three base colors.

It is recognized that "value" is a subjective term used to demonstrate the relative importance of one parameter to another. The assigned value concept implies that different individuals may assign different values to the same variable (Smith *et al.* 1995). However, assigning values in ranked or weighted order was considered necessary and justifiable in order to establish priorities for transportation corridor selection. Modification to perceived values have been established, and may be modified, based upon involvement by project planning participants.

4.1.1 Development/Transportation Corridors

This theme (Figure 2) depicts in red properties identified as containing structures used for residential, commercial, and industrial purposes. These data were derived from tax mapping, recent aerial photography, and a site visit. Green areas on this theme indicate a 1000-foot wide buffer to each side of existing transportation corridors. Fragmentation of natural communities is considered to result in a less significant effect on the environment when disturbance (such as a road alignment) is within these corridors.

4.1.2 Croatan National Forest

This theme (Figure 3) depicts lands within the Croatan National Forest (in green). Also included is the location of the Neusiok Trail (in orange), a publically-accessible hiking trail that extends for approximately 20 miles on a generally north-south axis from the Newport River to the Neuse River. The Neusiok Trail extends completely across the study area, and will be crossed by any roadway alternative.

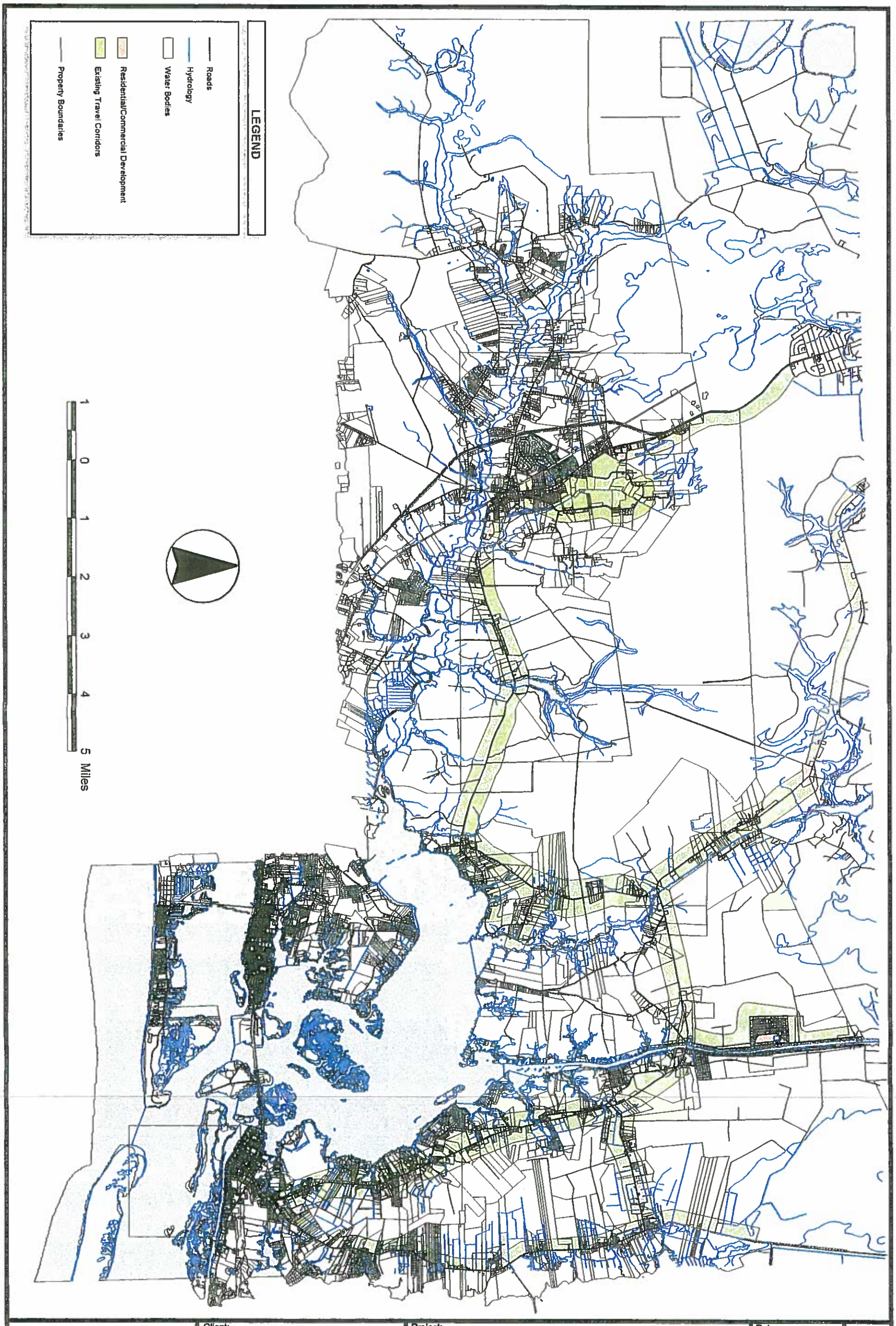
4.1.3 Physiography/Soils

The study area has been subdivided into four primary physiographic landscape units based on Natural Resource Conservation Service (NRCS) mapping, soil characteristics, and landscape position. Physiographic units include: 1) riverine floodplain, 2) organic soil flat/depression, 4) mineral soil flat, and 3) groundwater slope (Figure 4).

Both the riverine floodplain and organic soil flat/depression landscape units receive the highest ranking (depicted in red). These physiographic units occur within jurisdictional waters and wetlands, and are typically relatively undisturbed and of high quality. Riverine floodplains and organic soil flat/depressions are ranked highest due to water resource, water quality, and jurisdictional permitting concerns, including the difficulty in providing compensatory mitigation. In addition, floodplains and organic soil flats/depressions represent a limited portion of the total study area.

Mineral soil flats receive an intermediate ranking (depicted in yellow). This physiographic unit frequently occurs within jurisdictional wetland flats on interstream divides and is the dominant landscape feature within the study area. However, much of the area contained in this physiographic unit has undergone some level of disturbance, reducing environmental quality. Mineral soil flats are intermediately ranked due to presence of jurisdictional wetlands, abundance, perceived reductions in water quality values, and the capacity to mitigate for impacts.

Groundwater slopes receive the lowest ranking (depicted in green). This physiographic unit frequently occurs in non-jurisdictional areas adjacent to floodplains and water courses where



EcoScience Corporation
612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

Client:
NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

Project:
DEVELOPMENT / TRANSPORTATION CORRIDORS
U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

Date: MAY 1999
Scale: AS SHOWN
ESC Job #: 98-038

Figure 2

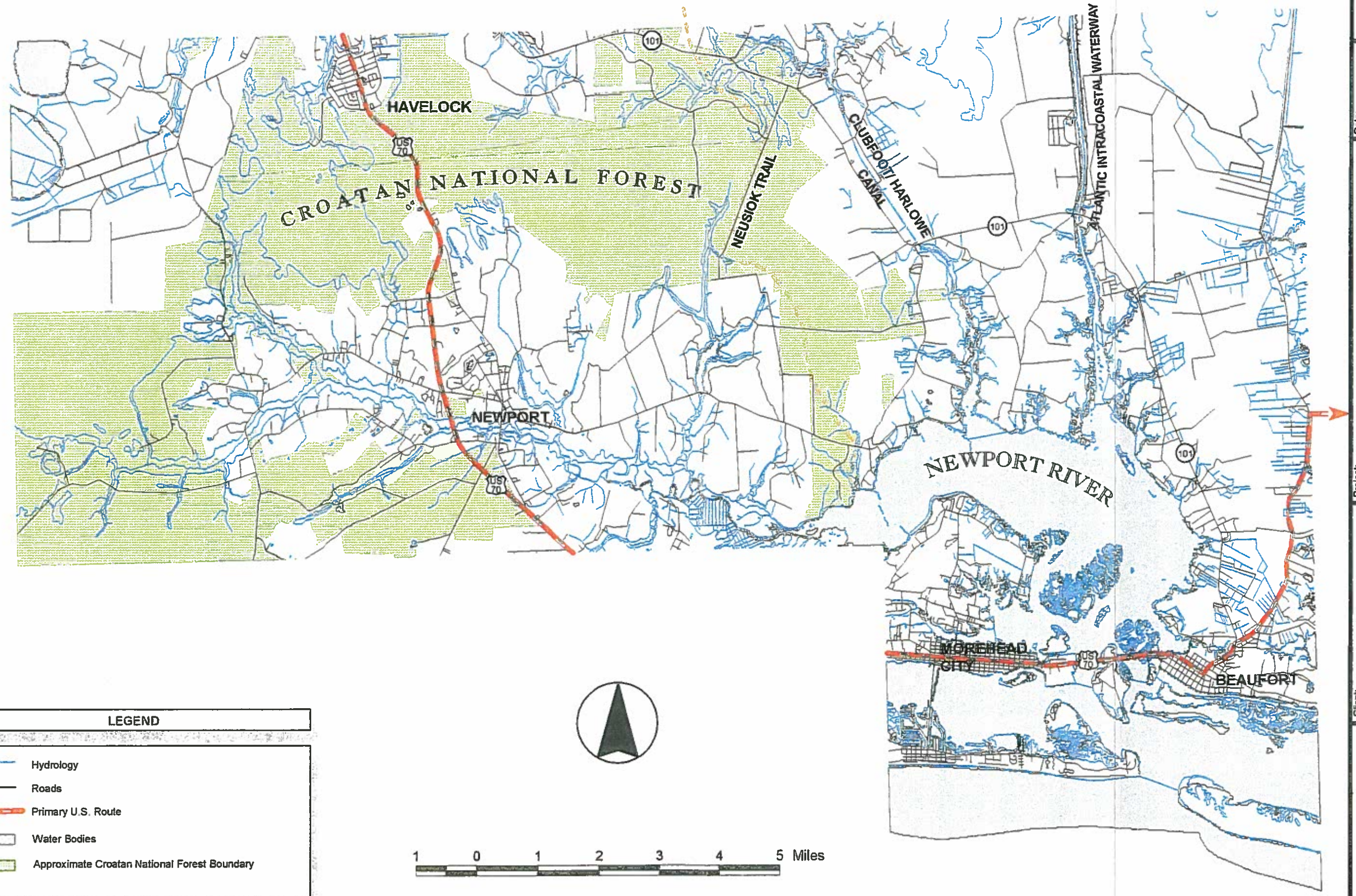


Figure 3

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Project:

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U.S. 70 Feasibility Analysis

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NC DEPARTMENT OF TRANSPORTATION

P.O. BOX 25201

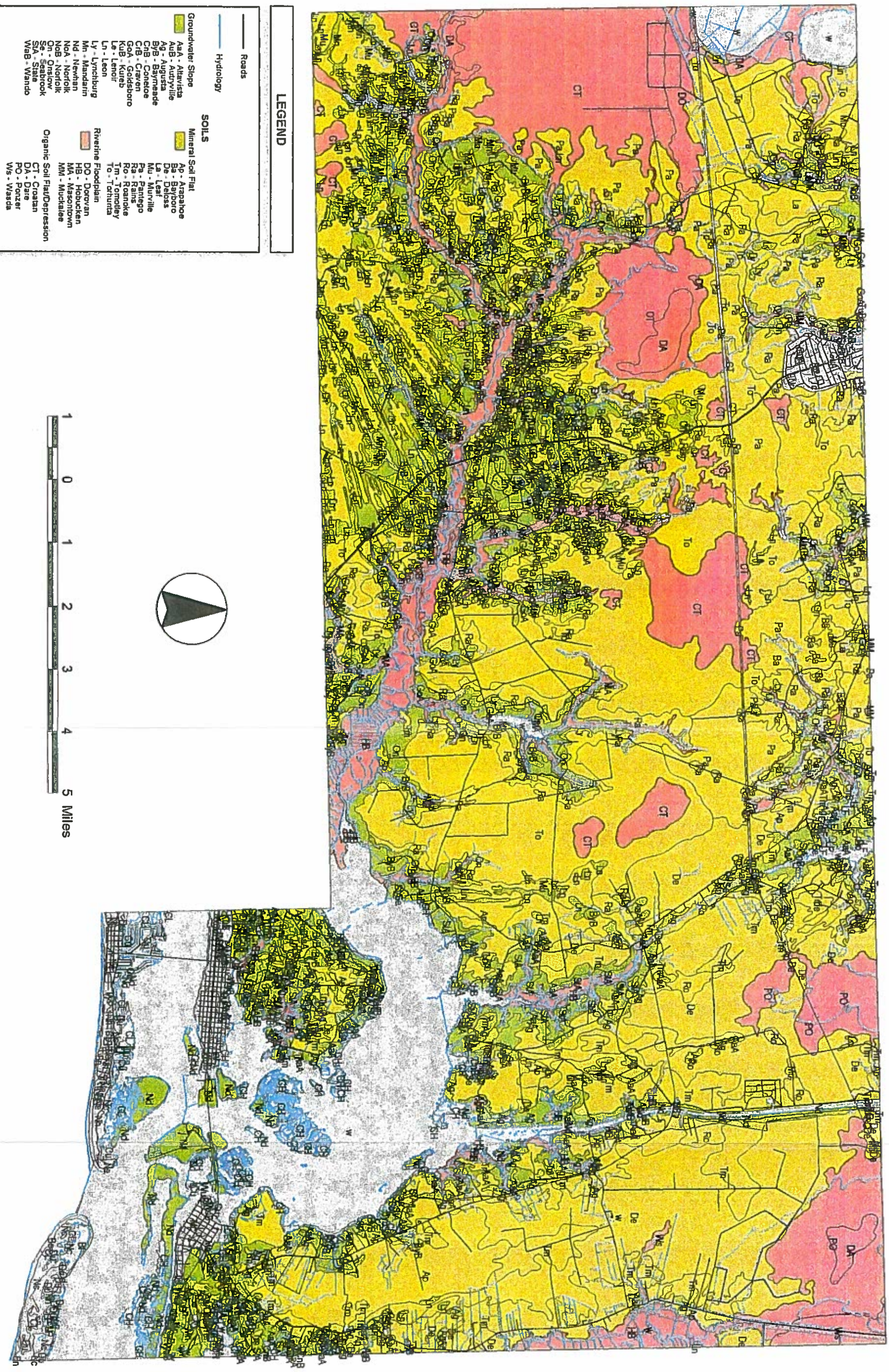
RALEIGH, NORTH CAROLINA 27611

EcoScience Corporation

612 Wade Ave., Suite 200

Raleigh, North Carolina 27605

Ph: 919 828-3433 Fax: 919 828-3518



EcoScience Corporation

612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

Client:
NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

Project:
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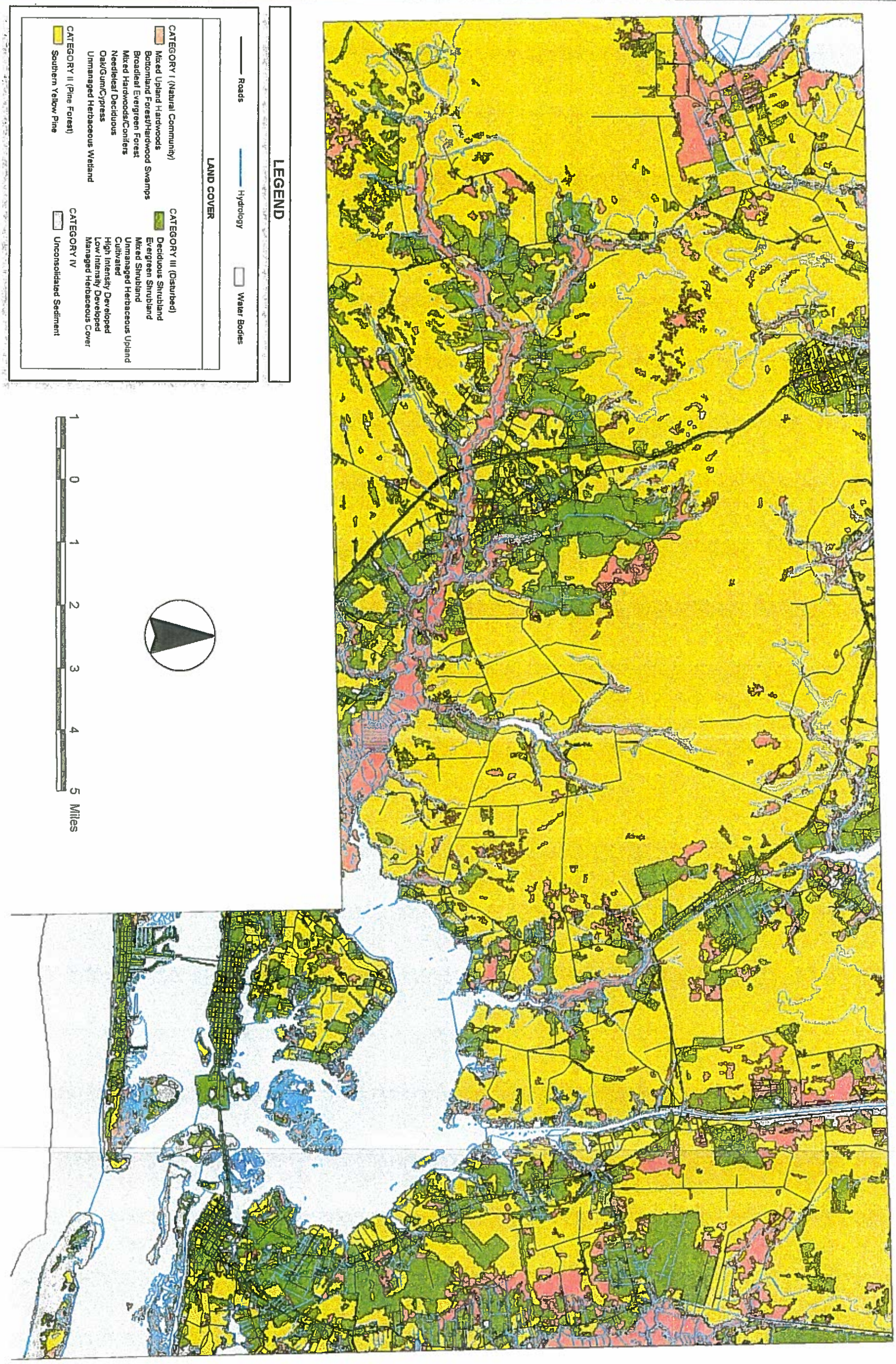
Figure 4



EcoScience Corporation
612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

Client:
NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

Project:
LAND COVER 1996
U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

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ESC Job #: 98-038

Figure 5

these systems often act as an environmental buffer and source of groundwater expression into riverine systems. In un-developed portions of the study area, this physiographic unit is typically managed for timber production; while in developed portions of the study area, this physiographic unit is typically maintained for residential and commercial/light industrial uses. Groundwater slopes receive the lowest ranking due to lack of jurisdictional status, unlikely need to mitigate for impacts, and general level of natural disturbance. Although water quality may depend upon the function of groundwater slopes (Brinson 1993), agricultural and development land uses are concentrated in these areas due to drainage characteristics.

4.1.4 Land Cover

Land cover has been subdivided into three primary types based upon relative importance to the local environment, abundance in the landscape, degree of disturbance, and potential for recovery from disturbance. The map units are designated: natural community (Category I), pine forest (Category II), and disturbed (Category III) (Figure 5). The diversity and structural complexity provided by mature, natural communities offers high habitat value to the environment and is unable to recover quickly from disturbance, resulting in Category I cover types being ranked highest (depicted in red).

A majority of the southern yellow pine cover type is in silvicultural production. Management practices within silviculture plots prevent forests from reaching mature stages, reducing the overall value of these areas to the environment. Some of the area identified as southern yellow pine supports pocosin forests, relatively more valuable systems in which mature communities are dominated by pines. However, since a majority of the southern yellow pine cover type is managed for timber production, this cover type is intermediately ranked (depicted in yellow).

Areas where natural vegetation has recently been heavily disturbed or removed for agricultural production or maintained as developed land are depicted in green as an indication of low value to the environment. Values of Category III areas are considered to be relatively easy to restore.

4.1.5 Coastal Management Wetlands

NCDCM has designated 13 vegetated wetland types within the study area, including modifiers within each type characterizing level and type of disturbance (see Appendix B). Wetland type modifiers include: cut-over, cleared, and ditched. Cut-over wetlands are those for which satellite imagery indicates a lack of vegetation in 1994. Cleared wetlands are those for which satellite imagery indicates a lack of vegetation in 1988 and 1994. Ditched wetlands are wetlands that have been at least partially ditched according to NWI mapping. Areas depicted

with these site modifiers are typically small and scattered, and, for the purpose of this study, have been lumped in with the unmodified base wetland types.

For purposes of this study, wetlands have been subdivided into three categories or generalized cover types (Figure 6). Category I (depicted in red) includes systems that would be difficult to replace, such as mature forests on fluvial soils of floodplains and headwater areas, pocosin vegetation on organic soils, and estuarine wetlands. Category II (depicted in yellow) includes both pine and hardwood forests on mineral soils, freshwater marshes, and areas maintained as disturbed due to management practices. Category II wetlands exhibit relatively low functional capacity when compared to Category I systems, and, therefore, have relatively lower value. Category III (depicted in white) includes areas that are not currently considered to be jurisdictional wetlands.

NCDCM is currently finalizing a digital wetland functional significance map for the 20 coastal counties. However, at the time of this study, these data were not yet available for public use.

4.1.6 Unique Natural Resources

This theme is used as a catch-all for a variety of notable study area natural resources. Resources depicted on this theme map (Figure 7) include: federal-protected species habitat, designated fish nursery areas, anadromous fish spawning habitat, the Walkers Mill Pond and Black Creek Coastal Land Trust easement, a Weyerhaeuser research study area, designated natural heritage areas and element occurrences, and historic districts and sites listed with the National Register.

Features considered to have the most value (depicted in red) include: cultural resources listed on the National Register of Historic Places, federal-protected species habitat, fish nursery areas, anadromous fish spawning areas, the Coastal Land Trust Conservation easement, and the Weyerhaeuser research study area. Considered to be of intermediate significance (depicted in tan) are: documented occurrences of Federal Species of Concern (FSC species) and state-listed species, natural heritage areas, and historic sites not on the National Historic Register listing.

The federal-listed species of concern within the study area are the red-cockaded woodpecker and the American alligator. The theme map indicates the locations of active red-cockaded cavity trees and potential foraging habitat within a 0.5-mile radius. As of the summer of 1998, USFS has documented five active cavity clusters, all between the western terminus and the Clubfoot-Harlowe Canal. The American alligator has been documented in Walkers Mill Pond. American alligator is listed as threatened based on the similarity in appearance to other

federal-listed crocodilians; however, there are no other crocodilians within North Carolina. Regardless of the status of the alligator, Walkers Mill Pond has been rated of high value (depicted in red) on the theme map due to the Coastal Land Trust conservation easement.

The Coastal Land Trust holds a 1071-acre conservation easement around Walkers Mill Pond on Weyerhaeuser lands. This conservation easement is located on both sides of Mill Creek Road (SR 1154). Figure 7 does not depict the conservation easement south of Mill Creek Road as the GIS mapping was not available to the public at the time of this study. However, Mill Creek Road marks the southern boundary of the study area so the missing data has not affected this feasibility study.

The Weyerhaeuser research study area is the subject of a multi-stakeholder water quality/hydrology research study which has been ongoing for over a decade. Any changes to groundwater levels or surface water discharge patterns would adversely affect this study. Weyerhaeuser has requested a minimum 0.25-mile buffer between the study area and new road facilities if practicable.

Five Natural Heritage Areas occur within the study area. The Natural Heritage Areas (NHA) designation is based on the NCNHP inventory of the natural diversity of the state. NHAs are evaluated based on occurrence of rare plant and animal species, rare or high quality natural communities, and geologic features. Sites with this designation are considered ecologically significant as the best representatives of the natural diversity of the state and therefore merit protection; however, this designation does not imply any protection or public access (DPR 1999). Because NHAs receive no formal protection, these areas are considered to be of relatively intermediate significance for the purpose of this study. Union Point Pocosin NHA and the Billfinger Road NHA both occur within Croatan National Forest. Union Point Pocosin NHA includes a large area of undisturbed, contiguous pocosin forest on an interstream divide which drains both north to the Neuse River Basin and South to the White Oak River Basin. The Billfinger Road NHA is in the headwaters of Mortons Mill Pond and includes pocosin, upland sand ridge, and bottomland forested communities in close proximity to each other. Walkers Mill Pond and Black Creek NHA generally encompasses the hardwood/cypress bottomlands associated with this system south of the national forest boundary and north of the Walkers Mill Pond dam near Mill Creek Road (SR 1157). The Sea Gate Woods NHA is north of the NC 101/AIWW bridge crossing and immediately west of the Sea Gate residential development. The North River Brackish Marshes NHA includes the marsh fringe of North River east of the eastern boundary of the study area. This area includes a large expanse of black needlerush marsh, receivers of runoff from the eastern portion of the Beaufort Peninsula.

4.2 Preliminary Corridors

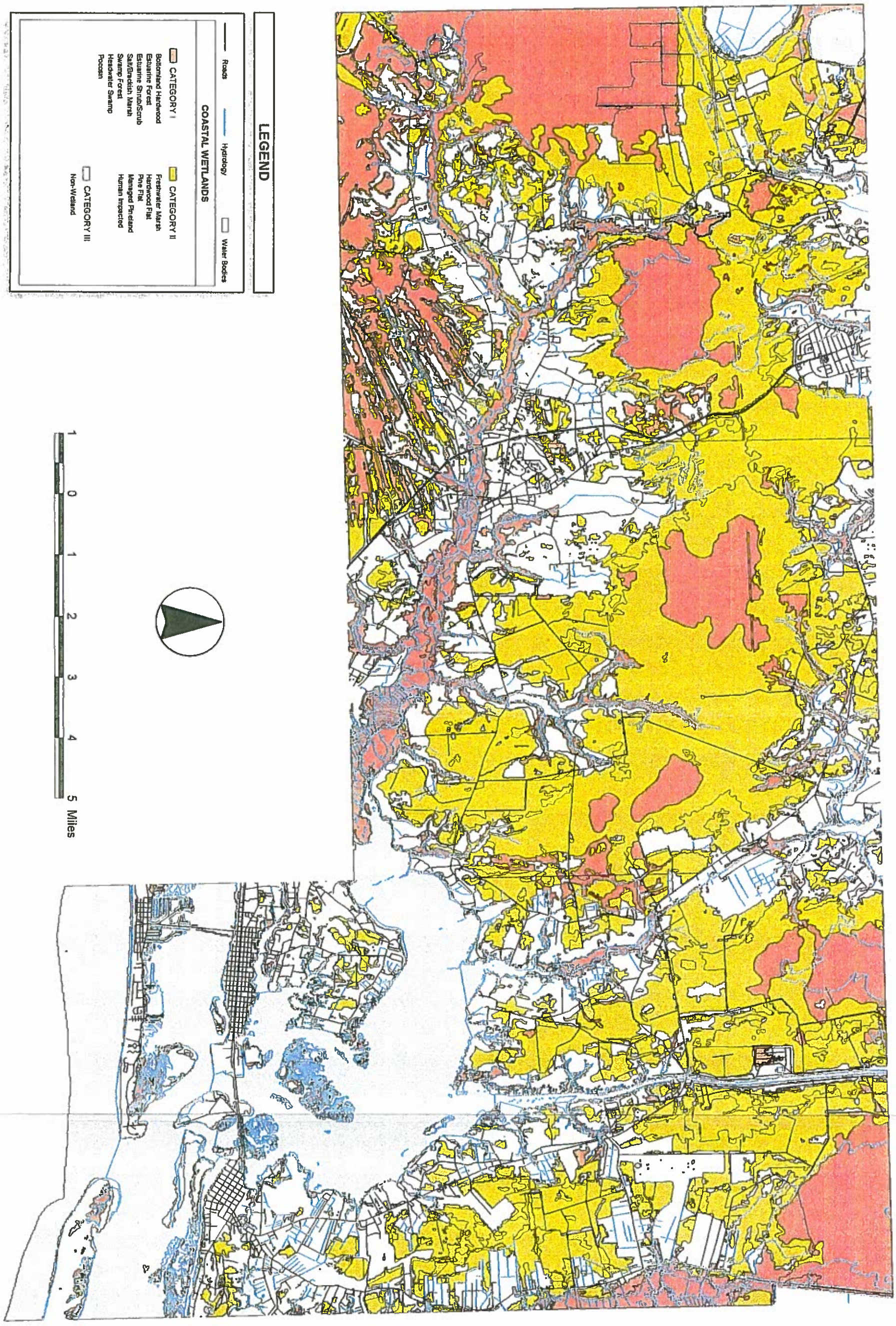
Significant environmental features, as shown on theme maps and determined by study rating procedures, are depicted together in Figure 8. In general, features indicated in red (features of highest environmental value) have been incorporated into this composite map. One exception is data concerning physiography/soils and land cover themes. The environmental value of these themes is considered to be interrelated. Many of the high-quality areas (depicted in red) on the physiography/soils theme map support plant communities that have been significantly disturbed through clearing or ditching, thus reducing the general environmental value of these areas. For this reason, the contribution of these two themes to the composite map is limited to areas of overlap of the highest-quality features (red areas). The overlap areas depict riverine floodplains and organic soil flats/depressions that support relatively undisturbed, mature plant communities.

Significant natural features depicted by the composite map include: water bodies; the physiography/soils and land cover overlap areas; Category I coastal wetlands; red-cockaded woodpecker territories; Coastal Land Trust property; the Croatan National Forests' Neusiok Trail; the Weyerhaeuser research study area; anadromous fish spawning areas; fish nursery areas; listed historic structures; and properties currently supporting structures used for residential, educational, commercial, and industrial purposes. In addition, the composite map indicates Category II coastal wetlands by gray shading.

4.2.1 Segment Generation

To assist with the determination of potential transportation corridors, the study area was divided into three sections (A, B, and C) defined by surface-water crossings (Figure 9). Section A contains the west end of the study area and is bounded to the west by US 70 and to the east by the Clubfoot-Harlowe Canal. Section B contains the central portion of the study area, bounded by the Clubfoot-Harlowe Canal to the west and the AIWW to the east. Section C includes the Beaufort Peninsula, located east of the AIWW and north of the Town of Beaufort.

With a goal of avoidance and minimization of impact to high quality areas, and considering comments from project participants and highway engineers, a series of preliminary roadway segments were generated within each section. This exercise resulted in seven corridor segments within Section A, three segments within Section B, and five segments within Section C (Figure 9).



EcoScience Corporation
612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

Client:
NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

Project:
COASTAL MANAGEMENT WETLANDS
U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

Date: MAY 1999
Scale: AS SHOWN
ESC Job #: 98-038

Figure 6

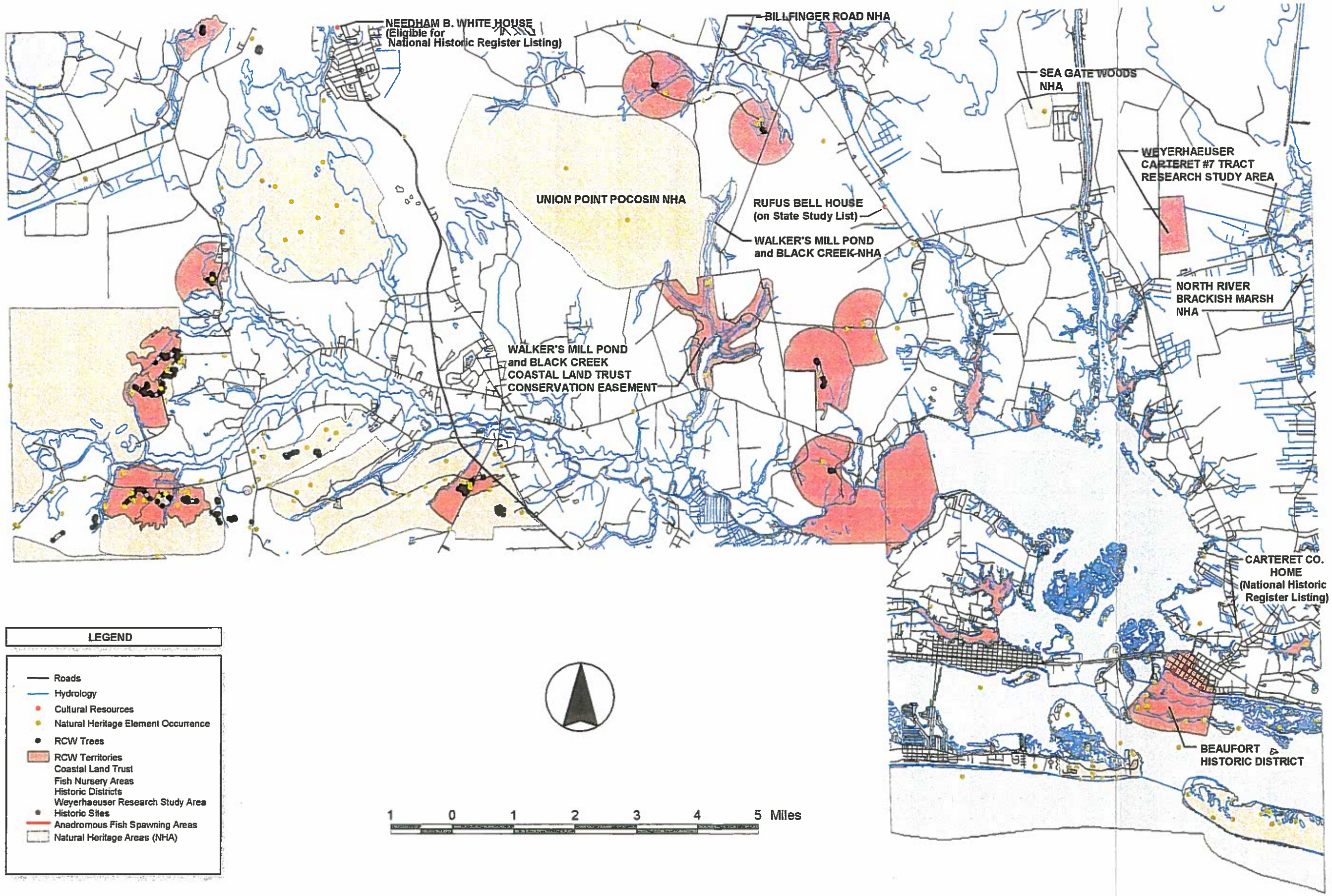


Figure 7

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Scale: AS SHOWN

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Project:

UNIQUE NATURAL RESOURCES

U.S. 70 Feasibility Analysis

Carteret / Craven Counties, North Carolina

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P.O. BOX 25201

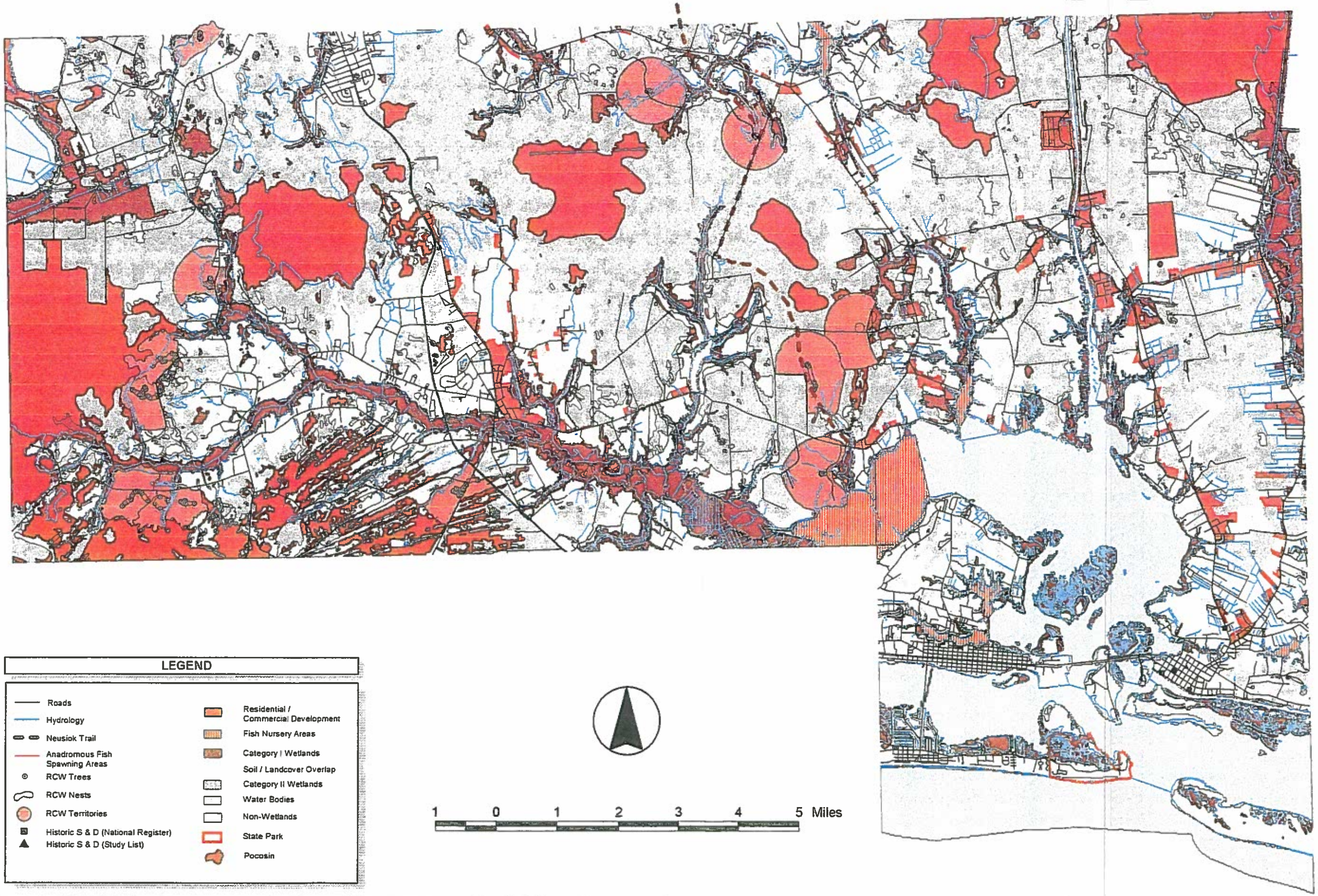
RALEIGH, NORTH CAROLINA 27611

EcoScience Corporation

612 Wade Ave., Suite 200

Raleigh, North Carolina 27605

Ph: 919 828-3433 Fax: 919 828-3518



Project:

COMPOSITE MAP

U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

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NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

EcoScience Corporation
612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

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Figure 8

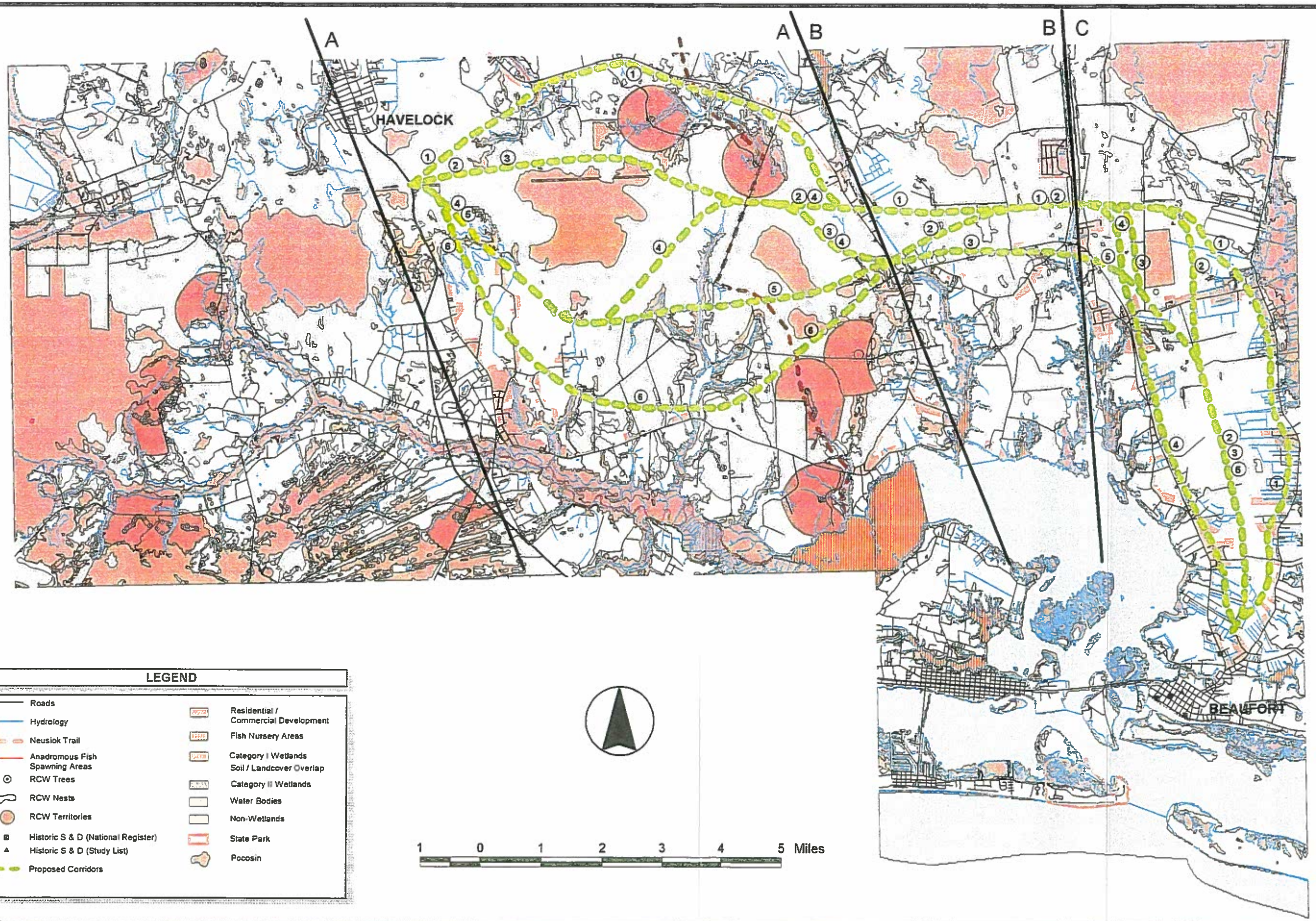

Figure 9

Date: MAY 1999

Scale: AS SHOWN

ESC Job #: 98-038

Project:

COMPOSITE MAP
PRELIMINARY CORRIDORS

U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

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NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

EcoScience Corporation
612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

Section A Corridors

All Section A segments have a common western terminus on US 70 south of Havelock (determined by the location of the eastern terminus of the Havelock Bypass (R-1015). Section A segments have two eastern termini, one just north of the US 101 crossing of the Clubfoot-Harlowe Canal (Section A southeastern terminus) and another approximately a mile north (Section A northeastern terminus) of the southeastern terminus. Both Section A eastern termini are areas of sparse human development. Significant natural features to be avoided within Section A include: red-cockaded woodpecker cavity trees and foraging habitat; pocosins, riverine bottomlands and associated headwater systems; and the Walkers Mill Pond Coastal Land Trust conservation easement.

Segment A1 extends northeast from the western terminus to US 101 in the vicinity of Hancock Creek, and thereafter runs parallel to and approximately 500 feet south of NC 101 to the northeastern terminus of Section A. This segment maximizes the use of existing transportation corridors within Section A; however, it also crosses several streams, including one utilized by anadromous fishes, as well as high-quality coastal wetlands.

Segments A2 and **A3** offer the shortest routes across Section A. Segment A2 extends from the western terminus on a generally eastward course to the northeastern terminus. Segment A3 is common with A2, except that the eastern end of Segment A3 dips south to the southeastern terminus of the section. Both segments avoid the highest-quality natural features; however, they fragment and isolate portions of the Croatan National Forest.

Segments A4/2 and **A4/3** utilize non-jurisdictional agricultural and residential cover types on the outskirts of Newport and are positioned to avoid high-quality natural features in the eastern portion of the section. Segment A4/2 extends southeast through the outskirts of Newport, then arcs northeast to avoid the headwaters of Black Creek before an eastward run to the northeastern section terminus. Segment A4/3 is common with A4/2, except that the eastern end dips south to the southeastern terminus of the section. These segments also fragment and isolate portions of the Croatan National Forest.

Segment A5 avoids fragmentation of the Croatan National Forest and the Coastal Land Trust property by utilizing much of the southern boundary of the national forest as a primary corridor. This segment initially extends southeast through the outskirts of Newport (common with the A4 segments), then cuts east across two forks of the Black Creek headwaters, both high-quality coastal wetlands containing relatively

undisturbed, mature forest communities, before arcing north to the southeastern terminus of the section.

Segment A6 maximizes the use of non-jurisdictional agricultural and residential areas north of Newport while minimizing impacts to the National Forest. From the western terminus, Segment A6 extends southeast across northern Newport. To avoid traffic accessability problems with existing Mill Creek Road (SR 1157) and the bottomland swamp south of the Walkers Mill Pond dam, this segment extends across the southern reach of Walkers Mill Pond before arcing northeastward to the southeastern terminus of the section.

Section B Segments

The two western termini of Section B segments are determined by the Section A eastern termini. Two Section B eastern termini (northeastern and southeastern) are located to allow Section C segments to avoid the Weyerhaeuser research study area. The southeastern terminus intersects the AIWW in the vicinity of the existing NC 101 bridge. The northeastern terminus intersects the AIWW approximately a mile north, south of the Sea Gate residential development.

Segment B1 extends from the northwestern terminus due east across Section B to the northeastern terminus. This segment avoids high-quality coastal wetlands and development adjacent to NC 101.

Segments B2 and **B3** have the southwestern terminus in common. Segment B2 arcs north to the northeastern terminus, avoiding high-quality coastal wetlands and development adjacent to NC 101. Segment B3 extends eastward, crossing NC 101 and Old Winberry Road (SR 1160) before ending at the southeastern terminus. This segment utilizes the existing NC 101 transportation corridor, thus minimizing habitat fragmentation; however, Segment B3 crosses two streams with adjacent high-quality coastal wetlands.

Section C Segments

The two western termini of Section C segments have been located to allow for avoidance of the Weyerhaeuser research study area. The southeastern terminus intersects the AIWW in the vicinity of the existing NC 101 bridge. The northeastern terminus intersects the AIWW approximately a mile north, south of the Sea Gate residential development. All Section C segments have a common southern terminus (determined by the eastern terminus of the Beaufort upgrade of US 70 [R-3307]).

Segment C1 extends east from the northwestern terminus before curving south to Merrimon Road (SR 1300) in the vicinity of Laurel Road (SR 1163), and thereafter runs parallel to and approximately 500 feet west of Merrimon Road/US 70 to the southern terminus. This segment maximizes use of an existing transportation corridor; however it also crosses several streams, high-quality coastal wetlands, and a series of developed properties, including East Carteret High School.

Segment C2 extends east from the northwestern terminus until clear of the Weyerhaeuser research study area before turning south and extending down the middle of the Beaufort peninsula to the southern terminus. This segment avoids all high-quality areas with the exception of development along Laurel Road.

Segment C3 turns south from the northwestern terminus and passes west of the Weyerhaeuser research study area before joining Segment C2 down the middle of the peninsula to the southern terminus. Like Segment C2, Segment C3 avoids all high-quality areas with the exception of development along Laurel Road.

Segment C4 arcs south from the northwestern terminus to NC 101 just north of the intersection with Laurel Road, and thereafter runs parallel to and approximately 500 feet east of NC 101 to the southern terminus. This segment utilizes the existing NC 101 transportation corridor; however, Segment C4 crosses several streams containing fish nursery areas and fringed by high-quality coastal wetlands and crosses an industrial site, several residential developments, and associated structures.

Segment C5 arcs south from the southwestern terminus to join Segment A3 north of Laurel Road and then A2 down the center of the peninsula. The shortest segment in Section C, C5 minimizes impacts to both high-quality environmental areas as well as residential, commercial, and industrial properties.

4.2.2 Rating Segments

A rating system was developed and implemented for a comparative analysis of preliminary corridor segments within each of the three study area sections. Although only high-quality areas from the theme maps were used to generate section segments, information concerning high-quality, intermediate-quality, and low-quality areas was used when rating these segments.

Segments were rated for each of nine environmental variables derived from background sources and theme mapping. These variables include the following:

1) **Coastal Wetlands:** Derived from the coastal management wetlands theme map.
2) **Streams:** Derived from the unique natural areas theme map. This variable accounts for number of streams crossed, whether or not crossed streams are in a relatively natural state or are channelized through a disturbed landscape, and whether or not crossed streams support primary nursery areas or anadromous fish spawning habitat.
3) **National Forest:** Derived from the Croatan National Forest theme map.
4) **Transportation Corridor:** Derived from the development/transportation theme map.
5) **Natural Heritage Areas:** Derived from the unique natural areas theme map.
6) **Habitat Fragmentation:** Derived from development/transportation, Croatan National Forest, and land cover theme maps and aerial photography. This variable reflects the length a segment passes through natural communities relative to the total length of that segment.
7) **Demography:** Derived from the development/transportation theme map.
8) **Landscape:** Derived from a combination of the physiography/soils theme, the land cover theme, and the overlap of the highest quality areas of these themes.
9) **Total Length:** Total linear distance, accounts for economic, as well as environmental aspects of roadway construction.

At least two potential variables are conspicuous by their absence: Federal-Protected Species and Cultural Resources. No need for these variables occurs in this analysis, as the footprints of proposed segments avoid impacts to documented occurrences of both federal-protected species and cultural resources.

4.2.2.1 Variable Ratings

The rating system allows for a comparison of segments within a section. For ease of comparison, variable ratings range from 0.0 to 1.0. High ratings (approaching 1.0) indicate high environmental values, which translate to poor options for roadways. Conversely, low ratings (near 0.0) indicate low environmental values, which translate to better options for roadways.

Two types of ratings are used in this analysis: absolute and scaled. Six variables receive absolute ratings (Coastal Wetlands, Landscape, Transportation Corridor, National Forest, Natural Heritage Areas, and Habitat Fragmentation). An absolute rating for a segment variable is independent of the status of other segments in the section. For instance, the

Coastal Wetland rating for one segment is independent of the Coastal Wetland rating for any other segment. This absolute rating depicts the status of wetlands only within the segment in question.

Three variables receive scaled ratings (Streams, Total Length, and Demography). A scaled rating for a segment variable is dependent on the status of that variable in all segments within a section. To use the Streams variable as an example: within a section, the segment with the greatest stream impacts receives a rating of 1.0, while the segment with the least stream impacts receives a rating of 0.0. Remaining segments within the same section with intermediate stream impacts are scaled to the proper relationship between 1.0 and 0.0.

The methods used to determine variable ratings are described in Appendix C. Variable ratings for all segments are presented in Table 3.

4.2.2.2 Segment Ratings

Individual variable ratings are interesting tools for comparing certain aspects of segments; however, segment ratings are needed to compare segments within study area sections. Segment ratings are achieved by combining all variable ratings for a segment, each weighted to reflect importance to the decision-making process for permit approval, as well as potential adverse environmental effects. Weighting of each variable rating is achieved through the use of a multiplication factor (multiplier), ranging from 1X to 5X.

Coastal Wetlands and **Streams** are assigned a multiplier of 5X due to the ecological and economic importance of these resources to the local environment, as well as permit implications of direct impacts to these features.

National Forest is assigned a multiplier of 4X due to federal land ownership, Section 4(f) considerations, and the presence of natural resources whose importance has been acknowledged by designation and protection as a national forest.

Natural Heritage Areas, Transportation Corridors, and **Habitat Fragmentation** are all assigned a multiplier of 3X. Although receiving no formal protection, Natural Heritage Areas (including the Coastal Land Trust conservation easement) are recognized by the state or private entities as harboring unique environmental features. The Transportation Corridors and Habitat Fragmentation variables account for similar issues from different perspectives. These variables provide credit for segments that avoid or minimize additional disturbances in the study area, an important ecological issue in an area with high near-future growth potential.

Table 3. Variable ratings for 15 preliminary corridor segments. Higher ratings indicate high environmental values, which translates to poor options for roadways. Rating methodology is included in Appendix C. Absolute ratings indicate the stand-alone status of a segment variable independent of other segments in the comparison. Scaled ratings indicate a segment's status relative to other segments in the comparison. Segment Ratings allow for comparison of segments within sections. A multiplier was used to weight variables according to permit issues and environmental values when computing Segment Ratings.

	Absolute Ratings						Scaled Ratings			
Segment	Coastal Wetlands	Landscape	Trans. Corridor	National Forest	Natural Heritage Areas	Habitat Fragment.	Streams	Demography	Total Length	Segment Rating
A1	0.38	0.31	0.35	0.36	0.03	0.88	1.00	0.00	0.43	0.48
A2	0.48	0.31	0.93	0.86	0.41	0.96	0.00	0.00	0.00	0.48
A3	0.48	0.31	0.94	0.76	0.44	0.92	0.00	0.00	0.27	0.48
A4/2	0.41	0.35	0.95	0.55	0.23	0.80	0.18	0.00	0.50	0.44
A4/3	0.42	0.33	0.95	0.50	0.21	0.78	0.18	0.00	0.80	0.44
A5	0.41	0.36	0.94	0.40	0.14	0.83	0.54	0.00	0.47	0.48
A6	0.37	0.28	0.79	0.23	0.06	0.71	0.45	0.00	1.00	0.41
B1	0.36	0.29	0.88	0.00	0.00	0.44	0.00	0.00	0.00	0.22
B2	0.45	0.33	0.86	0.00	0.00	0.79	0.00	0.00	0.00	0.28
B3	0.33	0.22	0.00	0.00	0.00	0.59	1.00	0.00	0.00	0.32
C1	0.23	0.25	0.48	0.00	0.00	0.41	0.53	1.00	1.00	0.36
C2	0.34	0.26	0.95	0.00	0.00	0.47	0.00	0.00	0.70	0.26
C3	0.32	0.27	0.93	0.00	0.00	0.54	0.00	0.04	0.48	0.25
C4	0.28	0.23	0.35	0.00	0.00	0.35	1.00	0.61	0.26	0.38
C5	0.37	0.27	0.84	0.00	0.00	0.54	0.00	0.02	0.00	0.23
Multiplier	5X	1X	3X	4X	3X	3X	5X	2X	1X	

Demography is assigned a multiplier of 2X due to the limited study area population and localized distribution of that population. Also, population impacts are considered to be more of a socio-economic than environmental issue. However this variable is included to acknowledge the importance of considering population impacts in project planning.

Landscape and **Total Length** are assigned a multiplier of 1X. Landscape is not weighted by a higher factor because the ecologically-significant aspects of this variable are also partially accounted for by Coastal Wetlands, Transportation Corridors, and Habitat Fragmentation. Total Length is relatively even among sections; however, weighting this variable by a factor higher than 1X results in ratings which rank corridors according to length, possibly diluting the importance of other environmental issues.

The weighted variable ratings are totaled and divided by the sum of the multipliers to determine a segment rating between 0.0 and 1.0. An example of a determination of a segment rating is provided in Appendix C. Variable multipliers and segment ratings are provided in Table 3. In general, sections located higher in the landscape, on interstream divides, have lower segment ratings, translating to better options for roadways.

Section A

The seven Section A segments range from a low rating of 0.41 to a high rating of 0.48 (Table 3). Segment A6 is the best option for a roadway due to a number of factors, primarily the relative minimization of impacts to Coastal Wetlands, National Forest, and Natural Heritage Areas. It is notable, however, that Segment A6 crosses the Coastal Land Trust conservation easement.

Segments A1, A2, A3, and A5 are rated equally poor for roadways. Segment A1 has the highest stream rating. Segments A2 and A3 fail to minimize impacts concerning National Forest and Habitat Fragmentation and these segments fail to take advantage of existing Transportation Corridors. Segment A5 does not take advantage of existing Transportation Corridors and this segment does not minimize Habitat Fragmentation. Segments A4/2 and A4/3 both receive intermediate ratings for most variables.

Section B

Section ratings for the three Section B segments are evenly spaced and range from a low of 0.22 to a high of 0.32 (Table 3). Segment B1 is the best option for a roadway due to avoidance of Streams and minimization of Habitat Fragmentation. Section B3 receives a poor segment rating due to Stream impacts.

Section C

The Section C segments that extend along the middle of the peninsula are best suited for a roadway, primarily due to avoidance of streams, fish nursery areas and populated areas. Section C segment ratings range from a low of 0.23 to a high of 0.38 (Table 3). Although Segment C5 has a high Coastal Wetland rating, this segment avoids impacts to Streams and has intermediate ratings for the remaining variables. Environmental characteristics of Segments C2 and C3 closely parallel Segment C5, and these two segments rate immediately behind Segment C5 as good options for roadways. Segments C1 and C4 minimize impacts to Coastal Wetlands and maximize use of Transportation Corridors; however, these two segments are poor options for roadways due to high ratings for Streams and Demography.

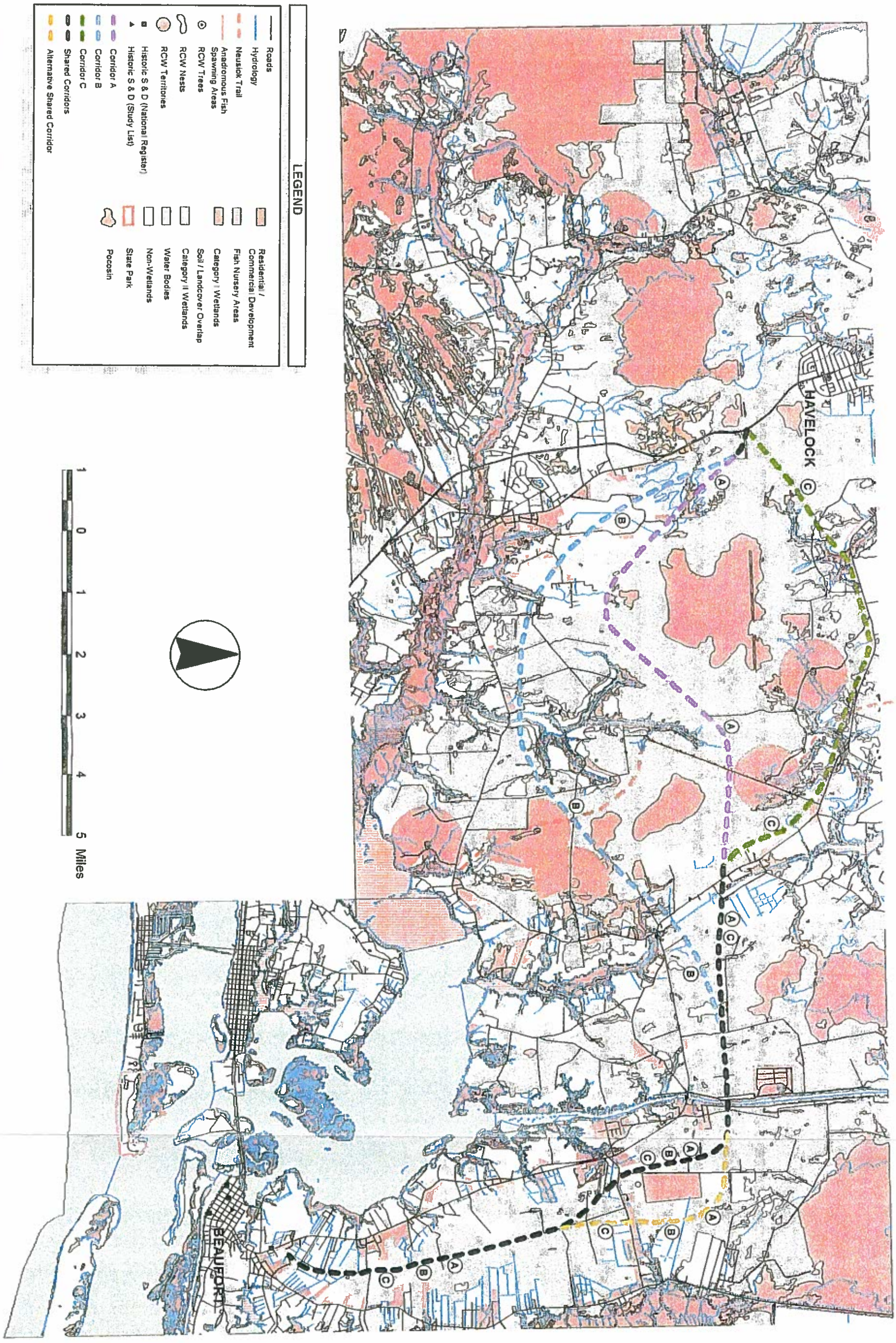
4.3 Selected Corridors

A total of 32 potential corridors were generated by combining segments across the three study area sections. A reduction in number of potential corridors was achieved by averaging combined segment ratings and choosing three corridors with low ratings. Corridor ratings resulting from the combination of segment ratings provide interesting results as high ratings of some sections are countered by low ratings of other sections. Each combination is ranked according to its overall suitability as a roadway corridor. Lower ratings indicate better suitability as roadway corridors. Conversely, higher ratings indicate poorer suitability as roadway corridors.

Table 4 provides a list of ratings and roadway suitability rankings for the 32 segment combinations (corridors) included in this study. Two nearly-identical corridors are essentially tied for the most feasible roadway alternative: Corridor A4/2-B1-C3 and A4/2-B1-C2 (ranked #1 and #2, respectively). The least feasible roadway alternative is Corridor A5-B2-C4.

A study of matrix analysis results reveals that Section A segments carry the most weight in determining the roadway suitability of corridors. Table 5 lists the highest-ranked corridor containing each of the Section A segments. The three corridors ranked highest are the selected corridors.

It was noted that substitution of Segment C2 for Segment C3 resulted in very minor scoring differences for the three highest rated corridors (less than .001 point difference). Segment C2 is also believed to be a reasonable and feasible alignment alternative from an environmental and engineering perspective. Therefore, Segment C2 alternatives have been identified for possible alignment consideration.



EcoScience Corporation

612 Wade Ave., Suite 200
Raleigh, North Carolina 27605
Ph: 919 828-3433 Fax: 919 828-3518

Client:
NC DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

Project:
COMPOSITE MAP
SELECTED CORRIDORS
U.S. 70 Feasibility Analysis
Carteret / Craven Counties, North Carolina

Date: MAY 1999
Scale: AS SHOWN
ESC Job #: 98-038

Figure 10

Table 4. Combined ratings and final ranks for the 32 possible segment combinations (corridors). Shading separates corridors by common Section A segments.

Corridor	Combined Rating	Rank	Corridor	Combined Rating	Rank
A1 B1 C1	0.353	23	A4/2 B1 C4	0.348	21
A1 B1 C2	0.319	6	A4/3 B2 C1	0.360	26
A1 B1 C3	0.318	5	A4/3 B2 C2	0.326	11
A1 B1 C4	0.359	25	A4/3 B2 C3	0.325	10
A2 B1 C1	0.356	24	A4/3 B2 C4	0.366	28
A2 B1 C2	0.322	9	A4/3 B3 C5	0.332	12
A2 B1 C3	0.321	8	A5 B2 C1	0.372	29
A2 B1 C4	0.362	27	A5 B2 C2	0.338	15
A3 B2 C1	0.372	29	A5 B2 C3	0.337	13
A3 B2 C2	0.338	15	A5 B2 C4	0.392	32
A3 B2 C3	0.337	13	A5 B3 C5	0.344	18
A3 B2 C4	0.378	31	A6 B2 C1	0.348	20
A3 B3 C3	0.344	18	A6 B2 C2	0.314	4
A4/2 B1 C1	0.342	17	A6 B2 C3	0.313	3
A4/2 B1 C2	0.308	2	A6 B2 C4	0.354	22
A4/2 B1 C3	0.307	1	A6 B3 C5	0.320	7

Table 5. Corridor designation, combined rating, and rank of the highest-ranked corridors containing each of the Section A segments. Selected corridors (bolded) are the three highest ranked from this pool. * Denotes alternatives for consideration.

Corridor	Combined Rating	Rank
A4/2 B1 C3	**0.307**	**1**
***(A4/2 B1 C2)**	**(0.308)**	**(2)**
A6 B2 C3	**0.313**	**3**
***(A6 B2 C2)**	**(0.314)**	**(4)**
A1 B1 C3	**0.318**	**5**
***(A1 B1 C2)**	**(0.319)**	**(6)**
A2 B1 C3	0.321	8
A4/3 B2 C3	0.325	10
A5 B2 C3	0.337	13
A3 B2 C3	0.337	13

Corridor A4/2-B1-C3

The matrix analysis ranked this corridor the highest overall. This corridor (Figure 10, Corridor A) meanders through Section A, utilizing disturbed land cover types (primarily agricultural land) to minimize impacts to high-quality features (coastal wetlands, protected species habitat, and Coastal Land Trust conservation easement). This corridor takes a direct route across Section B, extending down the middle of the Beaufort Peninsula, and avoids high-quality coastal wetlands, streams, primary fish habitat, and areas of human occupation. Substitution of Segment C3 with Segment C2 is a reasonable alternative for avoiding the Weyerhaeuser Research Study Area.

Corridor A6-B2-C3

This corridor (Figure 10, Corridor B) maximizes the use of non-jurisdictional areas in Section A, while minimizing impacts to national forest and natural heritage areas. This corridor takes a direct route across Section B, extending down the middle of the Beaufort Peninsula, and avoids high-quality coastal wetlands, streams, primary fish habitat, and areas of human occupation. Substitution of Segment C3 with Segment C2 is a reasonable alternative for avoiding the Weyerhaeuser Research Study Area.

Corridor A1-B1-C3

This corridor (Figure 10, Corridor C) maximizes the use of existing transportation corridors through Section A, while minimizing impacts to the national forest and natural heritage areas. The corridor takes a direct route across Section B, extending down the middle of the Beaufort Peninsula and avoids high-quality coastal wetlands, streams, primary fish habitat, and areas of human occupation. Substitution of Segment C3 with Segment C2 is a reasonable alternative for avoiding the Weyerhaeuser Research Study Area.

4.4 Engineering Feasibility of Selected Corridors

An engineering feasibility analysis was conducted of the selected corridors to determine viability of the alignments from a transportation safety perspective, and to provide estimated quantities for use in future right-of- way and cost estimates. It was determined that selected corridors meet transportation guidelines and NCDOT standards. All of the segments considered in this study are acceptable roadway alignments from an engineering perspective. Appendix D contains estimated preliminary quantities, a detailed segment breakout map, and typical roadway and bridge sections for the selected corridors.

5.0 SUMMARY

An environmental screening has been conducted to generate three potentially feasible roadway corridors for extension of US 70 between Havelock and Beaufort. The screening was based primarily on available information on file with NCDOT and CGIA, supplemented by file searches, comments from pertinent environmental resource agencies, and limited fieldwork.

These data were analyzed and grouped into themes of common significant environmental features, including: 1) development/transportation corridors; 2) Croatan National Forest; 3) physiography/soils; 4) land cover; 5) coastal management wetlands; and 6) unique natural resources. Features within each theme were subjectively ranked according to environmental values. Using a composite map of the highest-ranked study area features, a series of preliminary corridor segments were generated that minimize adverse environmental impacts.

Nine variables were determined to characterize environmental value in corridor segments including: 1) Coastal Wetlands; 2) Landscape; 3) Transportation Corridor; 4) National Forest; 5) Natural Heritage Areas; 6) Habitat Fragmentation; 7) Streams; 8) Demography; and 9) Total Length. A rating system utilizing these variables was developed and implemented to compare segments with each other, and then to compare corridors comprising various segment combinations.

This environmental screening resulted in the generation of a pool of 32 possible corridors. The rating system was used to select three feasible roadway corridors that minimize impacts to significant natural features (Figure 10). The three selected corridors vary in location from the proposed US 70 Havelock Bypass western terminus to the Clubfoot-Harlow Canal (Section A); however, remaining portions of the selected corridors (Section B from the Canal to the Intercoastal Waterway and Section C to north of Beaufort) share common ground. Avoidance of coastal wetlands, reduced impacts to significant natural areas and national forest lands, and minimization of areas of human occupation within the selected corridors are considerations which may allow for future consideration of these alternative routes in future roadway planning studies.

6.0 REFERENCES

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APPENDIX A

COMMENTS OF PROJECT PARTICIPANTS

Weyerhaeuser

P.O. Box 1391
New Bern, North Carolina 28563-1391
Tel (919) 633 7100

Dec. 11, 1998

Mr. David Modlin
NC DOT
Raleigh, NC

Dear Mr. Modlin:

Thank you for seeking Weyerhaeuser Co.'s. input on potential alignments of a highway to be built between Havelock and Morehead City and running through Beaufort. The comments included in this letter address the impacts of the preliminary study alignment on Weyerhaeuser Co.

1) The alignment in the vicinity of Newport, where it runs along the line between Weyerhaeuser and the USFS crosses a wetland area on which we have placed a conservation easement. This area is also included in the State Natural Heritage Inventory. A series of bridges would probably be necessary to mitigate the impact of the highway.

2) On the east side of the ICWW, the alignment comes much too close to an ongoing multi-stakeholder water quality/hydrology research study. Parties included in the study are NCSU, Duke Univ., Weyerhaeuser Co. and the National Council for Air and Stream Improvement. The alignment would need to be shifted a minimum of a quarter of a mile to the south and measures taken to have no impact on hydrology in the vicinity. This study is almost unique in that it has been ongoing for 10 years.

3) The alignment either eliminates or greatly affects access to several of our tracts of timberland on both sides of the waterway. The effect is that more than 10,000 acres of our land will be either left without access or the changes in access will significantly add to the hauling distance from these tracts to log markets. The alignment also splits portions of our holdings. The financial implications increased haul distances and management efficiency would be quite large and permanent.

Thank you again for this opportunity to provide input. I would be glad to discuss this further or visit the sites with you.

Sincerely,

Bob Emory

Bob Emory
Land Use Manager

North Carolina Department of Cultural Resources

James B. Hunt Jr., Governor
Betty Ray McCain, Secretary

Division of Archives and History
Jeffrey J. Crow, Director

January 26, 1999

MEMORANDUM

TO: David Modlin
Feasibility Studies
Division of Highways
Department of Transportation

FROM: David Brook
Deputy State Historic Preservation Officer

SUBJECT: US 70, new freeway from Havelock to Beaufort, Craven and Carteret Counties, ER 99-7954

Thank you for your letter of November 24, 1998, concerning the above project. We received additional information about the project at the December 11, 1998, meeting in New Bern. At your request, we are providing information on known cultural resources within the project study area.

We have conducted a search of our maps and files and have located the following structures of historical or architectural importance within the general area of the project:

Needham White House (CV 1204), southwest side of US 70, 0.7 mile southeast of junction with NC 101. This property is included on the state study list and has been determined to be eligible for listing in the National Register.

Clubfoot & Harlowe Creek Canal (CV 1338 & CR 565). This property is included on the state study list.

Rufus Bell House (CR 555), west side of NC 101, 0.6 mile north of junction with SR 1155, Harlowe vicinity. This property is included on the state study list.

Truss Bridge (CR 643), NC 101 over Harlowe Canal. This bridge was determined to be eligible for listing in the National Register but has subsequently been demolished.

Core Creek Bridge (CR 568), NC 101 over Intercoastal Waterway. This bridge was determined to be eligible for listing in the National Register but has subsequently been demolished.

Carteret County Home (CR 226), west side of NC 101, 0.2 mile north of SR 1170. This property is listed in the National Register.

Beaufort Historic District (CR 1). This property is listed in the National Register.

Since there has never been a comprehensive survey of historic architectural resources in Carteret County and Craven County was surveyed almost twenty years ago, there may be other properties of which we are unaware within the study area. Therefore, we recommend that an architectural survey be undertaken once project planning is initiated.

A review of our archaeological site files indicates that there are no apparent recorded sites within the immediate project area. However, little or no archaeological survey has been conducted in the area, and some portions of the corridor cross areas generally considered to have a high probability for both historic and prehistoric sites. Therefore, as planning progresses on the project, and the corridor is better defined, we recommend that the North Carolina Department of Transportation archaeologists conduct a more detailed review of the site potential.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763.

DB:slw

cc: Jerry McCrain, EcoScience Corp. 612 Wade Ave., Suite 200, Raleigh, 27605

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

January 29, 1999

IN REPLY REFER TO

Regulatory Division

Action ID No. 199900697, US 70 Environmental Screening Study, Carteret County, North Carolina.

Mr. David Modlin
Program Development
North Carolina Department of Transportation
Post Office Box 25201
Raleigh, North Carolina 27611-5201

Dear Mr. Modlin:

Reference the interagency meeting held on December 11, 1998, on the North Carolina Department of Transportation (NCDOT) environmental screening study for a new controlled access freeway from the Havelock Bypass to Beaufort, Carteret County, North Carolina.

The purpose of the environmental screening study is to evaluate the potential of a new freeway bypass of US 70 that would connect the Havelock Bypass to the proposed TIP project R-3307 at Beaufort. The study area is bounded on the north by NC 101, the south by Mill Creek Road and north of the Intracoastal Waterway by NC 101 on the west and US 70 on the east. Information provided prior to the meeting indicates that the study will address environmental concerns by compiling and analyzing all available environmental data to identify areas of environmental concern. Additionally, three new location alternatives that may have potential of being permitted will be developed.

The subject interagency meeting was the first of three meetings that will be held on the environmental screening study. The purpose and need of the proposed bypass project as you stated in the meeting is "There is a desire to construct a freeway from Havelock to Beaufort". It was further stated that the purpose of the interagency meetings is to help identify all environmentally sensitive areas and develop three freeway alternatives for the proposed Havelock-Beaufort Bypass project.

Although we commend the effort by NCDOT to address environmental concerns at an early stage, a purpose and need statement for the proposed project must be established prior to considering alternatives. The purpose and need statement should identify traffic needs and the purpose of a project to address the identified needs. Alternatives, including the upgrade of existing roadways, can then be identified that would meet the project purpose and need and can be evaluated based on the impacts to the natural and human environment.

Department of the Army (DA) permit authorization, pursuant to Section 404 of the Clean Water Act of 1977, as amended, will be required for the discharge of excavated or fill material in waters of the United States or any adjacent wetlands in conjunction with this project, including disposal of construction debris. Under our mitigation policy, impacts to wetlands should first be avoided or minimized. We will then consider compensatory mitigation for unavoidable impacts.

As you are aware, our permit program requires that we make a complete, thorough, and unbiased review of all factors associated with a proposed project that would result in the discharge of dredged or fill material into Waters of the United States, including wetlands. A major component of the review is the consideration of practicable alternatives, required by both the National Environmental Policy Act (NEPA) and the Clean Water Act (CWA) 404(b)(1) Guidelines (33 U.S.C. Section 1344(b); 40 CFR Part 230). The Clean Water Act requires that individual permit decisions be made only after a pubic interest review. Based on these requirements, we believe it is inappropriate for the Wilmington District to make any binding commitment concerning the selection of a single preferred alternative or comment on the likelihood of permit issuance or denial prior to going through the permit review process required by our regulations, found at 33 CFR part 325.

The District can, however, review, comment, and make recommendations to the initial planning review of study corridors with reference to potential Department of the Army permit concerns. Based on information provided at the subject meeting, it is likely that the proposed project will have significant environmental impacts and that a DA permit will be required. These impacts must also be addressed in environmental documentation as required by NEPA.

We recommend utilizing the procedures set forth in the interagency agreement to integrate Section 404 of the CWA with NEPA. This agreement provides a 12-step process for the purposes of improving coordination and efficiency of our operations, expedite construction of necessary transportation projects, enable more transportation projects to proceed on budget and on schedule, and improve the protection and enhancement of the waters of the United States.

Should you have any questions please contact me at (910) 251-4634.

Sincerely,

Dave Timpy
Regulatory Project Manager
Wilmington Field Office

Copies Furnished:

Mr. William D. Gilmore, P.E., Manager
Planning and Environmental Branch
Division of Highways
North Carolina Department of Transportation
Post Office Box 25201
Raleigh, North Carolina 27611-5201

Mr. John Dorney
Division of Water Quality
North Carolina Department of
Environment and
Natural Resources
4401 Reedy Creek Road
Raleigh, North Carolina 27607

Mr. Larry Hardy
National Marine Fisheries Service
Pivers Island
Beaufort, North Carolina 28516

Mrs. Kathy Matthews
Wetlands Section, Region IV
Water Management Division
United States Environmental Protection Agency
Atlanta Federal Center
61 Forsythe Street, SW
Atlanta, Georgia 30303

Mr. John Hefner, Field Supervisor
U.S. Fish and Wildlife Service
Fish and Wildlife Enhancement
Post Office Box 33726
Raleigh, North Carolina 27636-3726

Mr. David Cox
North Carolina Wildlife Resources Commission
512 N. Salisbury Street
Raleigh, North Carolina 27604-1188

Mrs. Debbie Bevins
State Historic Preservation Office
109 E. Jones Street
Raleigh, North Carolina 27601-2807

END

Copies Furnished:

Mr. William D. Gilmore, P.E., Manager
[redacted]

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

IN REPLY REFER TO

January 29, 1999

Regulatory Division

Action ID No. 199900697, US 70 Environmental Screening Study, Carteret County, North Carolina.

Mr. David Modlin
Program Development
North Carolina Department of Transportation
Post Office Box 25201
Raleigh, North Carolina 27611-5201

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NORTH CAROLINA
Coastal Land Trust

COPY

Main Office
720 Market Street
Wilmington, NC 28401
(910) 763-0332
Fax (910) 762-9486
mail nccoast@wilmington.net

Board of Directors

Dr. David Adams
Wilmington

John R. Baggett, III, MD
New Bern

Minnie Hunt
Sunset Beach

Nelson MacRae
Wilmington

Shelley S. Mastran
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Wilmington

Charles E. Roe
Raleigh

Carl Schmidt
Pine Knoll Shores

Pricey Taylor Harrison
Beaufort

John A.J. Ward
New Bern

J. Griffin Weld
Wilmington

New Bern Office

220 S. Front Street
P.O. Box 15451
New Bern, NC 28561
(252) 634-1927
Fax (252) 514-0051

Printed on recycled paper

March 16, 1999

Mr. David Modlin
North Carolina Department of Transportation
PO Box 25201
Raleigh, North Carolina 27611-5201

Dear Mr. Modlin:

RE: U.S. 70 Feasibility Study, Proposed Freeway from Havelock to Beaufort

The North Carolina Coastal Land Trust received the February 17th meeting minutes and the set of GIS maps associated with the subject project. We appreciate being dept apprised of progress on this feasibility study to date.

As we understand, the objective of the U.S. 70 Feasibility Study is to identify areas of environmental concern and to evaluate proposed corridors for a controlled access freeway linking Havelock and Beaufort. The general study area is located in Carteret County between U.S. 70 and N.C. 101. As you are aware, the Coastal Land Trust holds a 1,071 acre conservation easement around Walker's Millpond on Weyerhaeuser Corporation lands that is within the study area. Please note that this conservation easement is located on both sides of Mill Creek Road (S.R. 1154) which needs to be corrected on the GIS maps.

We discussed this project and the proposed highway corridors at our March 11, 1999 Board of Directors' meeting. We unanimously decided to voice our objection to all the proposed corridors that cross the Walkers Millpond conservation easement (corridors 4, 5 and 6 on the composite map). We are also very concerned about proposed corridors (corridors 2 and 3 on the composite map) that contribute to fragmentation of significant wetlands and wildlife habitats on the Croatan National Forest. The only alternative that seems palatable to us is proposed corridor 1, which primarily utilizes an existing alignment.

At a minimum, the Coastal Land Trust strongly encourages the North Carolina Department of Transportation to eliminate any alternatives that impact Walkers Millpond. In our opinion, Walkers Millpond stands out as a particularly significant resource within this region. The Millpond and its contiguous upland habitats are recognized by the State Natural Heritage Program as a significant natural area which consists of several natural community types including brackish marsh, cypress-gum swamp and mesic mixed hardwood forest. Together these communities provide habitat for: (1) several rare plant species including the

water spider orchid (*Habenaria repens*); (2) numerous uncommon bird species including the anhinga (*Anhinga anhinga*) and the Swainson's warbler (*Limnothlypis swainsonii*); and (3) important game species such as black bear (*Ursus americana*).

While the Coastal Land Trust is not an advocacy group and does not generally take a stand on highway projects, the conservation easement that we hold makes us and the hundreds of members of our organization very real parties in interest in this issue. It is worth noting that Weyerhaeuser and the Coastal Land Trust stand together in opposition to the project. We at the Coastal Land Trust believe that the proposed study area is a unique and environmentally sensitive region of our coast. As identified at the meetings and highlighted on your maps, this region has numerous natural resources of significance including endangered species habitats, relatively undisturbed wetlands, fish nursery areas, and large expenses of forested cover benefiting a myriad of wildlife species. While we can attest to the rapid growth in the area resulting in a real transportation problem, we hope that a solution can be found that does not simply follow the path of least resistance – a new road through undeveloped, but ecologically significant areas.

We appreciate the opportunity to provide input into this study. Please continue to keep us informed of future meeting.

Sincerely,

Michael Murchison

Michael Murchison
President

Camilla M. Herlevich

Camilla M. Herlevich
Director

cc: Mr. Jerry McCrain
Ecoscience Corporation
612 Wade Avenue, Suite 200
Raleigh, NC 27605

Mr. Bob Emory
Weyerhauser Corporation
PO Box 1391
New Bern NC 28563

Weyerhaeuser

P.O. Box 1391
New Bern, North Carolina 28563-1391
Tel (919) 633 7100

April 2, 1999

Dr. Gerald McCrain
EcoScience
612 Wade Ave.
Suite 200
Raleigh, NC 27605

Dear Dr. McCrain:

I apologize for the tardiness of these comments regarding the proposed freeway from Havelock to Beaufort. I hope they are not too late to be considered. I will keep them brief.

After reviewing the excellent maps you have produced and listening to the other parties involved, it appears to me that the only feasible alignment would parallel NC 101 to the maximum extent possible. The sensitive areas on the Croatan NF and the Weyerhaeuser/NC Coastal Land Trust easement adjacent to the Walker Mill Pond preclude a more southerly alignment.

In the vicinity of Weyerhaeuser's watershed study a separation of ¼ mile would probably work – preferably between the study and the Laurel Rd. More importantly, the drainage patterns in the vicinity must not be altered.

I would also encourage you consider the large blocks of contiguous forestland we own as significant wildlife habitat. There is ample data to support the high habitat value of commercially managed forests; particularly Weyerhaeuser's which are managed for sawlogs. This management regime includes lower sticking levels, longer rotations and one or more thinnings. The result is excellent habitat for both game and non-game species. The size of these forested areas alone is a habitat benefit which will be diminished if fragmented by a highway.

I was in the area the other day and observed that there is ample farmland adjacent to the Laurel Road, the Merrimon highway and some portions of NC 101 to accommodate much of the alignment.

Thank you for this opportunity to comment.

Sincerely,

Bob Emory

Bob Emory
Land Use Manager

APPENDIX B

N.C. DIVISION OF COASTAL MANAGEMENT
COASTAL WETLAND TYPE DESCRIPTIONS

NC Division of Coastal Management Wetland Type Descriptions

Salt/Brackish Marsh (w-type 1)
Any salt marsh or other marsh subject to regular or occasional flooding by tides, including wind tides (whether or not the tide waters reach the marshland areas through natural or artificial watercourses), as long as this flooding does not include hurricane or tropical storm waters. Coastal wetland plant species include: smooth cordgrass; black needlerush; glasswort; salt grass; sea lavender; salt marsh bullrush; saw grass; cattail; salt meadow cordgrass; and big cordgrass

Estuarine Shrub Scrub (w-type 3)
Any shrub/scrub dominated community subject to occasional flooding by tides, including wind tides (whether or not the tide waters reach the marshland areas through natural or artificial watercourses). Typical species include wax myrtle and eastern red cedar.

Estuarine Forested (w-type 15)
A forested wetland community subject to occasional flooding by tides, including wind tides (whether or not the tide waters reach the marshland areas through natural or artificial watercourses). Examples include pine-dominated communities with rushes in the understory or fringe swamp communities such as those that occur along the Albemarle and Pamlico sounds.

Maritime Forest (w-type 16)
A forested community characterized by its stunted growth due to the stresses imposed by its proximity to salt spray from the ocean. Typical vegetation includes live oak, red maple and swamp tupelo.

Freshwater Marsh (w-type 2)
Herbaceous areas that are flooded for extended periods during the growing season. Included are marshes within lacustrine systems, managed impoundments, some Carolina Bays, and other non-tidal marshes (i.e. marshes which do not fall into the Salt/Brackish Marsh category). Typical communities include species of sedges, millets, rushes and grasses that are not specified in the coastal wetland regulations. Also included are giant cane, arrowhead, pickeralweed, arrow arum, smartweed, and cattail

Pocosin (w-type 4)
Palustrine scrub/shrub communities (i.e. non-Estuarine Scrub/Shrub) dominated by evergreen shrubs, often mixed with pond or loblolly pines. Typically occur on saturated, acid, nutrient poor, sandy or peaty soils; usually removed from large streams; and subject to periodic burning.

Bottomland Hardwood or Riverine Swamp Forest (w-type 6, 7)
Riverine forested or occasionally scrub/shrub communities usually occurring in floodplains, that are semi-permanently to seasonally flooded. In bottomland hardwood systems, typical species include oaks (overcup, water, laurel, swamp chestnut), sweet gum, green ash, cottonwoods, willows, river birch, and occasionally pines. In swamp forest systems, typical species include cypress, black gum, water tupelo, green ash and red maple.

Depressional Swamp Forest (w-type 7)
Very poorly drained non-riverine forested or occasionally scrub/shrub communities which are semi-permanently or temporarily flooded. Typical species include cypress, black gum, water tupelo, green ash and red maple.

Headwater Swamp (w-type 17)
Wooded, riverine systems along first order streams. These include hardwood dominated communities with soil that is moist most of the year. Channels receive their water from overland flow and rarely overflow their own banks.

Hardwood Flat (w-type 9)
Poorly drained interstream flats not associated with rivers or estuaries. Seasonally saturated by high water table or poor drainage. Species vary greatly but often include sweet gum and red maple.

Pine Flat (w-type 10)
Palustrine, seasonally saturated pine communities on hydric soils that may become quite dry for part of the year. Generally occur in flat or nearly flat areas that are not associated with a river or stream system. Usually dominated by loblolly pine. This category does not include managed pine systems.

Managed Pineland (w-type 11)
Seasonally saturated, managed pine forests (usually loblolly pine) occurring on hydric soils.
This wetland category may also contain non-managed pine forests occurring on hydric soils. Generally, these are areas that were not shown on National Wetland Inventory maps. These areas may or may not be jurisdictional wetlands.

Human Impacted Area (w-type 40)
Areas of human impact have physically disturbed the wetland, but the area is still wetland. Impoundments and some cutovers are included in this category, as well as other disturbed areas, such as power lines.

Drained Wetland (w-type 21-37)
Any wetland system described above that is, or has been, partially drained/ditched according to the US Fish & Wildlife Service's National Wetland Inventory maps.

Cleared Wetland (w-type 41-57)
Areas of hydric soils for which satellite imagery indicates a lack of vegetation in *both* 1988 *and* 1994. These areas are likely to no longer be wetlands.

Cutover Wetland (w-type 61-77)
Areas for which satellite imagery indicates a lack of vegetation in 1994. These areas are likely to still be wetlands, however, they have been recently cut over. Vegetation in these areas may be regenerating naturally, or the area may in use for silvicultural activities.

Wetland Modifier Explanation:
Drained: add 20 to w-type (e.g., drained hardwood flat = 29)
Cleared: add 40 to w-type (e.g., cleared pocosin = 44)
Cutover: add 60 to w-type (e.g., cutover pine flat = 70)
Note that these modifiers are not applicable to Managed Pine and Human Impacted wetland types.

APPENDIX C

CALCULATION OF VARIABLE RATINGS

CALCULATION OF VARIABLE RATINGS

The rating system allows for a comparison of segments within a section. For ease of comparison, variable ratings range from 0.0 to 1.0. High ratings (closer to 1.0) indicate high environmental values, which translate to poor options for roadways. Conversely, low ratings (closer to 0.0) indicate low environmental values, which translate to better options for roadways.

Two types of ratings are used in this analysis: absolute and scaled. Six variables receive absolute ratings (Coastal Wetlands, Landscape, Transportation Corridor, National Forest, Natural Heritage Areas, and Habitat Fragmentation). An absolute rating for a segment variable is independent of the status of other segments in the section. For instance, the Coastal Wetland rating for one segment is independent of the Coastal Wetland rating for any other segment. This absolute rating depicts the status of wetlands only within the segment in question.

Three variables receive scaled ratings (Streams, Total Length, and Demography). Scaled ratings compare segments within a section. A scaled rating for a segment variable is dependent on the status of that variable in compared segments. To use the Streams variable as an example: within a section, the segment with the greatest stream impacts receives a rating of 1.0, while the segment with the least stream impacts receives a rating of 0.0. Remaining segments within the same section with intermediate stream impacts receive ratings between 1.0 and 0.0.

Variables with Absolute Ratings

Ratings for these variables (Table 3 in the main body of this document) were determined as follows. Total length (in miles) was determined for each segment. Using the theme maps, total lengths (in miles) were determined through the high-value categories (red areas) and the intermediate-value categories (yellow areas) of that theme. These measurements are provided in Table C1. High-value categories are worth 1.0 point per mile, while intermediate-value categories are worth 0.5 point per mile. The following equation was then used to calculate the variable rating:

$$Y\ (1.0) + Z\ (0.5)\ /\ X = \text{variable rating}$$

where: X = linear distance (in miles) of the segment
Y = linear distance (in miles) the segment travels through red areas
Z = linear distance (in miles) the segment travels through yellow areas

Table C1. Linear measurements (in miles) used to determine absolute ratings for six variables. Measurements are given for high quality areas (red), intermediate-quality areas (yellow), and transportation corridors (green) as depicted by theme mapping (Figures 2-7). Measurements for Habitat Fragmentation are linear distances through natural habitats.

		Coastal Wetlands		Land Cover		Physiography Soils		Land Cover/ Soils	Trans. Corridor	Habitat Fragmentation	National Forest		Natural Heritage Areas	
Segment	Total Length	Red	Yellow	Red	Yellow	Red	Yellow	Red	Green	Natural Habitats	Red	Yellow	Red	Yellow
A1	8.9	0.7	5.4	0.8	7.2	0.6	6.6	0.4	5.8	7.8	1.3	3.9	0.0	0.6
A2	7.6	0.1	7.1	0.1	6.4	0.1	7.4	0.0	0.5	7.3	6.4	0.3	2.1	2.0
A3	8.4	0.2	7.6	0.5	7.3	0.1	8.1	0.0	0.5	7.7	6.2	0.3	3.3	0.8
A4/2	9.1	0.0	7.4	0.8	6.4	0.9	7.9	0.6	0.5	7.3	4.5	1.0	1.9	0.4
A4/3	10.0	0.2	8.1	1.1	6.6	0.9	8.2	0.6	0.5	7.8	4.5	1.0	1.9	0.4
A5	9.0	0.7	5.9	0.9	6.6	1.6	6.4	0.7	0.5	7.5	1.7	3.8	0.0	2.6
A6	10.6	0.6	6.6	0.3	7.5	1.3	7.3	0.0	2.2	7.5	2.1	0.6	0.4	0.4
B1	3.2	0.0	2.3	0.6	1.2	0.0	3.2	0.0	0.4	1.4	0.0	0.0	0.0	0.0
B2	2.9	0.0	2.6	0.5	1.9	0.0	2.9	0.0	0.4	2.3	0.0	0.0	0.0	0.0
B3	2.9	0.2	1.5	0.0	1.4	0.0	2.4	0.0	2.9	1.7	0.0	0.0	0.0	0.0
C1	9.4	0.1	4.2	0.9	3.4	0.1	8.7	0.1	4.9	3.9	0.0	0.0	0.0	0.0
C2	8.7	0.0	5.9	0.5	4.1	0.1	8.2	0.0	0.4	4.1	0.0	0.0	0.0	0.0
C3	8.2	0.0	5.3	0.6	3.8	0.0	8.1	0.0	0.4	4.4	0.0	0.0	0.0	0.0
C4	7.7	0.6	3.1	1.1	1.9	0.0	6.5	0.1	5.0	2.7	0.0	0.0	0.0	0.0
C5	7.1	0.0	5.3	0.6	3.1	0.0	7.1	0.0	1.1	3.8	0.0	0.0	0.0	0.0

According to this equation, if the segment passes entirely through high-quality (red) areas, the variable will receive the highest rating possible (1.0); if the segment passes entirely through intermediate-quality (yellow) areas, the variable rating will be 0.5; and if the segment passes entirely through low-quality (green or white) areas, the variable will receive the lowest rating possible (0.0). Calculation of the Coastal Wetlands rating for Segment A1 is provided here as an example. The segment is 8.9 miles long and passes through 0.7 mile of high-quality coastal wetlands (red areas) and 5.4 miles of intermediate-quality coastal wetlands (yellow areas). The variable rating equation appears as follows:

$$(0.7 \text{ miles})(1.0) + (5.4 \text{ miles})(0.5) / 8.9 \text{ miles} = 0.38$$

Again, this variable rating is considered absolute because the value is independent of the values of other segments in the comparison.

Use of the absolute rating equation for the Transportation corridor variable initially provides a rating that indicates a better option for a roadway with higher values and a poorer option with lower values. Since these rating results are reverse indicators of suitability relative to other variables that use the absolute rating equation, Transportation corridor ratings have been inverted to accurately reflect values prior to use in the determination of overall ratings.

Variables with Scaled Ratings

Three variables have scaled ratings: Streams, Total Length, and Demography. Ratings for each variable (see Table 3 in the main body of the this document) were determined in a slightly different manner.

Data used in computing the **Streams** variable includes: number of streams crossed by an segment, level of disturbance of crossed streams, number of streams designated as fish nursery areas, and number of streams designated anadromous fish spawning habitat (Table C2). Within each segment, stream crossings were weighted based on level of disturbance: 1.0 point was assigned for each crossing of a stream through relatively undisturbed habitat, and 0.5 point was assigned for each crossing of a heavily-disturbed stream. Heavily-disturbed streams are typically channelized and occur in areas maintained for agriculture or silviculture. A crossing of a stream designated as a fish nursery area receives an additional 1.0 point, and a crossing of a stream designated as anadromous fish spawning habitat also receives an additional 1.0 point. Total number of points for each segment were then used to generate a comparative rating of segments within each section. The segment with the highest point total was assigned a Streams rating of 1.0; conversely, the segment with the

Table C2. Data used to determine scaled ratings for three variables. Stream and Total Length data were taken from theme mapping (Figures 7 and 8). The source of Demography data is 1 inch = 800 feet scale aerial photography, from which residential, commercial, educational, and industrial structures affected by alignments were counted.

	Streams					Total Length		Demography	
Alignment	Crossings	Nursery Areas	Anadromous Spawning	Total	Variable Rating	Length	Variable Rating	Structures	Variable Rating
A1	4.5	0	1	5.5	1.00	8.9	0.43	0	0
A2	0	0	0	0	0.00	7.6	0.00	0	0
A3	0	0	0	0	0.00	8.4	0.27	0	0
A42	1.0	0	0	1.0	0.18	9.1	0.50	0	0
A43	1.0	0	0	1.0	0.18	10.0	0.80	0	0
A5	3.0	0	0	3.0	0.54	9.0	0.47	0	0
A6	2.5	0	0	2.5	0.45	10.6	1.00	0	0
B1	0	0	0	0	0.00	3.2	0.00	0	0
B2	0	0	0	0	0.00	2.9	0.00	0	0
B3	2.0	0	0	2.0	1.00	2.9	0.00	0	0
C1	4.5	0	0	4.5	0.53	9.4	1.00	208	1.00
C2	0	0	0	0	0.00	8.7	0.70	4	0.00
C3	0	0	0	0	0.00	8.2	0.48	12	0.04
C4	5.5	3	0	8.5	1.00	7.7	0.26	124	0.61
C5	0	0	0	0	0	7.1	0.00	8	0.02

lowest point total was assigned a Streams rating of 0.0. Segments with point totals in between were assigned scaled Streams ratings based on the following equation:

$$X / Y = \text{variable rating}$$

where: X = point total of the specific segment being rated
Y = point total of the segment with the highest point total of the section

For example, within Section A, Segment A1 has the highest Streams point total (4.5). Therefore, Segment A1 receives a Streams rating of 1.0. Segment A5 has a Streams point total of 3.0, and using the previous equation, the variable rating is calculated as follows:

$$3.0 / 4.5 = 0.54$$

The Streams rating is scaled to reflect the stream status of a segment relative to the stream status of other segments in a section. The Streams value rating of a segment is completely dependent on the stream status of other segments in the comparison. A notable factor concerning the Streams variable is that neither the Clubfoot-Harlowe Canal nor the Atlantic Intracoastal Waterway were considered in the calculations of this variable as they equally affect all corridors.

The **Total Length** variable provides a rating that compares lengths of segments within a section. Total lengths (in miles) were measured for each segment. Within each section, the range between the longest and shortest segments was determined, and the proper differential length was assigned to each segment. The longest segment receives a Total Length variable rating of 1.0, and the shortest segment receives a Total Length variable rating of 0.0. The same rating equation used for Streams was then employed to determine Total Length ratings for segments with intermediate lengths as follows:

$$X / Y = \text{variable rating}$$

where: X = differential length (in miles) of the segment being rated
Y = differential length (in miles) of the longest segment

For instance, within Section C, Segment C1 is longest at 9.4 miles and Segment C5 is shortest at 7.1 miles, resulting in a total differential length of 2.3 miles. Each other segment within the section is assigned a differential length between 0 miles (variable rating of 0.0 for Segment C5) and 2.3 miles (variable rating of 1.0 for Segment C1). The total length of

Segment C2 is 8.7 miles, resulting in a differential length of 8.7 miles - 7.1 miles = 1.6 miles. Thus, the variable rating is calculated for Segment C2 as follows:

$$1.6 / 2.3 = 0{,}70$$

The **Demography** rating provides a simplistic means to compare the impact of segments on areas developed for residential, educational, commercial, and industrial uses. Aerial photography (photo date of January 1998, scale: 1 inch = 800 feet) was used to estimate the number of structures currently under the aforementioned land uses directly impacted by each segment. Based primarily on a study of aerial photographs used for this study, it appears that direct impacts on study area demography are primarily limited to Section C. Estimated number of structures impacted by each segment are listed in Table C2, with one exception. Segment C1 impacts an estimated 108 inhabited structures; however, one of the structures is East Carteret High School, located at the intersection of US 70 and Merrimon Road (SR 1300) on the east side of the Beaufort Peninsula. To increase the rating weight for the presence of this school, the estimated number of structures impacted by Segment C1 was increased by a total of 100, resulting in Segment C1 receiving the highest Demography rating (1.0). Demography ratings for other Section C segments were calculated using the same method used for Total Length. Segment C1 has the highest number of structures (208), and Segment C2 has the lowest number of structures (4), and therefore a Demography rating of 0.0. Appropriate differential values were assigned to each segment and used for the determination of the variable rating.

The calculation of the Demography rating for Segment C3 is provided here as an example. Segment C3 may directly impact 12 structures. The differential value for Segment C3 is 12 - 4 = 8, so the Demography rating of Segment C3 is calculated as follows:

$$8 / 208 = 0.04$$

Segment Ratings

Segment ratings are provided in Table 3 of the main body of this document. Segment ratings are achieved by combining all variable ratings for a segment, each weighted to reflect importance to the decision-making process for permit approval, as well as potential adverse environmental effects. Weighting of each variable occurs through the use of a multiplication factor (multiplier). For this study, multipliers range from 1X to 5X for the nine variables: Coastal Wetlands (5X), Streams (5X), National Forest (4X), Natural Heritage Areas (3X), Transportation Corridors (3X), Habitat Fragmentation (3X), Demography (2X), Landscape (1X), and Total Length (1X). Justification for assigned multipliers is provided in Section

4.2.2.2. The weighted variable ratings for each segment are totaled and divided by the sum of the multipliers to determine a segment rating between 0.0 and 1.0. The sum of the nine variable multipliers is 27. The calculation of the segment rating for Segment A1 is provided here as an example using the variable ratings in order listed in Table 3 (from the main body of the document:

$$(0.38)(5) + (0.31)(1) + (0.35)(3) + (0.36)(4) + (0.03)(3) + (0.88)(3) + (1.00)(5) + (0.00)(2) + (0.43)(1)/27 = 0.48$$

APPENDIX D

PRELIMINARY ENGINEERING ESTIMATES FOR SELECTED CORRIDORS

KO & ASSOCIATES, P.C.
Consulting Engineers

May 12, 1999

Mr. Jerry McCrain, Ph. D., CEP
612 Wade Avenue, Suite 200
Raleigh, North Carolina 27605

Re: Environmental Feasibility Study
US 70 New Location Corridor
Havelock to Beaufort
Craven - Carteret Counties
ESTIMATE OF MAJOR QUANTITIES

Dear Jerry:

Attached for your use, please find one copy of our estimate of preliminary quantities, detailed segment breakout map, and typical roadway and bridge sections for your use in obtaining a cost and R/W estimate from NCDOT. Please note that the streams were all considered to be bridged using the minimum bridge lengths required for a standard crossing. The R/W width and proposed typical section were coordinated with what TGS Engineers have proposed to use on the Havelock Bypass.

If you have any questions, please do not hesitate to call.

Sincerely,
Ko & Associates, P.C.

Warren F. Lamb, PE
Senior Transportation Engineer

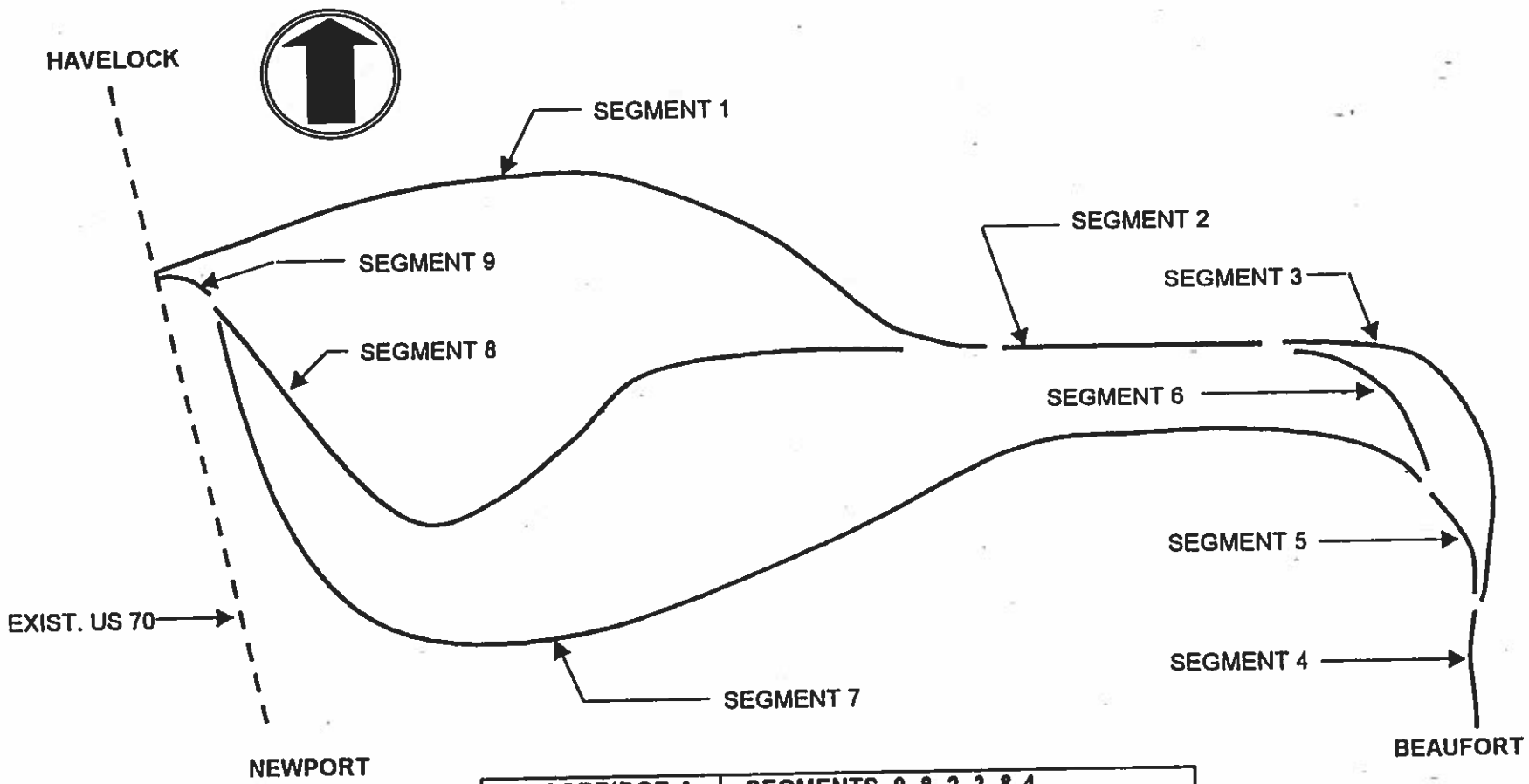
Attachments

1011 Schaub Dr., Suite 202 • Raleigh, NC 27606 • Phone: 919-851-6066 • Fax: 919-851-6846

PRELIMINARY ESTIMATE OF MAJOR QUANTITIES
FOR
US 70 NEW LOCATION CORRIDOR
TIP I.D. NO. FS-9902C
PROJECT NO. 6.401071
CARTERET & CRAVEN COUNTIES

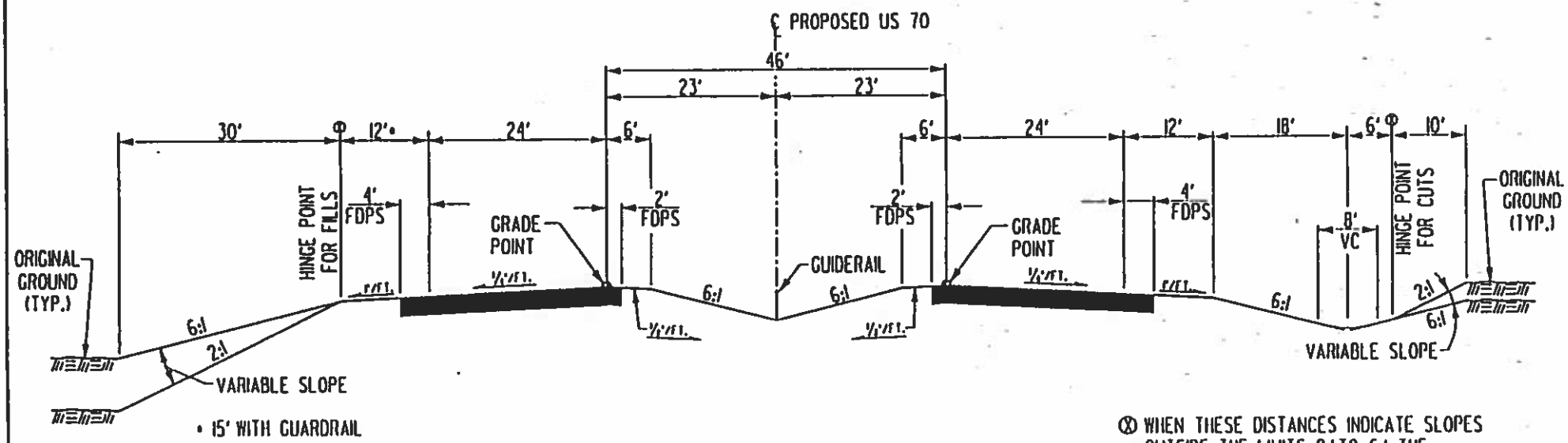
CORRIDOR SEGMENT	LENGTH (IN MILES)	ESTIMATED R/W WIDTH (FT)	STRUCTURES AT STREAM CROSSINGS	INTERCHANGE TYPE & STRUCTURES
1	8.8	300 '	2 @ 40' x 100' - STREAM 2 @ 40' x 100' - STREAM 2 @ 40' x 80' - STREAM	@ EXIST US 70 / DIAMOND / 2 BRIDGES @ 40' x 180'
2	4.5	300 '	2 @ 40' x 140' - HARLOWE CANAL 2 @ 40' x 300' - INTRACOASTAL WATERWAY	@ NC 101 / HALF-CLOVER / 2 BRIDGES @ 40' x 140'
3	3.2	300 '		@ SR 1163 / DIAMOND / 2 BRIDGES @ 40' x 140'
4	4.6	300 '		@US 70 (R-3307) / TRUMPET WITH TWO FLYOVERS 1 @ 26' x 370' ; 1 @ 32' x 780'
5	1.2	300 '		@ SR 1163 / DIAMOND / 2 BRIDGES @ 40' x 140'
6	1.7	300 '	2 @ 40' x 140' - HARLOWE CANAL 2 @ 40' x 80' - STREAM 2 @ 40' x 300' - INTRACOASTAL WATERWAY	
7	14.4	300 '	2 @ 40' x 80' - STREAM 2 @ 40' x 100' - STREAM 2 @ 40' x 600' - WALKER'S MILL POND 2 @ 40' x 140' - HARLOWE CANAL 2 @ 40' x 80' - STREAM 2 @ 40' x 300' - INTRACOASTAL WATERWAY	@ NC 101 / HALF-CLOVER / 2 BRIDGES @ 40' x 140'
8	7.8	300 '	2 @ 40' x 80' - STREAM	
9	0.4	300 '		@ EXIST US 70 / DIAMOND / 2 BRIDGES @ 40' x 180'

MAP OF CORRIDOR SEGMENTS
FOR
ENVIRONMENTAL SCREENING STUDY
US 70 NEW LOCATION CORRIDOR
TIP I.D. NO. FS-9902C
PROJECT NO. 6.401071
CARTERET & CRAVEN COUNTIES



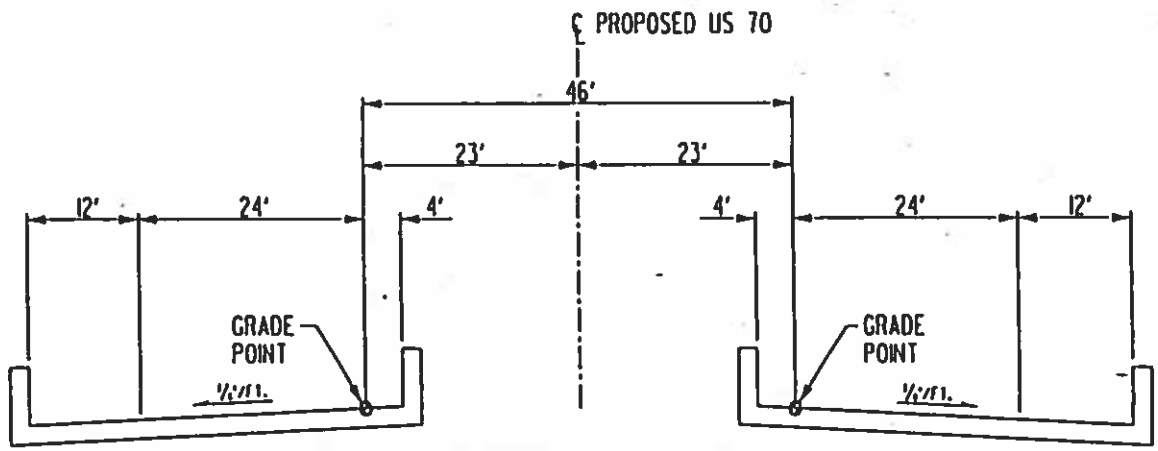
CORRIDOR A -	SEGMENTS 9, 8, 2, 3, & 4
CORRIDOR B -	SEGMENTS 9, 7, 5, & 4
CORRIDOR C -	SEGMENTS 1, 2, 6, 5, & 4

ENVIRONMENTAL SCREENING STUDY
US 70 NEW LOCATION CORRIDOR
TIP I.D. NO. FS-9902C
PROJECT NO. 6.401071
CARTERET & CRAVEN COUNTIES



⊗ WHEN THESE DISTANCES INDICATE SLOPES OUTSIDE THE LIMITS 2:1 TO 6:1, THE DISTANCE BECOMES VARIABLE AND THE MAXIMUM OR MINIMUM SLOPE MAINTAINED.

US 70 ROADWAY SECTION



US 70 STRUCTURE SECTION