portion of the flow through the inlet. The channel centerline station where the volume remaining to be dredge is equal to 200,000 cubic yards is 23+00. The station where pumping into the existing channel would begin is located in the existing ebb channel that swings past Island 2 (Figure 9.1). Therefore, the new channel would be completely open to the sea while the construction of the channel is completed across the shoals located between Island 2 and the Bogue Banks sand spit.

**10. ALTERNATIVES TO THE PROPOSED PLAN:** In addition to the without project alternative, which is addressed in the following section, alternatives to the channel relocation project considered include:

a. Stabilization of The Pointe Shoreline with a permanent hard structure.
b. Suspension of the COE channel maintenance activities in the existing channel.
c. Channel relocation without beach nourishment.
d. Long-term Inlet Sand Management Strategies.

A brief discussion of each of these alternatives follows.

**10.1. Hard Structure**. The use of hard structures such as groins, jetties, and/or revetments to protect The Pointe shoreline is not a reasonable or feasible alternative given the State of North Carolina's coastal management regulations that prohibit such structures. Accordingly, details of this alternative were not developed.

**10.2. Suspension of COE Channel Maintenance**. The COE has been using shallow draft sidecast dredges to maintain the authorized 8-foot mlw by 150-foot wide channel since 1981. During each maintenance operation, the dredging activities are restricted to the deepwater channel that exists at the time of project implementation. As a result, the maintenance dredging is not capable of maintaining a fixed channel alignment and the channel has continually migrated to the east during the maintenance dredging period. If channel maintenance was suspended in the hopes that a new channel would breach through the middle of the interior shoal nothing in the historic record of the inlet's evolution suggests this would occur. A new channel will likely breach through the middle of the inlet at some time in the future with or without maintenance. However, given the immediacy of the erosion problem at The Pointe, waiting for the channel to naturally reposition itself will result in continued erosion and damage to the development and infrastructure at The Pointe. Therefore, suspension of the maintenance dredging activities would not reduce or eliminate the existing erosion threat and is therefore not a reasonable alternative.

**10.3. Channel Relocation without Beach Nourishment**. In the interest of rapidly reestablishing the lost intertidal habitat that will accompany the repositioning of the inlet channel, consideration was given to stockpiling the dredged material during the channel relocation and transferring the stockpiled material into the existing channel once the channel is completed. This alternative would also include the construction of a sand dike across the existing channel. Areas where the dredged material could be stockpiled include the existing Bogue Banks sand spit and the shoal area located between the new

channel and the existing channel. The available dry land area on the spit totals about 900,000 square feet. Stockpiling 850,000 cubic yards in this area would result in a mound approximately 30 feet high. Stockpiling the material in the shoal area would create some additional problems with material being transported out of the stockpile area by tidal currents. This could possibly be overcome with the construction of a temporary sandbag dike around the stockpile area, but this would add substantially to the cost of the project. The area that could be used to stockpile the material has a surface area of approximately 2,000,000 square feet. Stockpiling 850,000 cubic yards in this area would create a mound approximately 15 feet high. The material could be stockpiled using a combination of the spit area and shoal area, which would reduce the height of the stockpile to about 10 feet.

This alternative would result in substantial damage to the habitat on the existing sand spit and the intertidal shoals, which would offset any accelerated recovery of the intertidal habitat loss as a result of the channel relocation. The amount of intertidal shoal that would be disturbed by the relocation of the channel be 2.8 million square feet (64 acres). Also, the need for beach nourishment material would still exist for the west end of Emerald Isle resulting in the Town of Emerald Isle using the offshore borrow area for this segment of their beach nourishment project. Accordingly, channel relocation without beach nourishment is not a reasonable alternative to the proposed channel relocation/beach nourishment project.

**10.4. Inlet Sand Management**. The only effective way to permanently control the location of the inlet channel is through a dedicated program of channel maintenance with the material removed from the channel distributed to the adjacent islands. However, the existing 8-foot mlw authorized depth for the inlet channel would not allow ocean certified pipeline dredges (the type of plant necessary to accomplish the work) to routinely maintain the channel given the minimum digging depths of this type of equipment is 12 feet. Increasing the authorized depth in Bogue Inlet would require detailed studies by the COE and Congressional authorization for the channel improvements. The process for obtaining approval for a deeper channel would take several years with the timeline beginning once Congress authorizes the COE to conduct a feasibility study. Such a study has not been authorized nor is authority for such a study being pursued by the COE. Given the immediacy of the erosion threat to development at The Pointe, waiting to gain approval for a deeper channel and associated sediment management is not an option that would address the present needs of the Town of Emerald Isle.

The COE is conducting a feasibility study for long-term storm damage reduction for Bogue Banks and will consider Bogue Inlet as a possible source of beach nourishment material for portions of the Island's shoreline. If the COE elects to use Bogue Inlet as a source of beach nourishment material and concentrates its activities along the channel corridor, the position of the channel could be stabilized. Any consideration of the inlet as a source of beach nourishment material will have to include sand management strategies that will distribute material to both Bogue Banks and Bear Island. The COE is not scheduled to complete the feasibility study for at least two more years with construction

delayed for several more years while final plans are prepared, environmental clearances obtained, and all of the necessary requirements of local cooperation satisfied. Accordingly, the Bogue Banks storm damage reduction project may offer some means to maintain the position of the Bogue Inlet channel in the future but will not be done in time to provide any immediate relief for The Pointe.

**11. NO ACTION ALTERNATIVES:** Easterly migration of the inlet shoreline began in February 1984 and continues today.

Two alternatives were evaluated for the without project condition. The first alternative (No Action – Alternative No. 1) assumed that the inlet shoreline would continue to migrate at a rate of sixty feet/year to the east over a period of ten years. Under this alternative, a structure would be lost to erosion once the inlet shoreline reaches its foundation. When this occurs, the structure would be abandoned and demolished by its owner. The second alternative (No Action – Alternative No. 2) assumed that sandbag revetments would be constructed to protect buildings and roads once they become threatened. The State of North Carolina considers a structure to be threatened once the erosion encroaches within 20 feet of its foundation. In the case of a road, the threatened status begins when erosion reaches the right-of-way. State rules allow temporary sandbags protecting buildings to remain in place for a period of two years after which they must be removed. Sandbag structures constructed to protect roads are allowed to remain in place for five years after which they must be removed. In practice, the State has granted some extensions of the two year and five year rules, particularly if a long-term protection plan is being formulated. However, for the without project analysis, the assumption was made that no long-term plans are being considered and that the sandbags must be removed at the end of their permit period. Both alternatives assumed that the existing sandbag revetments protecting The Pointe shoreline, which have essentially reached the end of their permit periods, would be removed at the beginning of the analysis.

A third alternative has been suggested that would involve the removal of threatened structures. However, in this situation, the eastward movement of the inlet shoreline not the landward movement of the ocean shoreline is threatening structures. As a result, there is no opportunity to relocate structures farther back on their existing lots. The option of relocating the threatened structures to other lots in The Pointe subdivision is also not available as there are currently only five vacant lots available and these vacant lots will be threatened during the next ten years under existing conditions. Accordingly, the only option would be to remove the buildings from The Pointe subdivision with most structures having to be relocated to sites completely off Bogue Banks. The economic impact on Emerald Isle would be essentially the same for structures removed from the island or lost to erosion; therefore, the abandonment/relocation alternative was not evaluated.

The projected 10-year shoreline position for the 60-foot/year erosion rate is shown on Figure 11.1. The base shoreline used for this projection is shown in red and generally follows the July 2002 vegetation line.

The evaluation of the economic impact of the without project alternatives included damage to real property including cleanup cost once a structure is lost, damage to infrastructure (roads and public utilities), construction of temporary access roads to isolated structures, loss of tax revenues for both the Town of Emerald Isle and Carteret County, and the reduction in household spending associated with the lost homes. In the case of Alternative No. 2, the total cost of providing temporary sandbag structures (construction, maintenance, and removal costs) was also included. Since the Town of Emerald Isle plans to provide beach nourishment along the west end of its shoreline, the cost of nourishing the 20,500 feet of beach using an offshore sand source was added to the economic losses associated with the erosion of the inlet shoreline in order to obtain a full measure of the total economic impact of the without project condition.

Table 11.1 provides a summary of the damages and economic impact to Emerald Isle and Carteret County for Alternative No. 1 in 2-year increments. Table 11.2 includes the estimated $5.8 million for nourishing the west end of Emerald Isle from an offshore sand source.

**Table 11.1**
**Summary of Damages and Impact on Local Economy**
**No Action - Alternative No. 1**
**Continued Inlet Shoreline Erosion Over the Next 10 Years**

| Year | Cumulative Present Worth Damages [(1)] | Cumulative Present Worth Lost Taxes Town & County | Cumulative Present Worth Reduction in Household Spending | Total Present Worth Economic Impact |
|---|---|---|---|---|
| 2 | $1,600,400 | $20,500 | $249,400 | $1,870,300 |
| 4 | $4,617,700 | $61,600 | $604,100 | $5,283,400 |
| 6 | $6,670,400 | $128,100 | $1,164,900 | $7,963,400 |
| 8 | $8,804,500 | $218,400 | $1,884,200 | $10,907,100 |
| 10 | $11,492,800 | $337,600 | $2,763,100 | $14,593,500 |

[(1)]Includes lost structures, damage to infrastructure, and temporary access roads.

**Table 11.2**
**Total Costs for No Action – Alternative No. 1**
**Including Offshore Nourishment Cost for the West End of Emerald Isle**

| Year | Total Present Worth Damages & Economic Impact Plus Offshore Dredging Costs |
|---|---|
| 2 | $ 7,670,300 |
| 4 | $ 11,083,400 |
| 6 | $ 13,763,400 |
| 8 | $ 16,707,100 |
| 10 | $ 20,393,500 |

Once the existing sandbags are removed from The Pointe shoreline, five structures would immediately fall victim to the inlet shoreline erosion. At the end of the first two years of the analysis, a total of seven structures would be destroyed. Over the ten year analysis period, thirty-six structures would be lost along with all of Bogue Court, Inlet Court, and a considerable portion of Inlet Drive.

Future damages and economic impacts to Emerald Isle and Carteret County for Alternative No. 2 are summarized in Table 11.3 with the total economic impact, including beach nourishment from an offshore sand source, provided in Table 11.4.

**Table 11.3**
**Summary of Damages and Impact on Local Economy**
**Without Project Condition - Alternative No. 2**
**Temporary Sandbags**

| Year | Cumulative Present Worth Damages [1] | Cumulative Present Worth Lost Taxes Town & County | Cumulative Present Worth Reduction in Household Spending | Total Present Worth Economic Impact |
|---|---|---|---|---|
| 2 | $1,099,900 | $16,800 | $208,000 | $1,324,700 |
| 4 | $2,101,500 | $34,300 | $426,000 | $2,561,800 |
| 6 | $3,992,600 | $66,300 | $726,000 | $4,784,900 |
| 8 | $6,218,500 | $113,100 | $1,178,100 | $7,509,700 |
| 10 | $8,134,900 | $183,500 | $1,859,400 | $10,177,800 |

[1] Includes lost structures, damage to infrastructure, temporary access roads and costs associated with sandbags.

**Table 11.4**
**Total Costs for Without Project Condition – Alternative No. 2**
**Including Offshore Nourishment Cost for the West End of Emerald Isle**

| Year | Total Present Worth Damages & Economic Impact Plus Offshore Dredging Costs |
|---|---|
| 2 | $7,124,700 |
| 4 | $8,361,800 |
| 6 | $10,584,900 |
| 8 | $13,309,700 |
| 10 | $15,977,800 |

The number of structures that would be lost following the removal of the existing sandbag revetments protecting The Pointe shoreline would be five under Alternative No. 2, however, sandbags would protect other threatened structures during the first two years following the removal of the existing sandbags so that no additional structures would be lost during the first two years. Since the sandbags protecting structures can only remain in place for two years, by the fourth year of the analysis, a total of nine structures would still be lost. Sandbag revetments constructed to protect threatened sections of Bogue Court and Inlet Drive would remain in place for five years and would prevent any damage to the roads and infrastructure during the first four years under the sandbag alternative. By the end of the ten year analysis period, the total number of structures lost to the inlet shoreline erosion would be twenty-nine with the majority of these losses occurring between years six and ten.

The cost of the Bogue Inlet Channel Relocation project will likely be between $5 and $6 million. Therefore, the project is economically justified even if the inlet shoreline only erodes another two years.

**12. ENVIRONMENTAL STUDIES AND COORDINATION:** The Draft EIS will consider potential direct, secondary and cumulative effects on Essential Fish Habitat (EFH), nesting and foraging habitat for shorebirds, intertidal and subtidal infauna/macrofauna, endangered and protected species, adjacent shorelines and estuarine habitat, water quality, socio-economic resources, cultural resources, health and safety, and other impacts identified through scoping, public involvement and interagency coordination. The scoping process involves Federal, State, County, and municipal agencies and other interested organizations and individuals. An official public scoping meeting was-held on October 29, 2002. The proposed action is being coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service under Section 7 of the Endangered Species Act, the Fish and Wildlife Coordination Act, and the

Magnuson-Stevens Fishery Conservation and Management Act; and with the North Carolina Division of Coastal Management under the North Carolina State Environmental Policy Act (SEPA).

The Town of Emerald Isle held a public, interagency meeting on May 29, 2002 to hear preliminary resource protection agency concerns regarding the proposed action. Federal and State agencies provided written comments that were addressed during development of the alternatives analysis and biological monitoring plan. The biological monitoring plans were coordinated and reviewed by the resource protection agencies to ensure that all ecological and biological concerns have been addressed. Potential impacts to significant marine, estuarine and beach/dune resources will be evaluated from the perspectives of avoidance, minimization, and mitigation.

The proposed project will be constructed between November 16th and March 31st to limit construction activities to the period outside the critical life stages of birds and fish, sea turtle nesting and hatching season, the migratory passage of marine mammals, and the flowering stages of plants.

13. **OVERVIEW OF RESOURCE PROTECTION AGENCY CONCERNS:** Biological resource concerns for the channel relocation efforts have been presented by several interested parties including the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the North Carolina Division of Water Quality, the North Carolina Natural Heritage Program, and the North Carolina Department of Environment and Natural Resources (including the Division of Coastal Management, Division of Marine Fisheries and the Wildlife Resource Commission). These concerns include impacts to benthic organisms during dredging operations; temporary increase in turbidity affecting Essential Fish Habitat, salt marsh, shellfish habitat and Submerged Aquatic Vegetation communities; direct and secondary impacts to nesting and foraging habitat for piping plovers, least terns, black skimmers, other shorebirds and waterbirds; concerns of adjacent islands erosion (i.e., Bear Island**,** Island Number 2) and interior marsh islands (primarily Dudley Island); intertidal and subtidal macroinfauna impacts from inlet closure and new channel creation; changes in salinity, temperature and turbidity levels in adjacent rivers and estuarine habitats; potential for increased sedimentation in Cow Channel; and alteration of migration patterns of marine mammals and sea turtles.

14. **BIOLOGICAL MONITORING PLAN:** Biological monitoring efforts have been designed to provide information regarding the utilization and habitat significance for listed, protected, and managed fish and wildlife species within the proposed project area. Due to concerns over indirect effects to Huggins and Dudley Islands, West End Beach, Bear Island, Island Number 2, areas of Bogue Sound, Hawkins Island, Jones Island, and Cedar Point Marshes in the White Oak River; these areas were considered for inclusion. Existing monitoring data for the Bogue Inlet study area is being evaluated and utilized, where appropriate, as a historical baseline. Essential Fish Habitat, Habitat Areas of Particular Concern and Critical Habitat for Wintering Piping Plover, as well as habitat for

listed and protected species such as sea turtles and seabeach amaranth, have also been identified within the study area.

The North Carolina Wildlife Resource Commission (NCWRC) maintains the most complete database on the piping plover population in North Carolina. Historical nesting and over wintering data is being evaluated to provide a baseline for impact evaluation. Additional pre- and post-construction monitoring was deemed necessary due to insufficiency of the existing data set and to provide accurate representation of the bird species utilizing the project area. All other colonial waterbirds and shorebirds will also be surveyed in conjunction with the piping plover surveys.

Approximately 14 square miles of land and water resources in and around Bogue Inlet will be extensively surveyed through the used of aerial photography, topographic/bathymetric surveying and habitat mapping to provide accurate pre-construction baseline data. Methods of avoidance and minimization of proposed project affects on shellfish, Submerged Aquatic Vegetation (SAV), fish populations, migratory shorebird nesting and foraging habitat, and sea turtle nesting habitat will be identified during the plan formulation analysis.

Three biological monitoring plans were developed for the project and designed to provide current baseline data upon which potential effects to sensitive resources within the project area can be evaluated. Pre-construction biological monitoring of the project area began in April 2003 and will continue until April 2004. A minimum of three-years post-construction monitoring is expected to be required by State and Federal resource protection agencies to evaluate project effects. Monitoring and sampling efforts within the study area include benthic macroinfauna sampling; piping plover, other shorebirds, and colonial waterbird monitoring; sea turtle nesting and hatching; and salt marsh community and sedimentation monitoring. Water quality sampling of turbidity will be conducted during construction to ensure that the project is in compliance the requirements of the North Carolina Department of Environmental Water Quality.

The biological monitoring plans were submitted to the Army Corps of Engineers on November 21, 2002 were also and distributed to members of the Project Delivery Team (PDT). The monitoring protocols, methods and schedules were reviewed and have been modified to address concerns presented by the COE, the North Carolina Wildlife Resource Commission, the North Carolina Division of Water Quality, USFWS, NMFS, and other members of the PDT.

A summary of the biological monitoring efforts is provided below. Refer to Figure 14.1 for a graphical representation of the biological monitoring efforts being conducted in the project area.

## 14.1 Bird Monitoring

Bird monitoring for the project is being conducted along four transect areas: Transect Area No. 1 begins along the northern edge of the west end of Bogue Banks, following the shoreline south to a location near The Pointe Subdivision; Transect No. 2 encompasses