

**Bogue Inlet Channel Erosion Response Project  
Draft Environmental Impact Statement**

of Emerald Isle's project objectives.

#### **5.4 THREATENED AND ENDANGERED SPECIES**

##### **5.4.1 Sea Turtles**

Alternatives A and B would have the same impacts on sea turtles as described below.

Direct and Indirect Impacts. Maintenance dredging activity in Bogue Inlet by the USACE Navigation Branch has not had any known impacts on sea turtles in the inlet; therefore, none is expected during future maintenance activities under Alternatives A and B. Erosion of the inlet shoreline will continue which could negatively impact sea turtle nesting along the 700 feet of inlet shoreline of Emerald Isle presently protected by sandbags. However, due to the relatively small area protected by the sandbags, the propensity of turtles to nest along the ocean shoreline and the rather low density of turtle nests along Bogue Banks, the erosion of the inlet shoreline does not appear to have a significant impact on sea turtle nesting success. Erosion along the eastern 7,500 feet of Bear Island will also likely continue and could have a negative impact on turtle nesting along that section of the island if the erosion is accompanied by vertical scarps. Phase 3 of the permitted Emerald Isle beach nourishment project would be constructed using offshore borrow areas. The 2003 turtle monitoring program has documented nesting in the newly nourished sections of Emerald Isle however since the impacts of the offshore material on sea turtle nesting success has not been completed no definitive conclusion can be made.

Cumulative Effects. As the inlet shoreline continues to migrate to the east, a vertical erosion scarp will continually be present which could hamper successful turtle nesting along the inlet shoreline. Given the sea turtle preference to nest along the ocean shoreline of Bogue Banks, the continued erosion of the inlet shoreline is not viewed as a major negative impact on turtle nesting. Nourishment of Phase 3 with material from an offshore borrow area will provide suitable nesting habitat for sea turtles. The possible inclusion of the Phase 3 beach area in a Federal storm damage reduction project should continue to provide suitable nesting habitat in this area for a period of 50 years following initiation of the Federal project. Erosion of the ocean shoreline on Bear Island could continue to negatively impact sea turtle nesting by decreasing the amount of nesting areas available.

Compatibility with Project Objectives. The inlet shoreline would remain in an eroded state, therefore, Alternatives A and B do not support the Town of Emerald Isle's project objectives.

Alternative C – Without Project - Sand Bag Revetments

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Direct and Indirect Impacts. Maintenance dredging activity in Bogue Inlet by the USACE Navigation Branch has not had any know impact on sea turtles in the inlet; therefore, none is expected during future maintenance activities under Alternative C. Construction of a series of sand bag revetments to protect homes once they become threatened should not negatively affect nesting sea turtles along the portion of the inlet shoreline protected by the sandbags since sea turtles tend to avoid highly dynamic inlet beaches. Unlike Alternatives A and B, the vertical erosion scarps that will accompany shoreline migration to the east will be replace by sand bags. The continued erosion of the inlet shoreline will not have a significant impact on sea turtles since they normally nest along the ocean shoreline and the number of nests along all of Bogue Banks is generally low. Nourishment of Phase 3 of the permitted Emerald Isle beach nourishment project would be accomplished using an offshore borrow source which should provide suitable sea turtle nesting habitat along this section of Emerald Isle. Ocean shoreline erosion on Bear Island will probably continue resulting in potential negative impacts on nesting sea turtles.

Cumulative Effects. Under current North Carolina regulations, sand bags will be removed after they have been in place for a period of two years when protecting homes. After sand bag removal, and loss of the at risk structure, a new sand bags installation will be constructed to protected the next line of threatened homes. Therefore, sandbags could be continually present during the next 10 years if the inlet shoreline continues to erode.

Compatibility with Project Objectives. Alternative C does not support the Town of Emerald Isle's project objectives as inlet shoreline erosion will continue to threaten upland development and prevent the reestablishment of access to the inlet shoreline to conditions that existed in the past.

### **Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Accounts of sea turtle deaths from dredging activities in Florida, Georgia, and North Carolina have been recorded; however, the majority of these deaths have been attributed to hopper dredges. According to the National Marine Fisheries Service and the Corps of Engineers, there have been no known turtle takes by cutter-suction pipeline dredges. Since the channel relocation would be accomplished using a cutter-suction pipeline dredge, the potential for direct take of sea turtle during dredging operations is low. The probability of the direct mortality to sea turtles should be further reduced since all dredging activities are scheduled to occur in the winter to early spring when most sea turtles are outside of inland coastal waters or wintering off the coast of North Carolina.

Alternative E would restore the 700 feet of inlet shoreline of Emerald Isle that is

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presently protected by sandbags. Since sea turtles normally nest along the ocean shoreline, restoration of the 700-foot shoreline segment will have no significant impact on turtle nesting on Bogue Banks. Erosion on the eastern 7,500 feet of Bear Island should be replaced by accretion while the western 7,500 feet of Emerald Isle is expected to erode in response to the new channel location. Phase 3 of the permitted Emerald Isle beach nourishment project would be accomplished using an offshore borrow source which should provide suitable sea turtle nesting habitat along the nourished beach. Due to financial constraints, the Town of Emerald Isle would likely not be able to complete Phase 3 of the nourishment project until 2007 – 2008 with the 23,831 feet of shoreline included in Phase 3 continuing to erode during the interim period. However, conditions along the Phase 3 shoreline are not so degraded as to prevent turtle nesting so the delay in nourishment should not significantly impact sea turtle nesting success along Bogue Banks. Phase 3 would place material along approximately 3,000 feet of the affected shoreline on the west end of Emerald Isle either as part of the main fill or the west taper section. This would reduce some of the erosive impacts of Alternative E; however, with nourishment delayed until 2007-2008, this section of the shoreline would also experience erosion prior to construction of Phase 3. Continued disposal of navigation maintenance material on the west end of Emerald Isle from the connecting channel will also lessen the erosive impacts of the channel relocation.

Cumulative Effects. The probability for the “take” of sea turtles by dredging activities is expected to be very low because the construction will be accomplished with cutter-suction pipeline dredges working during the winter and early spring when sea turtle presence in the area should be minimal. Therefore, cumulative impacts to sea turtle species is not expected to result from project implementation. Some turtle nesting habitat could be lost along the ocean beach on the west end of Emerald Isle as this shoreline responds to the new channel positions, however, this negative impact should be offset by accretion on the east end of Bear Island. Completion of Phase 3 of the permitted Emerald Isle beach nourishment project could be delayed until 2007-2008 which would result in the degradation of the beach along the 23,831 feet of shoreline included in Phase 3, but the additional degradation is not expected to significantly impact sea turtle nesting. Construction of the Phase 3 fill will partially offset some of the predicted erosion along the eastern 3,000 feet of the 7,500-foot affected shoreline on the west end of Emerald Isle.

Compatibility with Project Objectives. The 700 feet of inlet shoreline presently protected by sandbags would be restored with the implementation of the channel relocation without beach nourishment alternative as the existing channel fills and material accretes along the eastern inlet shoreline. The resulting wide sand beach with possible dune reformation may provide additional nesting habitat within the inlet complex. However, due to the propensity of turtles to nest along the ocean

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shoreline, the restoration of this relatively small shoreline segment is not expected to have a significant impact on sea turtle nesting success. Phase 3 of the permitted Emerald Isle beach nourishment project could be delayed until 2007 – 2008 resulting in the continued degradation of the ocean beach within the Phase 3 project area.

Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. Accounts of sea turtle deaths from dredging activities in Florida, Georgia, and North Carolina have been recorded; however, the majority of these deaths have been attributed to hopper dredges. Since the channel relocation would be accomplished using a cutter-suction pipeline dredge, the potential for direct take of sea turtle during dredging operations is low. The probability of the direct mortality to sea turtles should be further reduced since all dredging activities are scheduled to occur in the winter to early spring when most sea turtles are outside of inland coastal waters or wintering off the coast of North Carolina.

Nourishment of Emerald Isle using inlet sands should create a wider beach with characteristics similar to those of the native beach. Sand compatibility analyses of the inlet material demonstrate that the inlet sand is slightly coarser than the native beach material, but otherwise completely compatible with the native beach sands within the Phase 3 project area (see Appendix B).

Erosion on the eastern 7,500 feet of Bear Island should be replaced by accretion while the western 7,500 feet of Emerald Isle is expected to erode in response to the new channel location. However, approximately the eastern 3,000 feet of this affected area would receive some nourishment material as part of the Phase 3 beach nourishment project which should serve to partially mitigate for this predicted erosion. Additional mitigation for the shoreline erosion will come from the continued disposal of navigation maintenance material from the connecting channel on the extreme west end of Emerald Isle by the Corps of Engineers.

Cumulative Effects. The material that would be removed from Bogue Inlet to nourish the Phase 3 shoreline was derived from the adjacent beaches and is therefore completely compatible with the native beach material. The beach created by the inlet material will have characteristics similar to that of the native beach; therefore, there should not be any negative impacts on turtle nesting within the Phase 3 project area. Erosion of the beach along the western 7,500 feet of Emerald Isle in response to the new channel location could negatively impact turtle nesting; however, accretion along the eastern 7,500 feet of Bear Island should offset this negative impact. Also, some of the predicted erosion on the west end of Emerald Isle will be mitigated by the inclusion of 3,000 feet of the affected shoreline in the Phase 3 beach nourishment project and the continued disposal of

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navigation maintenance material on the extreme west end of Emerald Isle.

Compatibility with Project Objectives. Alternative F is expected to completely restore the 700 feet of inlet shoreline presently protected by the sandbag revetment and would provide quality material to nourish 23,831 feet of ocean shoreline included in the Phase 3 nourishment area. The predicted erosion of the west end of Emerald Isle would be partially offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project that includes 3,000 feet of the affected shoreline and the predicted accretion along the east portion of Bear Island resulting in no net loss of sea turtle nesting habitat. The beach created along the ocean shoreline included in Phase 3 will be compatible with the native beach. Alternative F completely supports the Town's objectives for the project as they relate to the restoration of the 700 feet of inlet shoreline presently protected by sandbags and along the ocean shorelines.

#### **5.4.2 Mammals**

##### **Humpback and Right Whales**

Alternatives A, B, and C are expected to have the same impacts on Humpback and Right whales as described below.

Direct and Indirect Impacts. Alternatives A, B, and C are not expected to have any direct or indirect impacts on Humpback and Right whales.

Cumulative Effects. Alternatives A, B, and C are not expected to have any cumulative impacts on Humpback and Right whales

Compatibility with Project Objectives. Listed whale species are not directly associated with the stated project needs or objectives.

Alternatives E and F are expected to have the same impacts on whales as described below.

Direct and Indirect Impacts. Whales are infrequently observed in the nearshore zone of North Carolina and not likely to be found within or adjacent to the shallow waters of the project area. In the event that Federal or State resource protection agencies require that a certified marine mammal observer be stationed on the dredge during project construction, the contractor will be required to provide trained personnel in compliance with the agency directive. Avoidance and activity cessation measures will be implemented to protect marine mammals in the project area.

Cumulative Effects. No cumulative effects to listed whale species or the viability

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of their populations are expected to result from Alternatives E and F.

Compatibility with Project Objectives. Listed whale species are not directly associated with the stated project needs or objectives.

**West Indian Manatee**

Alternatives A, B, and C are expected to have the same impact on West Indian Manatee as described below.

Direct and Indirect Impacts. The noise associated with the maintenance dredging activity in Bogue Inlet by the USACE Navigation Branch could discourage West Indian Manatee from entering Bogue Inlet; however, there are no known reports of this type of impact in Bogue Inlet.

Cumulative Effects. No cumulative impacts to manatees are expected to result from Alternatives A, B, and C.

Compatibility with Project Objectives. Manatees are not directly associated with the stated project needs or objectives.

**Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Turbidity levels resulting from dredging operations associated with the channel relocation, dike construction, and filling of the existing channel are predicted to be low and localized. Stockpiling material on the Emerald Isle sand spit should also not have any impact on turbidity. Therefore, SAV resources that manatees rely on as a food should not be affected during project construction. Noise associated with the construction of the new channel, sand dike, and mechanical filling of the existing channel could distract manatees as would the noise associated with the resumption of channel maintenance activities 1 to 2 years following project completion.

Injury to manatees is not likely as project construction will occur in the winter and early spring when ocean and estuary water temperatures are too cold for manatees. In the event that Federal or State resource protection agencies require that a certified marine mammal observer be stationed on the dredge during project construction, the contractor will be required to provide trained personnel in compliance with the agency directive. Avoidance and activity cessation measures will be implemented to protect marine mammals in the project area. Direct and indirect impacts to manatees from Alternative E should be negligible.

Cumulative Effects. Alternative E is not expected to have any impact on SAV; therefore, cumulative impacts on manatee are not anticipated.

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Compatibility with Project Objectives. Manatees are not directly associated with the stated project needs or objectives.

**Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Turbidity levels resulting from dredging operations associated with the channel relocation, dike construction, and the disposal of the channel material along the Phase 3 beach nourishment shoreline are predicted to be low and localized and have no significant impact on SAV resources manatees rely on as a food source. Noise associated with the construction of the new channel, sand dike, and beach nourishment could distract manatees as would the noise associated with the resumption of channel maintenance activities 1 to 2 years following project completion.

Injury to manatees is not likely as project construction will occur in the winter and early spring when ocean and estuary water temperatures are too cold for manatees. In the event that Federal or State resource protection agencies require that a certified marine mammal observer be stationed on the dredge during project construction, the contractor will be required to provide trained personnel in compliance with the agency directive. Avoidance and activity cessation measures will be implemented to protect marine mammals in the project area. As a result, direct and indirect impacts to manatees from Alternative F should be negligible.

Cumulative Effects. Alternative F is not expected to have any impact on SAV, therefore, cumulative impacts on manatee are not anticipated.

Compatibility with Project Objectives. Manatees are not directly associated with the stated project needs or objectives.

**5.4.3 Birds**

**Piping Plover**

Alternatives A, B, and C are expected to have similar impacts on piping plovers as described below.

Direct and Indirect Impacts. According to the Federal Register (50C Part 17), the sides of Bogue Inlet, including the inlet shoreline of Emerald Isle, are designated as Critical Habitat for Wintering Piping Plover. Alternatives A and B and to some extent Alternative C will result in the continued erosion of Emerald Isle inlet shoreline which could result in the loss of Critical Habitat for Wintering Piping Plovers. There is some indication that Island 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under

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Alternatives A, B, and C and could lead to the eventual disappearance of this ephemeral feature. Also, erosion of the ocean shoreline on the east end of Bear Island will likely continue and could impact piping plover use of that end of the island.

Cumulative Effects. The dynamic nature of Bogue Inlet, which will continue to result in the loss and reformation sand bars and sand islands within the inlet complex, is not expected to have any cumulative negative impact on piping plovers habitat.

Compatibility with Project Objectives. Alternatives A, B, and C would not have any significant impact on the natural evolution of the physical features within Bogue Inlet that are normally associated with piping plover habitat. However, the 700 feet of inlet shoreline presently protected by sandbags would not be restored.

### **Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Construction of the relocated channel across the ebb tide delta of Bogue Inlet will remove approximately 50 acres of shallow water habitat from the inlet shoal system while construction of the sand dike will create approximately 25 acres of shallow water and subtidal habitat. The filling of the existing channel will also create approximately 63 acres of shallow water and subtidal habitat. Noise associated with the channel dredging activity, dike construction, stockpiling of material along the Emerald Isle sand spit, and the mechanical transfer of the stockpiled material into the existing may stress Piping Plovers during the projected 3 to 4 month construction period by causing them to spend more time being alert than foraging and resting. Stockpiling material on the Emerald Isle sand spit will negatively impact invertebrates and infauna on which plovers feed. The impact on the invertebrates and infauna could last for 1 to 2 years until the disturbed area are repopulated by invertebrates and infauna from nearby undisturbed areas. There is some indication that Island 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under Alternative E and could lead to the eventual disappearance of this ephemeral feature.

Alternative E could create suitable shallow water foraging habitat for piping plover as a direct result of filling the existing channel or as an indirect result of the development of the sand spit off the west end of Emerald Isle.

Cumulative Effects. Construction of the sand dike followed by the deposition of the stockpiled material into the existing channel will create new intertidal sand flats that can be used as Critical Habitat for Piping Plovers. In addition, intertidal flat resources are anticipated to reform within the inlet complex at a level consistent

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with historic acreages characteristic of the Inlet. Erosion of 7,500 feet of ocean shoreline on the west end of Emerald Isle could damage existing piping plover habitat, however, accretion on the eastern 7,500 feet of Bear Island should offset the losses on Emerald Isle and provide the birds with more protected nesting habitat away from human disturbances. Also, the inclusion of 3,000 feet of the affected shoreline on the west end of Emerald Isle in the Phase 3 beach nourishment project would partially mitigate for some of the predicted erosion; however, construction of Phase 3 could be delayed until 2007-2008 due to funding constrains. The overall cumulative impacts from channel relocation on piping plover should be positive.

Compatibility with Project Objectives. Critical Habitat for Piping Plovers could be created within the Bogue Inlet complex particularly along the Emerald Isle inlet shoreline. Some beach habitat would be lost from the west end of Emerald Isle but this would be offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project in 2007-2008 and gains in habitat on the east end of Bear Island. This alternative supports the majority of the Town's project objectives, but does not satisfy the objective of providing high quality beach nourishment material for Phase 3 of the permitted Emerald Isle beach nourishment project.

**Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Construction of the relocated channel across the ebb tide delta of Bogue Inlet will remove approximately 50 acres of shallow water habitat from the inlet shoal system while construction of the sand dike will create approximately 25 acres of shallow water and subtidal habitat. Noise associated with the channel dredging activity, dike construction, and beach nourishment may stress Piping Plovers during the projected 3 month construction period by causing them to spend more time being alert than foraging and resting. There is some indication that Island 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under Alternative F and could lead to the eventual disappearance of this ephemeral feature

Alternative F could create suitable shallow water foraging habitat for piping plover as a direct result of the dike construction and as an indirect result of the development of the sand spit off the west end of Emerald Isle.

Some potential piping plover habitat on the western 7,500 feet of Emerald Isle could be lost as the shoreline erodes and adjust to the new channel position. Inclusion of 3,000 feet of this affected shoreline in the Phase 3 beach nourishment project and the continued disposal of connecting channel maintenance material on the extreme west end of Emerald Isle should partially offset these erosive impacts.

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The losses on Emerald Isle should be offset by gains along the eastern 7,500 feet of Bear Island. Since Bear Island is uninhabited, the beach and dune system created as a result of the new channel should offer better habitat for the piping plovers.

Cumulative Effects. Cumulative impacts to Piping Plovers from Alternative F should compare to cumulative impacts from Alternative E. Reformation of intertidal flats, intertidal areas near the sand dike, and beach habitat with compatible beach sand, are expected to be available for foraging, nesting, and roosting Piping Plovers. Therefore, cumulative impacts resulting from this alternative are anticipated to be positive.

Compatibility with Project Objectives. Critical Habitat for Piping Plovers could be created within the Bogue Inlet complex particularly along the Emerald Isle inlet shoreline. Some beach habitat would be lost from the west end of Emerald Isle but this would be offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project and gains in habitat on the east end of Bear Island. This alternative fully supports the Town of Emerald Isle's objectives for the project.

### **Critical Habitat for Wintering Piping Plover**

Alternatives A, B, and C are expected to have similar impacts on piping plovers as described below.

Direct and Indirect Impacts. According to the Federal Register (50C Part 17), the sides of Bogue Inlet, including the inlet shoreline of Emerald Isle, are designated as Critical Habitat for Wintering Piping Plover. Alternatives A and B and to some extent Alternative C will result in the continued erosion of Emerald Isle inlet shoreline which could result in the loss of Critical Habitat for Wintering Piping Plovers. Recent aerial mapping and modeling results as stated in Appendix B (Section 3.20) give some indication that Island No. 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction. This westerly migration is expected to continue under Alternatives A, B, and C and could lead to the eventual disappearance of this ephemeral feature. Also, erosion of the ocean shoreline on the east end of Bear Island will likely continue and could impact piping plover use of that end of the island.

Cumulative Effects. The dynamic nature of Bogue Inlet, which will continue to result in the loss and reformation of sand bars and sand islands within the inlet complex, is not expected to have any cumulative negative impact on piping plovers habitat.

Compatibility with Project Objectives. Alternatives A, B, and C would not have any significant impact on the natural evolution of the physical features within Bogue

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Inlet that are normally associated with piping plover habitat. However, the 700 feet of inlet shoreline presently protected by sandbags would not be restored.

**Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Construction of the relocated channel across the ebb tide delta of Bogue Inlet will remove approximately 50 acres of shallow water habitat from the inlet shoal system while construction of the sand dike will create approximately 25 acres of shallow water and subtidal habitat. The filling of the existing channel will also create approximately 63 acres of shallow water and subtidal habitat. Noise associated with the channel dredging activity, dike construction, stockpiling of material along the Emerald Isle sand spit, and the mechanical transfer of the stockpiled material into the existing may stress Piping Plovers during the projected 3 to 4 month construction period by causing them to spend more time being alert than foraging and resting. Stockpiling material on the Emerald Isle sand spit will negatively impact invertebrates and infauna on which plovers feed. The impact on the invertebrates and infauna could last for 1 to 2 years until the disturbed area are repopulated by invertebrates and infauna from nearby undisturbed areas. There is some indication that Island No. 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under Alternative E and could lead to the eventual disappearance of this ephemeral feature.

Alternative E could create suitable shallow water foraging habitat for piping plover as a direct result of filling the existing channel or as an indirect result of the development of the sand spit off the west end of Emerald Isle.

Cumulative Effects. Construction of the sand dike followed by the deposition of the stockpiled material into the existing channel will create new intertidal sand flats that can be used as Critical Habitat for Piping Plovers. In addition, intertidal flat resources are anticipated to reform within the inlet complex at a level consistent with historic acreages characteristic of the Inlet. Erosion of 7,500 feet of ocean shoreline on the west end of Emerald Isle could damage existing piping plover habitat, however, accretion on the eastern 7,500 feet of Bear Island should offset the losses on Emerald Isle and provide the birds with more protected nesting habitat away from human disturbances. Also, the inclusion of 3,000 feet of the affected shoreline on the west end of Emerald Isle in the Phase 3 beach nourishment project would partially mitigate for some of the predicted erosion; however, construction of Phase 3 could be delayed until 2007-2008 due to funding constraints. Once Phase 3 beach nourishment is completed, negative impacts to piping plovers could potentially result from increases in disturbances from predator and human activity. However, the overall cumulative impacts from channel relocation on piping plover should be positive.

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Compatibility with Project Objectives. Critical Habitat for Piping Plovers could be created within the Bogue Inlet complex particularly along the Emerald Isle inlet shoreline. Some beach habitat would be lost from the west end of Emerald Isle but this would be offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project in 2007-2008 and gains in habitat on the east end of Bear Island. This alternative supports the majority of the Town's project objectives, but does not satisfy the objective of providing high quality beach nourishment material for Phase 3 of the permitted Emerald Isle beach nourishment project.

### **Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Construction of the relocated channel across the ebb tide delta of Bogue Inlet will remove approximately 50 acres of shallow water habitat from the inlet shoal system while construction of the sand dike will create approximately 25 acres of shallow water and subtidal habitat. Noise associated with the channel dredging activity, dike construction, and beach nourishment may stress Piping Plovers during the projected 3 month construction period by causing them to spend more time being alert than foraging and resting. There is some indication that Island No. 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under Alternative F and could lead to the eventual disappearance of this ephemeral feature

Alternative F could create suitable shallow water foraging habitat for piping plover as a direct result of the dike construction and as an indirect result of the development of the sand spit off the west end of Emerald Isle.

Some potential piping plover habitat on the western 7,500 feet of Emerald Isle could be lost as the shoreline erodes and adjust to the new channel position. Inclusion of 3,000 feet of this affected shoreline in the Phase 3 beach nourishment project and the continued disposal of connecting channel maintenance material on the extreme west end of Emerald Isle should partially offset these erosive impacts. The losses on Emerald Isle should be offset by gains along the eastern 7,500 feet of Bear Island. Since Bear Island is uninhabited, the beach and dune system created as a result of the new channel should offer better habitat for the piping plovers.

Cumulative Effects. Cumulative impacts to Piping Plovers from Alternative F should compare to cumulative impacts from Alternative E. Reformation of intertidal flats, intertidal areas near the sand dike, and beach habitat with compatible beach sand, are expected to be available for foraging, nesting, and roosting Piping Plovers. However, after the construction of the sand dike and the existing channel

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is filled, isolated inlet piping plover habitats will be more accessible and thus, be more susceptible to increases in predator and human affects. Cumulative impacts resulting from this alternative are still anticipated to be positive.

Compatibility with Project Objectives. Critical Habitat for Piping Plovers could be created within the Bogue Inlet complex particularly along the Emerald Isle inlet shoreline. Some beach habitat would be lost from the west end of Emerald Isle but this would be offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project and gains in habitat on the east end of Bear Island. This alternative fully supports the Town of Emerald Isle's objectives for the project.

### **Roseate Tern**

Direct and Indirect Impacts. Alternatives A and B and to some extent Alternative B would allow the continued erosion of the Emerald Isle inlet shoreline which could result in the loss of roseate tern habitat. Recent arial mapping and modeling results as stated in Appendix B (Secion 3.20) give some indication that Island No. 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction. This westerly migration is expected to continue with Alternatives A, B, and C and could lead to the eventual disappearance of this ephemeral feature. Also, erosion of the ocean shoreline on the east end of Bear Island will likely continue and could affect roseate tern use of that end of the island.

Cumulative Effects. The continued loss of roseate tern habitat may result in cumulative negative impacts to the species.

Compatibility with Project Objectives. The inlet habitats and resources including those used by roseate terns, would not be restored or maintained under the no action alternative which does not support the project objectives.

### **Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Construction of the relocated channel across the ebb tide delta of Bogue Inlet will remove approximately 47.6 acres of shallow water habitat from the inlet shoal system while construction of the sand dike will create approximately 22.2 acres of shallow water and subtidal habitat. The filling of the existing channel will also create approximately 131.8 acres of shallow water and subtidal habitat. Noise associated with the channel dredging activity, dike construction, stockpiling of material along the Emerald Isle sand spit, and the mechanical transfer of the stockpiled material into the existing may stress roseate tern during the projected 3 to 4 month construction period by causing them to spend more time being alert than foraging and resting. Stockpiling material on the Emerald Isle sand spit will negatively impact invertebrates and infauna on which

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roseate terns feed. The impact on the invertebrates and infauna could last for 1 to 2 years until the disturbed area are repopulated by invertebrates and infauna from nearby undisturbed areas. There is some indication that Island No. 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under Alternative E and could lead to the eventual disappearance of this ephemeral feature.

Alternative E could create suitable shallow water foraging habitat for roseate terns as a direct result of filling the existing channel or as an indirect result of the development of the sand spit off the west end of Emerald Isle.

Cumulative Effects. Construction of the sand dike followed by the deposition of the stockpiled material into the existing channel will create new intertidal sand flats that can be used by roseate terns. In addition, intertidal flat resources are anticipated to reform within the inlet complex at a level consistent with historic acreages characteristic of the Inlet. Erosion of 7,500 feet of ocean shoreline on the west end of Emerald Isle could damage existing roseate tern habitat, however, accretion on the eastern 7,500 feet of Bear Island should offset the losses on Emerald Isle and provide the birds with more protected nesting habitat away from human disturbances. Also, the inclusion of 3,000 feet of the affected shoreline on the west end of Emerald Isle in the Phase 3 beach nourishment project would partially mitigate for some of the predicted erosion; however, construction of Phase 3 could be delayed until 2007-2008 due to funding constraints. Beach nourishment may increase the potential for predator and human effects to roseate terns and their resources. However, the overall cumulative impacts from channel relocation on roseate terns should be positive.

Compatibility with Project Objectives. Habitat for roseate terns could be created within the Bogue Inlet complex particularly along the Emerald Isle inlet shoreline. Some beach habitat would be lost from the west end of Emerald Isle but this would be offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project in 2007-2008 and gains in habitat on the east end of Bear Island. This alternative supports the majority of the Town's project objectives, but does not satisfy the objective of providing high quality beach nourishment material for Phase 3 of the permitted Emerald Isle beach nourishment project.

**Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Construction of the relocated channel across the ebb tide delta of Bogue Inlet will remove approximately 47.6 acres of shallow water habitat from the inlet shoal system while construction of the sand dike will create approximately 22.2 acres of shallow water and subtidal habitat. Noise associated with the channel dredging activity, dike construction, and beach nourishment may

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stress roseate terns during the projected 3 month construction period by causing them to spend more time being alert than foraging and resting. There is some indication that Island No. 2, located between Bogue Banks and Bear Island just west of the existing channel, is migrating in a westerly direction (see Appendix B). This westerly migration is expected to continue under Alternative F and could lead to the eventual disappearance of this ephemeral feature.

Alternative F could create suitable shallow water foraging habitat for roseate terns as a direct result of the dike construction and as an indirect result of the development of the sand spit off the west end of Emerald Isle.

Some potential roseate tern habitat on the western 7,500 feet of Emerald Isle could be lost as the shoreline erodes and adjust to the new channel position. Inclusion of 3,000 feet of this affected shoreline in the Phase 3 beach nourishment project and the continued disposal of connecting channel maintenance material on the extreme west end of Emerald Isle should partially offset these erosive impacts. The losses on Emerald Isle should be offset by gains along the eastern 7,500 feet of Bear Island. Since Bear Island is uninhabited, the beach and dune system created as a result of the new channel should offer better habitat for the roseate terns.

Cumulative Effects. Cumulative impacts to roseate terns from Alternative F should compare to cumulative impacts from Alternative E. Reformation of intertidal flats, intertidal areas near the sand dike, and beach habitat with compatible beach sand, are expected to be available for foraging, nesting, and roosting roseate terns. However, after the reformation of these habitats, isolated roseate tern habitat will be more susceptible to increases in predator and human affects. Cumulative impacts resulting from this alternative are still anticipated to be positive.

Compatibility with Project Objectives. Habitat for roseate terns could be created within the Bogue Inlet complex particularly along the Emerald Isle inlet shoreline. Some beach habitat would be lost from the west end of Emerald Isle but this would be offset by the construction of Phase 3 of the permitted Emerald Isle beach nourishment project and gains in habitat on the east end of Bear Island. This alternative fully supports the Town of Emerald Isle's objectives for the project.

### **5.4.4 Seabeach Amaranth**

Alternatives A, B, and C would have similar impacts on seabeach amaranth as described below.

Direct and Indirect Impacts. Erosion of the inlet shoreline of Emerald Isle and the south shoreline of Dudley Island that lies adjacent to Eastern Channel would continue under Alternatives A, B, and C as would the erosion along the west end of Bear Island. This erosion could result in the loss of seabeach amaranth habitat.

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The nourishment of the Phase 3 shoreline with material from offshore borrow areas could provide additional seabeach amaranth habitat. In this regard, monitoring of the completed sections of the Bogue Bank Beach Nourishment project has found higher seabeach amaranth counts post-construction compared to pre-construction counts.

Cumulative Effects. Continued erosion of the project area shorelines resulting from Alternatives A, B, and C may contribute to the loss of additional seabeach amaranth habitat and resources.

Compatibility with Project Objectives. Alternatives A, B, and C do not support the Town's objectives for the project and does not support the restoration of critical seabeach amaranth resources.

Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. Direct and indirect impacts to seabeach amaranth from channel relocation would include the loss of potential habitat along the beach and dune system on the western 7,500 feet of Emerald Isle, a similar gain in beach and dune system habitat on the eastern 7,500 feet of Bear Island, and the eventual restoration of potential habitat along 23,831 feet of ocean shoreline associated with the construction of Phase 3 of the permitted Emerald Isle beach nourishment project. Erosion of the south shoreline of Dudley Island should be curtailed until the sand spit reforms and merges with the sand dike. Construction of Phase 3 of the permitted Emerald Isle beach nourishment project would be accomplished using offshore borrow areas which has proven to have a positive impact on the number of seabeach amaranth plants observed on Bogue Banks. However, due to the limited fiscal capability of the Town of Emerald Isle, construction of Phase 3 could be delayed several years until the Town is financially able to support the project. This could result in the continued erosion of the ocean shoreline included in Phase 3 of the beach nourishment project resulting in the loss of seabeach amaranth resources.

Cumulative Effects. Construction of Phase 3 of the permitted Emerald Isle beach nourishment project would probably occur in 2007-2008 using material from offshore borrow areas. Beach nourishment has been shown to be positive for the growth of seabeach amaranth and thus, the nourishment to Emerald Isle from offshore borrow areas would provide more beach habitat for seabeach amaranth once the project was constructed.

Compatibility with Project Objectives. The 700 feet of inlet shoreline habitat fronting the existing sandbag revetment would be restored which could make it suitable for the propagation of seabeach amaranth. The nourishment of Bogue Banks with an offshore sand source has had a positive impact on the number of

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seabeach amaranth plants found along the entire length of Bogue Banks and therefore should have the same impact within the Phase 3 nourishment area for Emerald Isle. However, if the channel is relocated without beach nourishment, the Town of Emerald Isle would not be immediately able to financially support a separate beach nourishment project for Phase 3, and the project could be delayed several years.

**Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Nourishment of Phase 3 of the permitted Emerald Isle beach nourishment project would be accomplished simultaneously with the relocation of the inlet channel resulting in the immediate restoration of 23,831 feet of ocean shoreline with high quality beach material. This should provide immediate habitat opportunities for seabeach amaranth along Emerald Isle. Shoreline adjustments on the western 7,500 feet of Emerald Isle could result in the loss of some seabeach amaranth habitat while a gains in habitat could occur on the eastern 7,500 feet of Bear Island. Inclusion of 3,000 feet of the affected shoreline on the west end of Emerald Isle in the Phase 3 beach nourishment project and the continued disposal of connecting channel maintenance material on the extreme west end of Emerald Isle should partially offset these erosive impacts.

Cumulative Effects. With project implementation and construction of the sand dike across the existing channel, sediment deposition in the abandoned channel may result in the formation of intertidal flats. The sand flats may eventually accrete to a point where they become emergent and transition to a supratidal resource with beach and dune characteristics that allow for the establishment of seabeach amaranth. Therefore, this alternative should provide potential habitat for seabeach amaranth and have a positive cumulative effect on seabeach amaranth resources.

Compatibility with Project Objectives. Alternative F is predicted restore the habitat along the 700 feet of inlet shoreline presently protected by sandbags and ocean shorelines of Emerald Isle and fully supports the project objectives.

**5.5 MARINE RESOURCES**

**5.5.1 Inlet Resources**

**Benthic Infaunal Community**

Alternatives A and B would have the same impacts on benthic infaunal communities as described below.

Direct and Indirect Impacts. Erosion is predicted to continue along western Emerald Isle in association with the eastward movement of the navigation channel.

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Dredging of the existing channel in Bogue Inlet and the connecting channel leading from the Atlantic Intracoastal Waterway (AIWW) to the inlet by the USACE Navigation Branch will continue to impact benthic communities located in the approximate 20 acre channel prism area. The disposal of the dredged material from the inlet channel off to the side of the vessel will continue to affect benthic communities located adjacent to the channel area. However, recolonization and repopulation of disturbed habitats is expected to occur as organisms move to the channel area from adjacent undisturbed habitat.

Cumulative Effects. No significant or additional loss of benthic organisms or the habitat they utilize is anticipated to result from Alternatives A and B.

Compatibility with Project Objectives. The Town of Emerald Isle's objectives for the project are not supported by these alternatives.

Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. Construction of sand bag revetments are expected to reduce erosion along the shoreline of Emerald Isle, however, maintenance of the navigation channels will still be conducted by the USACE Navigation Branch. Therefore, direct and indirect impacts to benthic organisms from the sand bag revetment alternative should be comparable to the direct and indirect impacts to benthic organisms from Alternatives A and B.

Cumulative Effects. The cumulative effects to benthic infaunal populations resulting from this alternative are comparable to Alternatives A and B.

Compatibility with Project Objectives. The Town of Emerald Isle's objectives for the project are not supported by this alternative.

Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. Direct impacts to 47.6 acres of subtidal habitat will occur during channel construction which will destroy benthic organisms located in the channel area. Approximately 22.2 acres of channel bottom will be directly impacted by the construction of the sand dike and an additional 131.8 acres of channel bottom filled with the transfer of the stockpiled material to the existing channel. However, recolonization and repopulation of disturbed habitats is expected to occur as organisms move to the project area from adjacent undisturbed habitat. In addition, temporary impacts may occur from increases in sedimentation and turbidity levels, such as direct burial of benthic organisms and lower dissolved oxygen in the waters surrounding benthic communities.

Cumulative Effects. Because benthic organisms can recolonize disturbed areas

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quickly and the water quality impacts are anticipated to be minimal and temporary, cumulative impacts to benthic organisms from the channel relocation without beach nourishment alternative are not likely to occur.

Compatibility with Project Objectives. The project objectives, with the exception of the use of the inlet material for beach nourishment are supported by this alternative.

**Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Direct impacts to 47.6 acres of subtidal habitat will occur during channel construction which will destroy benthic organisms located in the channel area. Approximately 22.2 acres of channel bottom will be directly impacted by the construction of the sand dike. Over a period of 4 to 6 years, 131.8 acres of the existing channel will fill with littoral material from the abandoned portion of the ebb tide delta lying off the west end of Emerald Isle and the erosion of material from the western end of the Emerald Isle ocean shoreline. However, recolonization and repopulation of disturbed habitats is expected to occur as organisms move to the project area from adjacent undisturbed habitat. In addition, temporary impacts may occur from increases in sedimentation and turbidity levels, such as direct burial of benthic organisms and lower dissolved oxygen in the waters surrounding benthic communities.

Cumulative Effects. The existing channel located seaward of the sand dike is expected to gradually fill with the influx of littoral sediment off the west end of Emerald Isle and the onshore movement of the abandoned ebb tide delta material situated off the west end of Emerald Isle. Benthic communities located in the existing channel could be overtaken by the influx of littoral sediment, however, cumulative impacts to benthic communities are not likely to occur from the channel relocation with beach nourishment because benthic organisms can quickly recolonize disturbed areas and water quality impacts are expected to be minimal and temporary.

Compatibility with Project Objectives. The project objectives are supported by this alternative.

**Shellfish**

Alternatives A, B, and C would have the same impacts on shellfish as described below.

Direct and Indirect Impacts. If the easterly migration of the inlet channel continues, the sand spit separating the Coast Guard Channel from the inlet could be breached. The altered flow patterns in the estuary could introduce higher salinity ocean water

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into shellfish resources. Under Alternatives A, B, and C, the USACE Navigation Branch would continue to use sidecast dredges to maintain the navigation channel with the dredged material being discharged directly into the water column of Bogue Inlet. There is no indication that previous maintenance dredging activities in Bogue Inlet have caused adverse direct or indirect impacts to shellfish resources.

Cumulative Effects. If the sand spit breaches and there is a direct exchange of oceanic water through the Coast Guard Channel occurs, shellfish resources could be cumulatively affected by the alteration of tidal flows and water quality in the estuary.

Compatibility with Project Objectives. The Town of Emerald Isle's objectives for the project are not supported by this alternative.

**Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Increases in turbidity are anticipated from the dredging of the new channel, construction of the sand dike, and the mechanical transfer of the stockpiled material to fill the existing channel. However, turbidity is not expected to exceed the State standard outside the immediate area of construction. Shellfish are susceptible to impacts from increases in turbidity that can lead to adverse respiratory and feeding effects. The low silt percentage and low suspension time of the sediment is expected to result in minimal and temporary impacts within the project area, but shellfish resources are not expected to be adversely influenced by project construction since the closest shell fish area is located in the western end of Bogue Sound approximately 700 feet from the landward end of the proposed channel.

Cumulative Effects. No cumulative impacts to shellfish are anticipated to occur from the channel relocation because water quality changes are expected to be temporary and minimal.

Compatibility with Project Objectives. The project objectives, with the exception of the use of the inlet material for beach nourishment are supported by this alternative.

**Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Increases in turbidity are anticipated from the dredging of the new channel and construction of the sand dike. However, turbidity is not expected to exceed the State standard outside the immediate area of construction. Shellfish are susceptible to impacts from increases in turbidity that can lead to adverse respiratory and feeding effects. The low silt percentage and low suspension time of the sediment is expected to result in minimal and temporary