APPENDIX A

BIOLOGICAL ASSESSMENT

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Louisiana Coastal Area (LCA)
Terrebonne Basin Barrier Shoreline Restoration
Terrebonne Parish, Louisiana

August 2010

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1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that, "Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried, out by such agency…. Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species…"

This Biological Assessment (BA) provides the information required pursuant to Implementing Regulation 50 CFR 402.14 in accordance with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, et seq.; the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 et seq.); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. The purpose of the BA is to evaluate the potential impacts of the proposed restoration efforts for the Terrebonne Basin Barrier Shoreline Restoration (TBBSR) Study on Federally-listed and proposed threatened and endangered species and designated and proposed critical habitat. Furthermore, the BA determines whether any such species or habitats are likely to be adversely affected by implementing the first component of construction of National Ecosystem Restoration Plan.

A programmatic BA was prepared in 2004 for the LCA Ecosystem Restoration Study (USACE 2004a). This proposed Project is an outgrowth of the LCA comprehensive programmatic restoration study. The 2004 programmatic BA is thereby incorporated by reference.

2 DESCRIPTION OF THE STUDY AREA

The TBBSR Project provides for the restoration of the Timbalier and Isles Dernieres barrier island chains located in Terrebonne Parish and Lafourche Parish, Louisiana. The Study Area is located in the 3rd Congressional District. The basin is separated from the Gulf of Mexico (GOM) by a chain of barrier islands, which serve as a natural barrier to storm events and reduce marine influences on interior wetlands within the basin (Figure 1-1).

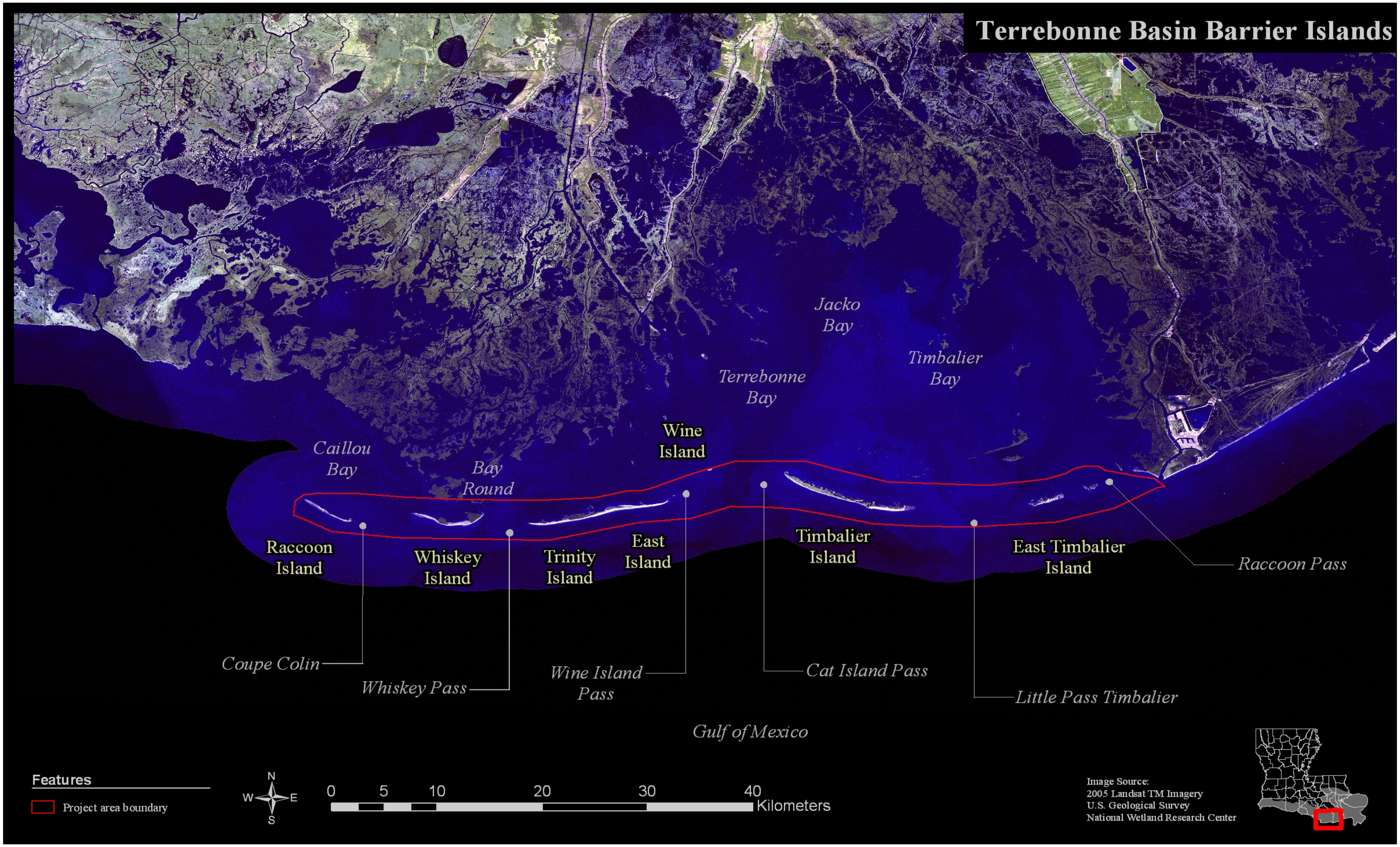


Figure 1-1. Terrebonne Basin Barrier Shoreline Restoration Study Area.

2.1 Isles Dernieres Reach

The Isles Dernieres Reach represents a barrier island arc approximately 22 miles long in Terrebonne Parish and extends from Caillou Bay east to Cat Island Pass. Raccoon Island, Whiskey Island, Trinity Island, East Island, and Wine Island, the primary islands that comprise the Isles Dernieres barrier island chain, are backed by Bay Blanc, Bay Round, Caillou Bay, and Terrebonne Bay, and bordered by the Gulf of Mexico (GOM) on the seaward side. The islands range from approximately 0.1 to 0.7 miles wide and are generally composed of a thin sand cap over a thick mud platform. Elevations are generally low and the islands are frequently overwashed (USACE 2004c).

The Isles Dernieres have been and continue to be an important commercial and recreational resource for Louisiana and the nation for more than 150 years. The islands support habitats that are critical to the State's commercial fishing industry. Furthermore, the mineral-rich subsurface below Terrebonne Bay, Lake Pelto, and Timbalier Bay has supported a high concentration of oil and gas wells.

The first major coastal resort in Louisiana was located here and was washed away by the great hurricane of 1856 (USACE 2004c). The Isles Dernieres are also the location of five Coastal Wetland Planning, Protection, and Restoration Act (CWPPRA) projects. These projects included: Raccoon Island (TE-29), Whiskey Island (TE-27), Trinity Island (TE-24), East Island (TE-20), and New Cut (TE-37).

2.2 Timbalier Reach

The Timbalier Reach is comprised of Timbalier Island and East Timbalier Island. The two islands are on the western edge of the Lafourche barrier shoreline and are located about 60 miles southwest of New Orleans, Louisiana. This barrier island shoreline is approximately 20 miles long and backed by Terrebonne and Timbalier Bay to the north and delimited by Raccoon Pass to the east and Cat Island Pass to the west. The islands range from 0.1 to 0.6 miles wide and have low elevations. The Timbalier Islands support onshore and offshore oil and gas development and production. Oil and gas production facilities are prevalent along East Timbalier Island, while only a few scattered facilities are present along Timbalier Island. Oil and gas canals are present on both islands (USACE 2004c).

3 PURPOSE AND NEED FOR PROJECT

The overarching problem in the Terrebonne Basin barrier islands (hereafter referred to as Study Area) is a lack of sustainability of the coastal ecosystem, primarily due to coastal land loss. Natural processes and human actions, such as the construction of oil field canals and the containment of waterways, have threatened the long-term viability of the Study Area. These processes and activities have caused significant adverse impacts to the Terrebonne Basin barrier island shoreline, resulting in extensive barrier island habitat loss and ecosystem degradation (USACE 2004a). Specific problems in the Study Area include:

- Land loss due to erosion threatens the geomorphic and hydrologic barrier systems
- Longshore sediments are significantly reduced, limiting the ecosystem's ability to be self-sustaining
- Loss of barrier islands ecosystem habitat

- Freshwater wetlands are impacted by increased salinity

3.1 Critical Needs

The critical needs in the Study Area include:

- Restore and/or preserve critical and essential geomorphic structures (beach, dune, ridge, and marsh) of the Terrebonne Basin barrier system
- Reduce and/or prevent future land loss, habitat loss, and fragmentation of the land features
- Protect vital local, regional, and national socio-economic resources
- Protect the back barrier estuarine environments from the high energy marine processes and associated salinities of the GOM
- Near-term restoration should be synergistic with future restoration by maintaining or restoring the integrity of Louisiana's coastline, upon which all future coastal restoration is dependent
- Design and operate restoration features that support the development of large-scale, long-range comprehensive coastal restoration

The sustainability of the coastal ecosystems is threatened by the inability of the barrier islands to maintain geomorphologic functionality. The Isles Dernieres and Timbalier barrier islands are expected to be impacted by multiple tropical weather events over the next several decades. Each storm poses the risk of breaching the existing islands. As a result, these barrier islands will continue to degrade and migrate landward as an increasingly fragmented chain of smaller barrier islands. The fragmentation of the barrier islands will progressively increase the risk of a single storm event causing widespread fundamental changes in the hydrodynamics and ecological function of the interior bay system.

Complete opening of the bays to the unabated effects of storms will increase the volume of open water and fetch within these bays, decreasing their ecologic value. Ecologic changes will occur and storm surges will increase, requiring greater levels of flood risk reduction infrastructure in populated areas. As the islands continue to fragment and migrate northward allowing intrusion of the GOM, restoration will become progressively more expensive and difficult to implement. The effects of increased wave and storm energy will increase stress on, and contribute to a reduction in the vigor and aerial extent of, the remaining wetlands that now serve as a buffer affording protection against storms to the developed areas located north of the Study Area (USACE 2008).

3.2 Study Area Opportunities

Opportunities for ecosystem restoration include:

- Restore diversity of the barrier island habitats
- Increase longevity of the barrier island geomorphic function
- Increase sediment into the long-shore process
- Improve the barrier island habitat

Many of the above opportunities can be utilized in combination with planned or existing projects to produce synergistic effects while minimizing disruptions to the surrounding ecosystem and economy.

3.3 Planning Objectives

The LCA TBBSR study objectives are a localized and project specific delineation of the LCA objectives. Based on the function of these barrier islands and problems identified for the Terrebonne islands during this study, the following planning objectives were developed to assist the development and evaluation of alternative plans.

- Provide an expanded footprint of minimized barrier island section to provide the geomorphic form and ecologic function of the Terrebonne Basin barrier islands, reducing volume loss within the LCA TBBSR Study Area below the historic average (1880 through 2005).
- Restore and improve various barrier island habitats that provide essential habitats for fish, migratory birds, and other terrestrial and aquatic species, mimicking, as closely as possible, conditions which would occur naturally in the area for the 50 year period of analysis.
- Increase sediment input to supplement long-shore sediment transport processes along the gulf shoreline by mechanically introducing compatible sediment, and increasing the ability of the restored area to continue to function and provide habitat for the 50-year period of analysis with minimum continuing intervention.

3.4 Planning Constraints

Planning constraints relevant to the Project include natural resources limitations such as lack of suitable sediments for restoration; environmental impacts of human activities in the Study Area; infrastructure and cultural resources that must be avoided or relocated; and limitations in the characterization and simulation of environmental processes that determine the effects of alternatives plans. Barrier shoreline systems are dynamic. Each hurricane and winter season will impact the shoreline to varying degrees. Breaches created during a hurricane are often healed through the natural sand transport processes. However, lack of sediment in the Terrebonne barrier system has limited the natural ability of these breaches to close. Throughout the study, the team's analyses attempted to incorporate data related to these changes. However, the dynamic nature of the shoreline makes it more difficult to accurately simulate and predict the affects of the various alternatives.

3.5 Purpose

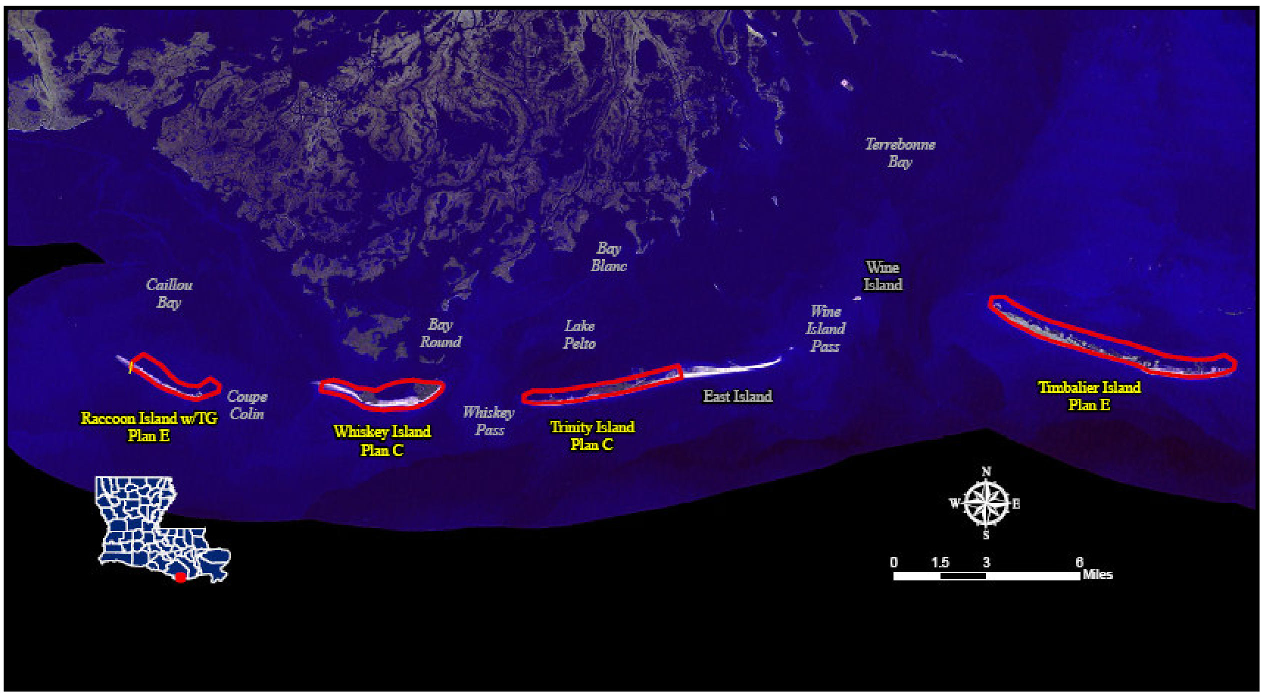
The purpose of the Project is to address the critical near-term need for shoreline restoration in the Study Area through simulation of historical conditions (USACE 2004a). This would be achieved by enlarging the existing barrier islands (width and dune crest) and reducing the current number of breaches. Additional objectives include analyzing the current conditions of the barrier islands, assessing impacts from the hurricanes of 2005 and 2008, and reaffirming the validity of the findings of the FPEIS conducted for the 2004 LCA Report (USACE 2004b).

4 PROPOSED PROJECT

4.1 National Ecosystem Restoration Plan

The National Ecosystem Restoration (NER) plan consists of Raccoon Island with Terminal Groin (Plan E), Whiskey Island (Plan C), Trinity Island (Plan C), and Timbalier Island (Plan E). The plan was selected because it is a Best Buy plan that restores the geomorphologic form and ecologic function of the four islands in the Terrebonne Basin barrier system. Immediately after construction (TY1), the NER will add 3,283 acres of habitat (dune, intertidal, and supratidal) to the existing island footprints of Raccoon, Whiskey, Trinity, and Timbalier Islands, increasing the total size of the islands to 5,840 acres. This includes approximately 472 acres of dune, 4,320 acres of supratidal habitat, and 1,048 acres of intertidal habitat. The NER plan is presented in Figure 4-1.

Figure 4-1. The National Ecosystem Restoration Plan



The creation of dune, supratidal, and intertidal habitats will provide essential habitats for fish, migratory birds, and other terrestrial and aquatic species. Furthermore, by using the proposed borrow areas, the project would increase sediment input to supplement long-shore sediment transport processes along the gulf shoreline by mechanically introducing compatible sediment, and increasing the ability of the restored area to continue to function and provide habitat with minimum continuing intervention. The plan also represents a system-wide and cost effective approach of restoring as many islands within the Terrebonne Basin barrier system which are constructible with available sediment sources.

Each of the islands in the NER plan will require at least one renourishment event in order to maintain their geomorphologic form and ecologic function throughout the 50-year period of analysis. The renourishment quantities and sequencing are provided in Table 4-1. Marsh renourishment was not included since the initial restoration plan provides for significant intertidal habitat throughout the 50 year period of analysis. The resulting habitat acres, including renourishment benefits, are provided in Table 4-2.

Table 4-1. Renourishment Sequencing and Quantities.

Island Plan	Renourishment Year	Renourishment Plan
Raccoon Plan E w/ TG	TY30	Restore Plan B
Whiskey Plan C[a]	TY20	Add Plan C
	TY40	Add Plan B
Trinity Plan C	TY25	Add Plan C
Timbalier Plan E	TY30	Restore Plan B

[a] Whiskey would require two renourishments, one at TY20 and one at TY40

Table 4-2. Summary of Habitat Values for the NER Plan

Island	Habitat Type	Habitat Acres												
		TY0 2012	TY1 2013	TY5 2017	TY10 2022	TY20 2032	TY21 2033	TY25 2037	TY26 2038	TY30 2042	TY31 2043	TY40 2052	TY41 2053	TY50 2062
Raccoon w/TG Plan E	Dune	0	63	50	29	20	18	10	8	0	45	15	14	3
	Supratidal	51	688	678	659	650	603	416	369	182	204	165	166	170
	Intertidal	188	38	39	40	39	82	253	295	466	468	486	484	468
	Total	239	789	767	728	709	703	679	672	648	717	666	664	641
Whiskey Plan C	Dune	0	65	61	57	0	65	61	61	57	51	0	57	0
	Supratidal	377	830	328	223	84	496	375	344	223	209	84	387	164
	Intertidal	443	377	808	828	847	834	782	769	717	693	472	461	363
	Total	820	1272	1197	1108	931	1395	1218	1174	997	953	556	905	527
Trinity Plan C	Dune	39	129	122	67	0	0	0	129	122	113	34	30	0
	Supratidal	232	456	316	270	190	170	90	496	320	311	230	216	90
	Intertidal	311	564	632	635	594	595	597	590	561	543	380	362	199
	Total	582	1149	1070	972	784	765	687	1215	1003	967	644	608	289
Timbalier Plan E	Dune	57	215	183	160	0	0	0	0	0	155	13	12	0
	Supratidal	549	2346	2257	2130	1996	1859	1313	1176	629	667	524	495	236
	Intertidal	374	69	71	74	76	183	612	719	1148	1146	1123	1120	1088
	Total	979	2630	2511	2364	2072	2043	1925	1895	1777	1968	1660	1626	1324
Total	Dune	95	472	416	313	20	83	71	198	179	364	62	113	3
	Supratidal	1209	4320	3579	3282	2920	3129	2193	2385	1354	1391	1003	1264	660
	Intertidal	1315	1048	1550	1577	1556	1694	2244	2373	2892	2849	2461	2427	2118
	Total	2619	5840	5545	5172	4496	4905	4508	4956	4425	4604	3526	3803	2781

4.2 First Component of Construction

The NER plan, which consists of Whiskey Plan C, Trinity Plan C, Raccoon Plan E with Terminal Groin, and Timbalier Plan E was selected as the NER because it was a Best Buy that fulfills the planning objectives of the project. The plan also represents a system-wide and cost effective approach of restoring as many islands within the Terrebonne Basin barrier system which are constructible with available sediment sources. However, the NER plan cannot be constructed under the current WRDA 2007 authorization. Therefore, a subset of the NER plan is recommended as the first component of construction.

In order to identify the first component of construction from the NER plan, the PDT performed separate cost refinements on each island in the NER using MCACES Second Generation (MII). The original contingency was also refined using Crystal Ball. These refinements inflated the costs of the islands, leaving Trinity Island Plan C and Whiskey Island Plan C as the only islands plans that could be constructed within the budget. Consequently, a separate screening process was conducted on the two islands to select the most appropriate island for the first component of construction.

Although Whiskey Plan C provides slightly fewer AAHUs than Trinity Island Plan C (379 AAHUs vs. 387 AAHUs), it was selected as the first component of construction due to a number of qualitative benefits provided by the plan. For example, Whiskey Plan C was designed to avoid approximately 286 acres of existing mangroves on the island in order to minimize the ecologic impact during construction. The plan will restore a total of 1,272 acres of dune, supratidal, and intertidal habitat on the Terrebonne Basin Barrier Shoreline. Since the island is considered a valuable wildlife habitat (Isles Dernieres Barrier Islands Wildlife Refuge) and the LDWF is reestablishing a pelican rookery on the island, maintaining adequate areas of healthy beach, dune, and marsh is particularly important. The island is also a critical habitat for endangered species including the piping plover and is a valuable stopover habitat for migratory birds.

The initial construction of Whiskey Island is estimated to take 447 days to complete. This includes beach, dune, and marsh fill activities. As seen in Table 4-1, Whiskey Island Plan C will require two renourishment intervals. The first would occur at TY20 and would include the addition of the same amount of dune and supratidal beach habitat that was originally created in TY1 (i.e. add a Plan C to the template at TY20). The second renourishment interval would occur at TY 40 and would include the addition of the same amount of dune and supratidal beach habitat needed to construct a Plan B template. The resulting habitat acres, including renourishment benefits, are provided in Table 4-2.

4.3 Components

The following sections detail the proposed templates for each of the four islands in the NER plan, including Whiskey Island Plan C, which was selected as the first component of construction.

4.3.1 Raccoon Island Plan E with Terminal Groin

Raccoon Plan E proposes a dune height of +7.7 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 1.7 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The dune elevation is considerably higher than that of Trinity and Whiskey because the plan is design to withstand 25 years of additional background erosion rather than just 5 years. Furthermore, the thickness of the 25-year plan (Plan E) results in a higher compaction rate.

The slopes of the beach and dune are set 60:1 and 30:1 (horizontal to vertical), respectively. The marsh fill is proposed on the landward side of the dune at an elevation of +3.7 feet NAVD 88. As with the dune elevation, the marsh elevation is higher than that of Whiskey and Trinity because it is designed withstand a longer duration of background erosion.

Immediately after construction (TY1), the Raccoon Plan E will add 554 acres of habitat (dune, intertidal, and supratidal) to the existing 235-acre island footprint, increasing the size of the island to 789 acres. This includes 63 acres of dune, 688 acres of supratidal, and 38 acres of intertidal habitat.

Eight detached and segmented breakwaters were constructed as part of a CWPPRA project (TE-29) in 1997. The breakwaters were installed to reduce shoreline retreat, promote sediment deposition along the beach, and to protect shorebird habitat. Due to the success of the TE-29 breakwaters, eight additional breakwaters were constructed as part of a separate CWPPRA project (TE-48) that was completed in 1997. The breakwaters were installed west of the original breakwaters. TE-48 also included the creation of approximately 60 acres of emergent and intertidal back-barrier marsh.

Raccoon Plan E was designed to complement the intertidal marsh created as part of TE-48. Plan E was also designed to avoid approximately 58 acres of existing mangroves immediately adjacent to and gulfward of TE-48 (Figure 4-2).

The restoration plan for Raccoon Island (the western-most island), will include the construction of a terminal groin. The terminal groin will be approximately 1200 feet long and 75 feet wide and will be installed at the western terminus of the template to prevent sediment migration out of the Isle Dernieres system. The sediment that moves off of Raccoon Island to the west is lost to the shoals and buried by the mud stream from the Atchafalaya, so a terminal groin on Raccoon Island will not starve another island. Apart from the terminal groin, the natural long-shore sediment transport mechanisms within the Isles Deneries and Timbalier Islands would not be altered by the Project.

Fill quantities for the dune/beach and marsh components of Raccoon Plan E are 5.2 million and 5.1 million cubic yards, respectively. The plan will utilize beach/dune material from Ship Shoal and marsh material from the Raccoon Island TE-48 borrow area. However, the borrow area does not have enough material to construct the marsh in its entirety. Therefore, approximately 2.7 million cubic yards of sand will be dredged from Ship Shoal to provide a base layer for the marsh. The marsh material from the Raccoon Island TE-48 borrow area will be deposited on the sand material to provide an adequate foundation for the marsh.

For the dune area, the material will be pumped from the dredge to the beach. The material will then be worked on the beach by bulldozers and front-end loaders. For the marsh area, the material will be pumped from the offshore borrow site. Containment dikes will be constructed around the perimeter. Sediment for the containment dikes will be dredged from existing material inside the marsh creation area. These operations will be completed in a manner that will minimize turbidity of the water at the dredge site and the discharge site. The initial construction of Raccoon Island is estimated to take 454 days to complete. This includes beach, dune, and marsh fill activities as well as the construction of the terminal groin. Figure 4-2 presents the plan view of Raccoon Plan E the proposed terminal groin.

Approximately 11,912 feet of sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings will include a variety of native species. The recommended planting density is no greater than 8-foot centers.

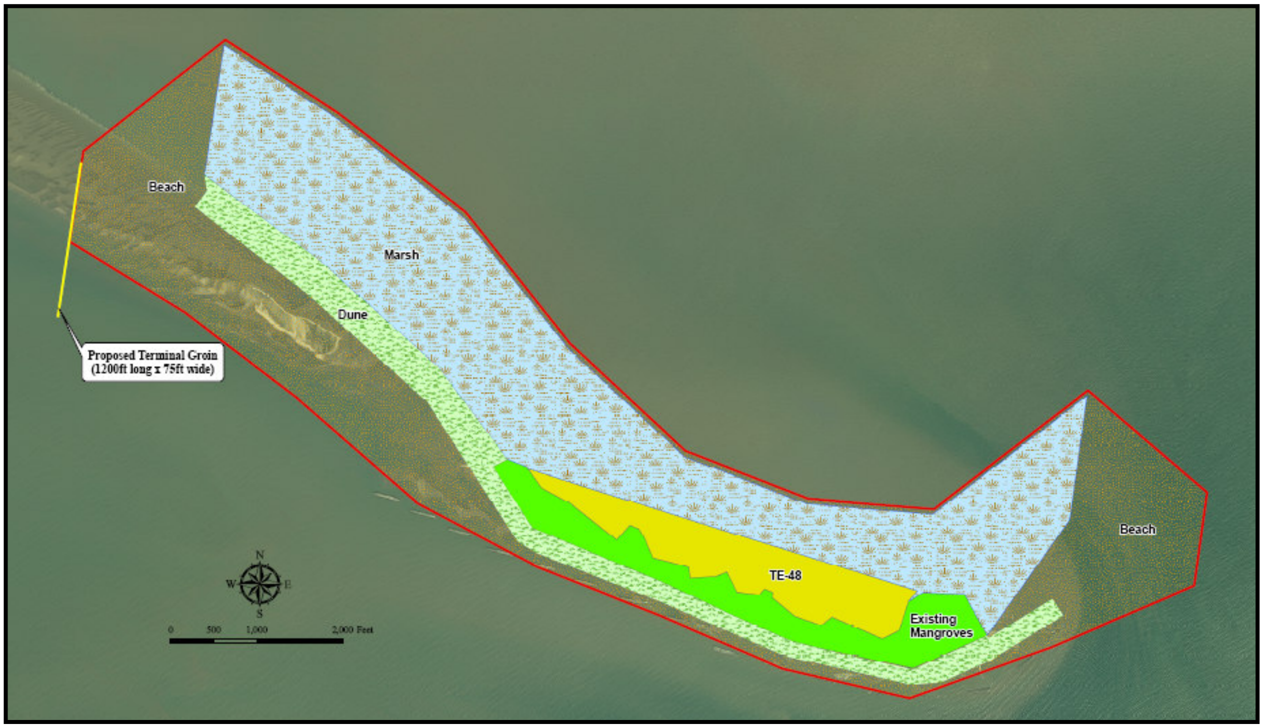


Figure 4-2. Raccoon Island Plan E with Terminal Groin

4.3.2 Whiskey Island Plan C

Whiskey Island Plan C, which is one of the four islands in the NER plan, was also selected as the first component of construction . The plan proposes a dune height of +6.4 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 0.4 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The slopes of the beach and dune are set 60:1 and 30:1 (horizontal to vertical), respectively.

The marsh fill is proposed on the landward side of the dune at an elevation of +2.4 feet NAVD 88. Although the design elevation for the marsh is 1.6 feet NAVD 88, the marsh will be constructed at a higher elevation to account for initial vertical adjustments.

The plan will utilize beach/dune material from the Ship Shoal borrow area and marsh material from Whiskey 3a borrow area. Fill quantities for the initial construction of the dune/beach and marsh components of Whiskey Plan C are 8.3 million and 0.6 million cubic yards, respectively. For the dune area, the material will be pumped from the dredge to the beach. The material will then be worked on the beach by bulldozers and front-end loaders. For the marsh area, the material will be pumped from the offshore borrow site. Containment dikes will be constructed around the perimeter. Sediment for the containment dikes will be dredged from existing material inside the marsh creation area. These operations will be completed in a manner that will minimize turbidity of the water at the dredge site and the discharge site. The initial construction of Whiskey Island is estimated to take 447 days to complete. This includes beach, dune, and marsh fill activities. Figure 4-3 presents the plan view of Whiskey Plan C.

Approximately 18,075 feet of sand fencing will be installed. The sand fences are porous barriers that reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences will promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings will include a variety of native species. The recommended planting density is no greater than 8-foot centers.

Figure 4-3. Whiskey Island Plan C

4.3.3 Trinity Island Plan C

Trinity Plan C proposes a dune height of +6.4 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 0.4 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The slopes of the beach and dune are set 60:1 and 30:1 (horizontal to vertical), respectively. The marsh fill is proposed on the landward side of the dune at an elevation of +2.5 feet NAVD 88, which is slightly higher than the dune elevation at Whiskey. Due to the existing topography of Trinity Island, the required marsh fill thickness is greater and thus results in a higher compaction rate. As with Whiskey Island, the dune and marsh elevations account for vertical adjustments occurring after the first six months of construction.

Immediately after construction (TY1), the Trinity Plan C will add 585 acres of habitat (dune, intertidal, and supratidal) to the existing 564-acre island footprint, increasing the size of the island to 1,149 acres. This includes 129 acres of dune, 456 acres of supratidal, and 564 acres of intertidal habitat.

Trinity Plan C will utilize beach/dune material from Ship Shoal and marsh material from the Whiskey 3A borrow area. Fill quantities for the dune/beach and marsh components of Trinity Plan C are 3.1 million and 4.0 million cubic yards, respectively. For the dune area, the material will be pumped from the dredge to the beach. The material will then be worked on the beach by bulldozers and front-end loaders. For the marsh area, the material will be pumped from the offshore borrow site. Containment dikes will be constructed around the perimeter. Sediment for the containment dikes will be dredged from existing material inside the marsh creation area. These operations will be completed in a manner that will minimize turbidity of the water at the dredge site and the discharge site. The initial construction of Trinity Island is estimated to take 484 days to complete. This includes beach, dune, and marsh fill activities. Figure 4-4 presents the plan view of Trinity Plan C.

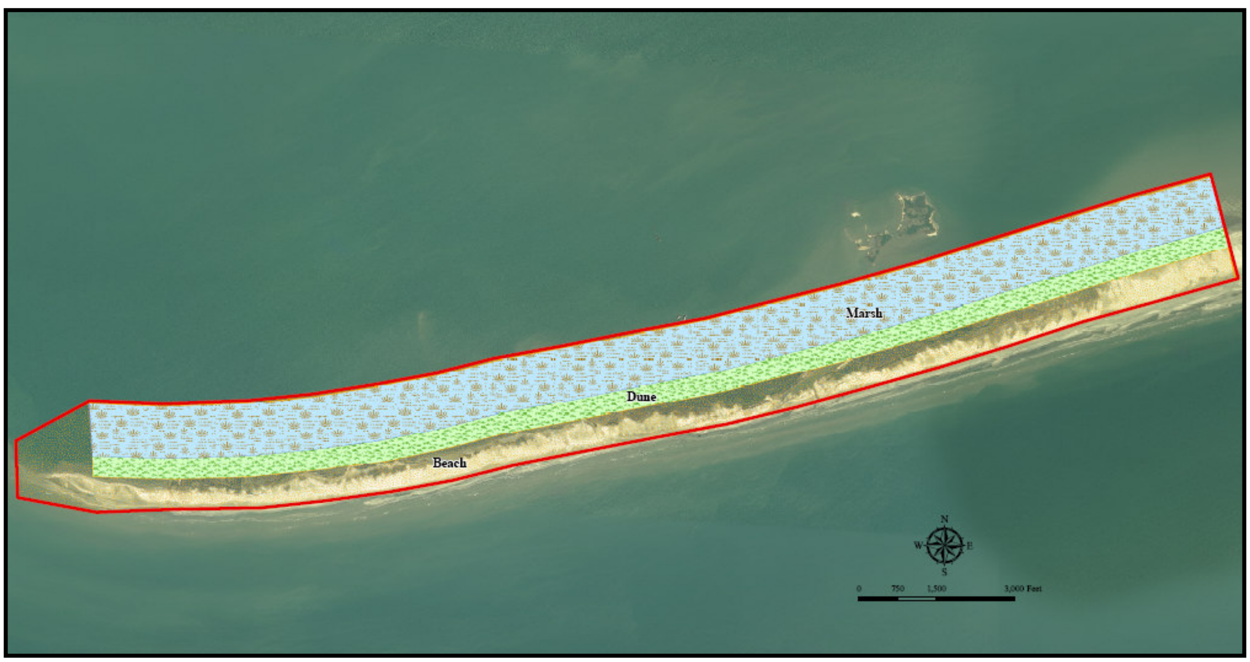


Figure 4-4. Trinity Island Plan C

Approximately 22,467 feet of sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings will include a variety of native species. The recommended planting density is no greater than 8-foot centers.

4.3.4 Timbalier Island Plan E

Timbalier Plan E proposes a dune height of +7.1 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 1.1 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The slopes of the beach and dune are set 60:1 and 30:1 (horizontal to vertical), respectively. The marsh fill is proposed on the landward side of the dune at an elevation of +3.2 feet NAVD 88. As with Raccoon Island Plan E, the elevations of the plan are larger than that of Trinity and Whiskey because it is designed to withstand a longer period of background erosion. Furthermore, the larger plans are thicker and thus exhibit higher compaction rates.

Immediately after construction (TY1), the Timbalier Plan E will add 1,675 acres of habitat (dune, intertidal, and supratidal) to the existing 955-acre island footprint, increasing the size of the island to 2,630 acres. This includes 215 acres of dune, 2,346 acres of supratidal, and 69 acres of intertidal habitat.

Fill quantities for the dune/beach and marsh components of Timbalier Plan E are 10.7 million and 9.1 million cubic yards, respectively. Timbalier Plan E will utilize beach/dune material from South Pelto and marsh material from Whiskey 3A (marsh material). However, the marsh borrow areas do not have adequate material to construct the marsh in its entirety. Therefore, approximately 8.6 million cubic yards of sand will be dredged from South Pelto, Whiskey 3A (sandy material), and New Cut to provide a base layer for the marsh. The marsh material from Whiskey 3A will be deposited on the sand material to provide an adequate foundation for the marsh.

For the dune area, the material will be pumped from the dredge to the beach. The material will then be worked on the beach by bulldozers and front-end loaders. For the marsh area, the material will be pumped from the offshore borrow site. Containment dikes will be constructed around the perimeter. Sediment for the containment dikes will be dredged from existing material inside the marsh creation area. These operations will be completed in a manner that will minimize turbidity of the water at the dredge site and the discharge site. The initial construction of Timbalier Island is estimated to take 1,095 days to complete. This includes beach, dune, and marsh fill activities. Figure 4-5 presents the plan view of Timbalier Plan E.

Approximately 35,425 feet of sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings will include a variety of native species. The recommended planting density is no greater than 8-foot centers.

Figure 4-5. Timbalier Island Plan E

5 DESCRIPTION AND STATUS OF SPECIES

There are twenty-nine animals and three plant species, under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), presently classified as threatened or endangered within the state of Louisiana (Table 5-1). Based on a letter from USFWS to the U.S. Army Corps of Engineers dated March 2010 (USFWS 2010a), Federally listed threatened/endangered species occurring in the Study Area include the piping plover, West Indian manatee, loggerhead sea turtle, Kemp's Ridley sea turtle, green sea turtle, leatherback sea turtle, and hawksbill sea turtle. The USFWS also identified the Brown Pelican and colonial nesting waterbirds as species of special interest within the Study Area. The USFWS letter is provided in Annex A1.

Compliance with the ESA (7 U.S.C. 136; 16 U.S.C. 460 et seq.) has been coordinated with the USFWS and the NMFS for those species under their respective jurisdictions. The use of recommended primary activity exclusion zones and timing restrictions would be utilized, to the maximum extent practicable, to avoid project construction impacts to any threatened or endangered species or their critical habitat within the Study Area. The USACE will continue to closely coordinate and consult with the USFWS and the NMFS regarding threatened and endangered species under their jurisdiction that may be potentially impacted by the proposed action. Although the West Indian manatee and the Hawksbill, Kemp's ridley, Leatherback, Loggerhead, and Green sea turtles may be found in the Study Area, the only endangered species with a high potential for adverse impacts from the proposed project is the piping plover. Multi-project research is currently underway to determine the potential for diversion impacts to this species. Formal consultation on the piping plover has been conducted and the USFWS has issued a Biological Opinion (Annex A2). The USACE has agreed to comply with the RPM and the terms and conditions outlined in the Biological Opinion.

In September of 2010, the USFWS provided a draft version of the USFWS Coordination Act Report (FWCAR). The report reiterated the status of the threatened and endangered species in the study area as well as the species of special Interest (USFWS, 2010c). Furthermore, the USFWS provided recommendations for minimizing impacts to these species during construction. These recommendations will be implemented to the fullest extent practicable. All construction and renourishment activities will be conducted in close coordination with USFWS as well as LDWF.

Table 5-1. Threatened and Endangered Species in Louisiana

Classification	Species	Scientific Name	Status	Jurisdiction	Found in Study Area?
Mammals	Florida Panther[1]	Felis concolor coryl	Endangered	USFWS	No
	Red Wolf[1]	Canis rufus	Endangered	USFWS	No
	West Indian Manatee	Trichechus manatus	Endangered	USFWS	Yes
	Louisiana Black Bear	Ursus americanus luteolus	Threatened	USFWS	No
Birds	Bachman's Warbler[2]	Vermivora bachmanii	Endangered	USFWS	No
	Eskimo Curlew[1]	Numenius borealis	Endangered	USFWS	No
	Ivory-billed Woodpecker[1]	Campephilus principalis	Endangered	USFWS	No
	Least Tern; interior population	Sterna antillarum	Endangered	USFWS	No
	Red-cockaded Woodpecker	Picoides borealis	Endangered	USFWS	No
	Piping Plover	Charadrius melodus	Threatened	USFWS	Yes
Reptiles	Hawksbill Sea Turtle	Eretomchelys imbricate	Endangered	USFWS/NMFS	Yes
	Kemp's (Atlantic) Ridley Sea Turtle	Lepidochelys kempii	Endangered	USFWS/NMFS	Yes
	Leatherback Sea Turtle	Dermochelys coriacea	Endangered	USFWS/NMFS	Yes
	American Alligator[3]	Alligator mississippiensis	Threatened	USFWS	No
	Gopher Tortoise	Gopherus polyphemus	Threatened	USFWS	No
	Green Sea Turtle	Chelonia mydas	Threatened	USFWS/NMFS	Yes
	Loggerhead Sea Turtle	Caretta caretta	Threatened	USFWS/NMFS	Yes
	Ringed Sawback Turtle	Graptemys oculifera	Threatened	USFWS	No
	Snake, Louisiana Pine	Pituophis ruthveni	Candidate[4]	USFWS	No
Fish	Pallid Sturgeon	Scaphirhynchus albus	Endangered	USFWS	No
	Gulf Sturgeon	Acipenser oxyrinchus desotoi	Threatened	USFWS/NMFS	No
	Dusky Shark	Carcharhinus obscurus	Candidate[4]	NMFS	No
	Sand Tiger Shark	Odontaspis Taurus	Candidate[4]	NMFS	No
	Night Shark	Carcharinus signatus	Candidate[4]	NMFS	No
	Speckled hind	Epinephelus drummondhayi	Candidate[4]	NMFS	No

Classification	Species	Scientific Name	Status	Jurisdiction	Found in Study Area?
	Saltmarsh topminnow	Fundulus jenkensi	Candidate[4]	NMFS	No
	Jewfish	Epinephelus itajara	Candidate[4]	NMFS	No
	Warsaw Grouper	Epinephelus striatus	Candidate[4]	NMFS	No
Invertebrates	Mussel, Fat Pocketbook	Potamilus capax	Endangered	USFWS	No
	Pink pearlymussel Mucket	Lampsilis abrupta	Endangered	USFWS	No
	Inflated (Alabama) Heelsplitter	Potamilus inflatus	Threatened	USFWS	No
	Louisiana Pearlshell	Margaritifera hembeli	Threatened	USFWS	No
Marine Mammals	Sperm Whale	Physeter macrocephalus	Endangered	NMFS	No
	Sei Whale	Balaenoptera borealis	Endangered	NMFS	No
	Humpback Whale	Megaptera novaeangliae	Endangered	NMFS	No
	Finback Whale	Balaenoptera physalus	Endangered	NMFS	No
	Blue Whale	Balaenoptera musculus	Endangered	NMFS	No
Plants	American Chaffseed	Schwalbea Americana	Endangered	USFWS	No
	Louisiana Guillwort	Isoetes louisianensis	Endangered	USFWS	No
	Earth Fruit	Geocarpon minimum	Threatened	USFWS	No

1 The Florida panther, red wolf, Eskimo curlew, and ivory-billed woodpecker are presumed to be extinct in the state.

2 There has been no confirmed Bachman's warbler U.S. nesting ground sighting since the mid-1960s, however, several sightings of the species have occurred on wintering grounds during the last decade. This species may be extirpated in Louisiana.

3 For law enforcement purposes, the alligator in Louisiana is classified as "Threatened due to Similarity of Appearance." They are biologically neither endangered nor threatened. Regulated harvest is permitted under state law.

4 Candidate species are not protected under the ESA, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

The following sections provide the federal status, species descriptions, and habitat information for the threatened/endangered species found within the Project Boundary of the NER plan. The Project Boundary refers to each of the four island in the NER plan (which includes the first component of construction) as well as the borrow areas used in their construction. Much of this information was adapted from the Biological Assessment conducted for the Barataria Basin Barrier Shoreline (BBBS) Restoration Feasibility Study (USACE 2009) and CWPPRA Project TE-50 (USEPA 2009). The BBBS project was considered to be directly applicable because the project proposes similar restoration efforts for barrier islands near the Project Boundary. The CWPPRA Project was constructed on Whiskey Island in 2009 and was therefore considered applicable to the TBBSR Project. Colonial nesting birds and the Brown Pelican are also discussed since they are Species of Interest that are found within the Project Boundary.

5.1 Piping Plover

The piping plover, (*Charadrius melodus*), is a small shorebird approximately seven inches in length with a wingspan of approximately fifteen inches and weighs from 1.5 to 2 ounces. It is sand-colored on the back with white undersides. The piping plover is distinguished from similar species by its bright orange legs. During the breeding season, the plover has a single black band across its breast and forehead, which are absent during the winter.

The piping plover is named for its melodic mating call. It is a small, pale-colored North American shorebird. The bird's light sand-colored plumage blends in with sandy beaches and shorelines. There are three populations of piping plovers in the United States. The most endangered is the Great Lakes breeding population, which encompasses only thirty-two breeding pairs. The Northern Great Plains and Atlantic Coast populations are classified as threatened and include 1398 and 1372 breeding pairs, respectively. All piping plovers winter along the southeast and Gulf coasts and are classified as threatened in their wintering habitat (USFWS 2000). Major threats to the piping plover include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

As seen in Figure 5-1, the historical breeding range in North America of the piping plover included the Atlantic coastal beaches from Newfoundland to South Carolina; beaches of the Great Lakes; and the northern Great Plains region from Alberta to Ontario and south to Nebraska (USFWS 2000). These populations were reported to winter along the GOM, the Atlantic coast from North Carolina to Florida, eastern Mexico, and in the Caribbean Islands (Haig and Oring 1985). Approximately thirty-five percent of the total breeding piping plover population winters along the Gulf coast from Florida to Texas and represents fifty-six percent of the Great Lakes/Great Plains population (Nicholls and Baldassarre 1990).

The population potentially occurring within the Project Boundary is the Great Lakes population. They arrive from their northern breeding grounds as early as late July and may be present for eight to ten months of the year.

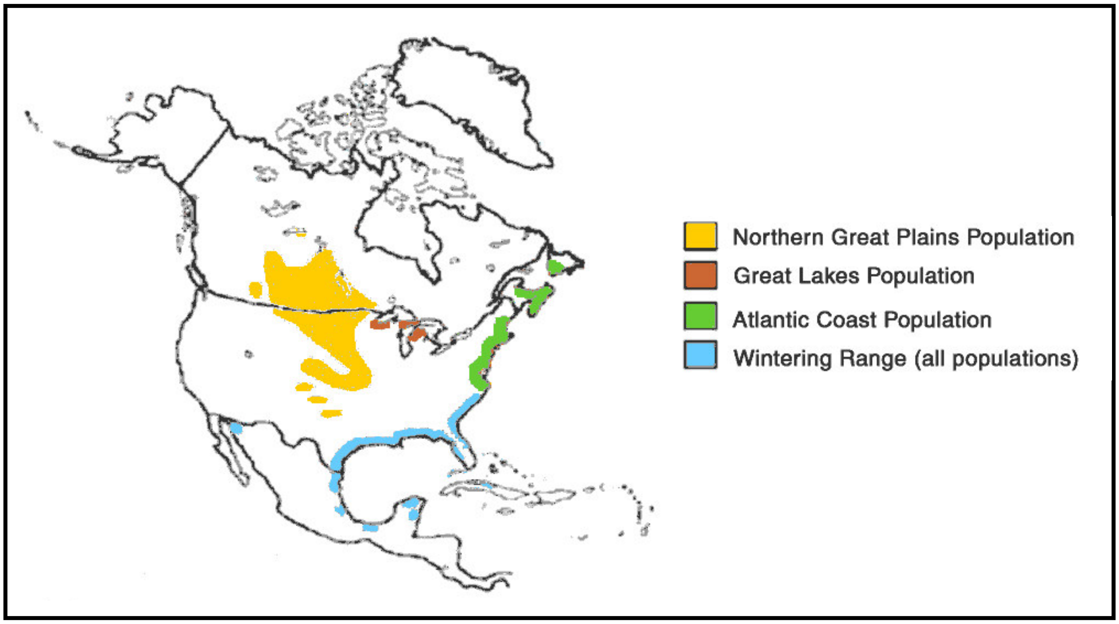


Figure 5-1. Distribution of Piping Plover Populations (USFWS 2000)

Northward migration to the breeding grounds occurs during late February, March, and early April (Patterson 1988, MacIvor et al. 1990). Plovers will breed at one year of age (MacIvor 1990, Haig 1992) and are monogamous, but usually shift mates from year to year (Wilcox 1959, Haig and Oring 1988, MacIvor et al. 1990).

Southward migration to the wintering grounds along the southern Atlantic coast and GOM shoreline extends from late July through September. Individuals can be found on their wintering grounds throughout the year but sightings are rare in May, June, and early July (USFWS 1996).

Ideal wintering habitat for the piping plover on the Gulf of Mexico coast would contain large sand flats or sand-mud flats adjacent to a tidal pass or tidal inlet (Haig and Oring 1985, Nicholls 1989). A thin layer of mud covering the sand seems to attract plovers, due to possible food or refuge association (Nicholls 1989). Nicholls observed that barrier beaches with over wash areas or sections of old marshes also attract plovers. A gulf-facing beach having a very low gradient, thus an increased intertidal zone, offers an almost equally attractive area (Haig and Oring 1985). Also piping plovers will inhabit spoil islands on the Gulf Intracoastal Waterway on both Atlantic and Gulf Coasts. Winter 2001 census observations were in the following habitat types: mudflats (36.3%), sandy beaches (33.2%), sand/salt flats (23.1%) algal mats (2.8%), oyster reefs (1.0%) and gravel shores (0.1%; Haig 2004).

Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers (USEPA 2006)

In July of 2001, the USFWS designated specific areas in the United States as critical habitat for wintering piping plovers (Federal Register / Vol. 66, No. 132, 10 July 2001). Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components." The USFWS also indicated that constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important primary constituent elements of intertidal flats include sand and/or mud flats with no or very sparsely emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers (USFWS, 2001). The USFWS designated a total of 1,798 miles (165,211 acres) of shoreline along the GOM and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana. The critical habitat designations within Louisiana include:

- Unit LA-1: Texas/Louisiana border to Cheniere au Tigre. 6,548 acres in Cameron and Vermilion Parishes
- Unit LA-2: Atchafalaya River Delta. 2,276 acres in St. Mary Parish, LA
- Unit LA-3: Point Au Fer Island. 482 acres in Terrebonne Parish.
- Unit LA-4: Isles Dernieres. 1,964 acres in Terrebonne Parish
- Unit LA-5: Timbalier Island to East Grand Terre Island. 5,735 acres in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes.
- Unit LA-6: Mississippi River Delta. 259 acres in Plaquemines Parish, LA.
- Unit LA-7: Breton Islands and Chandeleur Island Chain. 7,700 acres in Plaquemines and St. Bernard Parishes, LA

The NER plan occurs within critical habitat designation Unit LA-4 and LA-5. Critical habitat acreages for Raccoon, Whiskey, Trinity, and Timbalier Island are summarized in Table 5-1 and visually delineated on Figures 5-2 through 5-5.

Table 5-2. Critical Habitat Acreages for the NER Plan

Island	Critical Habitat (acres)[1]
Raccoon Island	171
Whiskey Island	269
Trinity Island	303
Timablier Island	572
Total NER Plan	1315

[1]Based on 2008 USGS aerial photography

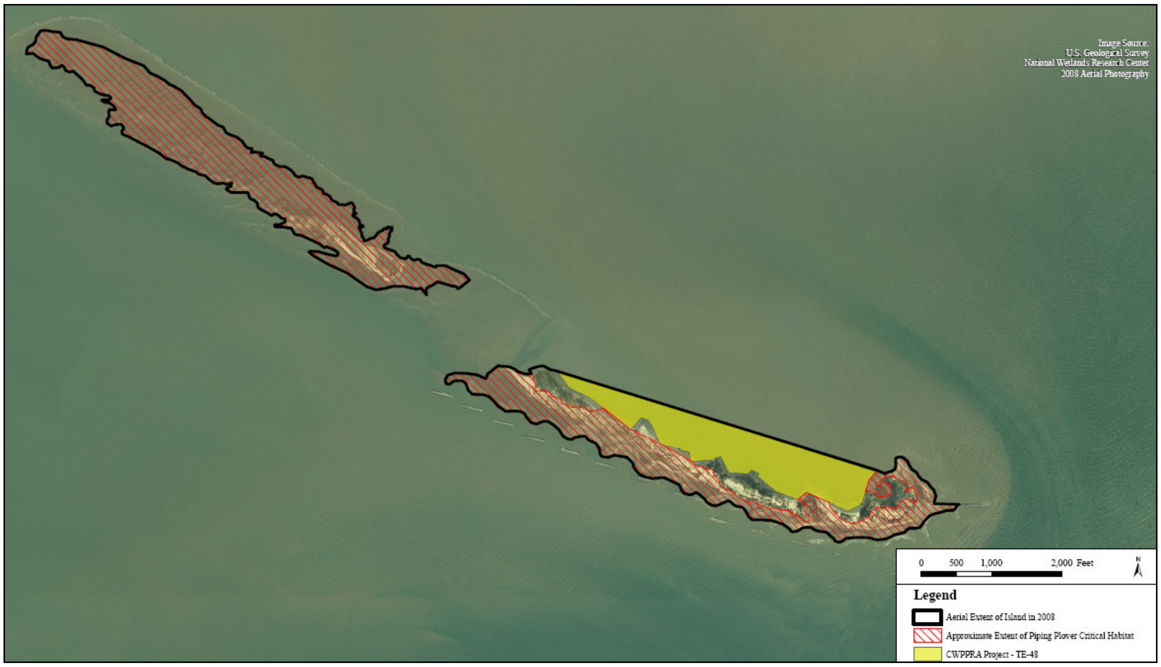


Figure 5-2. Piping Plover Critical Habitat on Raccoon Island

Figure 5-3. Piping Plover Critical Habitat on Whiskey Island

Figure 5-4. Piping Plover Critical Habitat on Trinity Island

Figure 5-5. Piping Plover Critical Habitat on Timbalier Island

5.2 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) was Federally-listed as an endangered species in March 11, 1967. The species is further protected as a depleted stock under the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361-1407).

Manatees are marine mammals that inhabit marine, estuarine, and freshwater environments. They utilize freshwater runoff sites and springs for drinking water; secluded canals, embayments, and lagoons for resting, cavorting, procreating, and raising young; and open waterways for traveling. Preferred feeding areas include shallow seagrass beds near deep channels and smooth cordgrass beds in salt marshes. Because they are a subtropical species, they are adversely affected by cold weather and are susceptible to "cold stress syndrome". During periods of intense cold, they seek out warm-water refuges including springs and warm-water discharge pipes from industrial facilities (USFWS 2010b).

Manatees occasionally enter in Lakes Pontchartrain and Maurepas. Sightings appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast (USFWS 2010c).

Although manatee sightings are increasing locally, global populations of manatees have declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals. Adult manatees typically give birth to a single calf every two to five years. Because of their low reproductive rate, manatees are less capable of rebounding from adverse environmental impacts (USFWS 2010b).

5.3 Hawksbill Sea Turtle

The Hawksbill sea turtle (*Eretomchelys imbricate*) was listed as an endangered species throughout its range on June 2, 1970. It is one of seven species of sea turtles found throughout the world. One of the smaller sea turtles, it has overlapping scutes (plates) that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from thirty to thirty-six inches (0.8- 1.0 meters) carapace length, and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak.

The hawksbill sea turtle is one of the most infrequently encountered sea turtles in offshore Louisiana. However, a hawksbill was reported near Calcasieu Lake in 1986. Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than seventy feet. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental United States, nesting sites are restricted to Florida where nesting is sporadic at best (NMFS /USFWS 1993). Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the Project area.

5.4 Kemp's Ridley Sea Turtle

On December 2, 1970, the Kemp's ridley sea turtle (*Lepidochelys kempii*) was designated as endangered across its entire range (35 FR 18319). Critical habitat has been proposed, but has not been finalized to date.

The Kemp's ridley is the rarest, most endangered, and enigmatic of all sea turtles world-wide (Perrine 2003; Spotila 2004). Although this small sea turtle has continued to decline in Louisiana, it is still believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961).

The Kemp's ridley has the most limited distribution of any sea turtles except the Australian flatback (Perrine 2003). For the most part, breeding is confined to a limited stretch of beach on the Gulf coast of Mexico. The known range of this species includes the GOM and the Atlantic Ocean. The current range for Kemp's ridley in the United States includes marine habitat of the following coastal states: Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

Inshore areas of the GOM appear to be important habitat for Kemp's ridleys, as they tend to concentrate around the mouths of major rivers (Frazier 1980). Members of this genus are characteristically found in waters of low salinity and high turbidity and organic content, where shrimp are abundant (Zwinenberg 1977; Hughes 1972 as cited in Frazier 1980). Kemp's ridleys have been collected in Louisiana from Lake Borgne, Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989).

Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there. Stomach analyses of specimens collected in shrimp trawls off Louisiana revealed crabs, gastropods, and clams (Dobie et al. 1961). Although Kemp's ridleys are considered primarily carnivorous benthic feeders (Ernst and Barbour 1972), jellyfish as well as by-catch from shrimp trawlers have been reported as part of their diet (Landry 1986).

5.5 Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*) was listed as an endangered species throughout its range on June 2, 1970 (35 FR 8491). Critical habitat was designated on September 26, 1978 (43 FR 43688), March 23, 1979 (44 FR 17710), and March 23, 1999 (64 FR 14051). Critical habitat has been designated for shoreline and adjacent waters of the U.S. Virgin Islands (50 CFR 17.95; 50 CFR 226.207). The leatherback is found throughout the tropical waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972), the GOM, and the Caribbean (Carr 1952). Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W. This turtle exhibits seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features (Pritchard 1971; Fritts et al. 1983). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to mid-Florida.

Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been reported in Louisiana (Gunter 1981; Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been collected from or sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989).

Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians, and have been associated with large schools of cabbage head jellyfish (*Stomolophus meleagris*). Fritts et al. (1983) reported that these turtles also ingest plastic, apparently mistaking it for food.

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Leatherbacks are seriously declining at all major nesting beaches throughout the Pacific. The decline is dramatic along the Pacific coasts of Mexico, Costa Rica and Malaysia. Nesting along the Pacific coast of Mexico declined at an annual rate of twenty-two percent over the last twelve years, and the Malaysian population represents one percent of the levels recorded in the 1950s. The collapse of those nesting populations was precipitated by a tremendous over-harvest of eggs, direct harvest of adults, and incidental mortality from fishing. In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Nesting data for these locations have been collected since the early 1980s and indicate that the annual number of nests is likely stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking. Nesting activity has also declined in French Guiana due to erosion of nesting beaches. The population appears to have shifted to Surinam, where annual numbers of nests rose from less than 100 in 1967 to 5,565 in 1977 and 9,816 in 1987. Current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide.

5.6 Green Sea Turtle

Breeding populations of the green sea turtle (*chelonian mydas*) in Florida and the Pacific coast of Mexico are listed as endangered, all others are listed as threatened under the Endangered Species Act of 1973, as amended, on July 28, 1978 (43 FR 32800). Critical habitat for the green sea turtle was designated on September 2, 1998 (63 FR 46701); critical habitat was redesignated and amended on March 23, 1999 (64 FR 14067). Critical habitat has also been designated for waters surrounding Culebra Island, Puerto Rico (50 CFR 226.208).

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68˚F (20˚C), their distribution can be correlated to grass bed distribution, location of nesting beaches, and associated ocean currents (Perrine 2003; Spotila 2004). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Population decline has been attributed to heavy fishing pressure and human nest predation (Dundee and Rossman 1989; Perrine 2003; Spotila 2004). Historically, green sea turtles were fished off the Louisiana coast, especially the Chandeleur Islands (Rebel 1974). Exploitation and incidental drowning in shrimp trawls has contributed to the decline of this species and its eventual listing (King 1981). During their first year of life, green sea turtles are primarily carnivorous, feeding mainly on invertebrates. Green turtles are the only sea turtles that eat large amounts of plants, feeding in shallow water areas with abundant seagrasses or algae (Fritts et al. 1983; Spotila 2004). Green sea turtles also feed on invertebrates and carrion (Dundee and Rossman 1989). The green sea turtle grows to the second largest size of any sea turtle, with a maximum shell length of 55 inches (140 cm) and a maximum weight of 517 lbs (235 kg), but most are considerably smaller (Perrine 2003).

The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77˚F (25˚C). As a species that migrates long distances, these turtles face special problems associated with differing attitudes toward conservation in different countries. Green turtles are the only sea turtles known to come ashore for purposes other than nesting. Both immature and adult green sea turtles are known to bask (Perrine 2003).

In the southeastern United States, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

Green sea turtles are also found throughout the North Pacific, ranging as far north as Eliza Harbor, Admiralty Island, Alaska, and Ucluelet, British Columbia. In the eastern North Pacific, green sea turtles have been sighted from Baja California to southern Alaska. In the central Pacific, green sea turtles can be found at most tropical islands. In U.S. Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. The primary nesting site is at French Frigate Shoals.

Female green sea turtles lay one to seven clutches of eggs in a single nesting season with each clutch contains an average of 110 eggs (Spotila 2004). The number of nests has been estimated to be between 350 to 2,300 nests annually. Green sea turtles nest at two, three, or four-year intervals. This nesting activity indicates a population of less than 1,000 females in the breeding population of Florida and Mexico. It takes longer for a green turtle to reach maturity than any other sea turtle, typically living 45-59 years (Spotila 2004).

5.7 Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) was listed as a threatened species on July 28, 1978 (43 FR32800). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806); and March 19, 1980 (45 FR 17588)) but has not been finalized.

Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, and the Carolinas; some nesting also occurs on the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as far north as Alaska, and as far south as Chile. Occasional sightings are also reported from the coast of Washington, but most records are of juveniles off the coast of California. Southern Japan is the only known breeding area in the north Pacific (NMFS 2010).

The loggerhead sea turtle has continued to decline in Louisiana (USFWS 2010). Perrine (2003) and Spotila (2004) provide recent summaries of loggerhead sea turtle biology, behavior and conservation. Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the GOM.

The largest of the hard-shell sea turtles, the loggerhead is distributed worldwide in temperate and tropical bays and open oceans. Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. The population decline of loggerheads can be attributed to egg and nestling predation by mammals and birds (Dundee and Rossman 1989).

Nesting on the Gulf Coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central Gulf Coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955; Hendrickson 1980; Nelson 1986). Landry (1986) suggested that these turtles may also feed on discarded by-catch from shrimp trawling. Adult loggerheads feed in waters less than fifty meters deep, while the primary foraging areas for juveniles appears to be in estuaries and bays (Nelson 1986; Rabalais and Rabalais 1980).

5.8 Brown Pelican

Although the brown pelican (*Pelecanus occidentalis*) was removed from the List of Endangered and Threatened Species on December 17, 2009, brown pelicans and their nests continue to be protected under the Migratory Bird Treaty Act (USFWS 2010c).

Brown pelicans nest in Louisiana from April through August. They are known to nest on barrier islands in Lafourche and Terrebonne Parishes. Nesting surveys conducted by LDWF between 2004 and 2008 revealed that Raccoon was the only island with nesting location within the Project Boundary (LDWF 2004, 2006, 2007, 2008, and 2010). Results of the surveys for Raccoon Island are presented in Table 5-2.

Table 5-2. Estimated Number of Nests/Nesting Pair of Brown Pelicans

Year	Raccoon Island
2004	5,400
2005	6,200
2006	3,075
2007	3,850
2008	7,600

In spring and summer, nests are built in mangrove trees or other shrubby vegetation, although ground nesting may also occur. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance (USFWS 2010c).

5.9 Colonial Nesting Waterbirds

The islands included in the NER host a variety of colonial nesting waterbird species. These species breed in high densities along the shorelines and barrier islands of Coastal Louisiana. The benefits of colonial nesting include group defense from predation, increased foraging efficiency, and maximization of limited breeding sites (Wittenberger and Hunt 1985, Siegel-Causey and Kharitonv 1990).

Many of these species exhibit both site fidelity and group adherence (Michot et al. 2003). They tend to concentrate their breeding efforts in relatively few colonies, even to the exclusion of adjacent, potentially suitable sites (Forbes and Kaiser 1994). Consequently, large populations are susceptible to stochastic events that could adversely impact their breeding success, and thus survival. These events include erosion-induced habitat loss, coastal development, sea level rise, and predation (Jackson et. al 1982, Burger 1984, Visser and Peterson 1994, Goodrich and Buskirk 1995, Rolland et al. 1998, Erwin et al. 2003).

Colonial nesting waterbirds have been identified as species of special interest within the Project Boundary by the USFWS (USFWS, 2010a). In 2008, the LDWF conducted a survey of colonial nesting waterbirds on the Isles Dernieres (LDWF, 2010). The results from the study are presented in Table 5-3.

Table 5-3. Estimated Number of Nests/Nesting Pair of Colonial Nesting Waterbirds

Year	Raccoon Island	Whiskey Island	Trinity Island	Timbalier Island
American Oystercatcher	2	6	5	NA
Black Skimmer	1,100	535	75	NA
Black-crowned Night Heron	120	0	0	NA
Black-necked Stilt	0	3	0	NA
Brown Pelican	7,600	0	0	NA
Clapper Rail	0	10	10	NA
Great Egret	150	0	0	NA
Green Heron	0	0	5	NA
Gull-billed Tern	30	11	0	NA
Laughing Gull	8,000	0	0	NA
Least Tern	0	70	45	NA
Reddish Egret	20	0	0	NA
Roseate Spoonbill	30	0	0	NA
Royal Tern	10,600	0	0	NA
Sandwich Tern	4,800	0	0	NA
Snowy Egret	80	0	0	NA
Tri-colored Heron	400	0	0	NA
White Ibis	70	0	0	NA
Willet	0	0	12	NA
Wilson's Plover	30	36	30	NA

NA – Not Available

Results from the survey revealed the presence of colonial nesting birds within the project boundary, particularly on Raccoon Island. Although Timbalier Island was not surveyed in 2008, similar surveys conducted in 2006 did not reveal any colonial nesting bird species.

6 ANTICIPATED EFFECTS OF THE PROPOSED PROJECT

6.1 NER Plan

The anticipated effects of the proposed NER plan are discussed in the following section. Impacts resulting from the one-island first component of construction are discussed in Section 6.2.

6.1.1 Piping Plover

Critical Habitat Impacts

Beneficial impacts to the piping plover and its critical habitat include the restoration of habitat and prolonged life of barrier islands for the NER plan, as well as creating new barriers or structures that would function to protect critical habitat. Much of the existing system is sediment-starved, and the proposed Project would introduce sediment into the system that would be re-worked and redistributed through future storm events, thus maintaining and/or enhancing the features of critical habitat (i.e. sand and mud flats) that are essential to piping plover conservation. Apart from the terminal groin on Raccoon Island, the project is not expected to alter the natural long-shore sediment transport mechanisms within the Isles Deneries and Timbalier Islands. Without the terminal groin, the sediment that moves off of Raccoon Island to the west is lost to the shoals and buried by the mud stream from the Atchafalaya. Therefore, the terminal groin on Raccoon Island will not starve other islands in adjacent reaches.

In order to quantify the benefits of the project, the predicted critical habitat acres for the "no action" alternative (i.e. future without project conditions) were compared to that of each island in the NER plan (i.e. future with project conditions). Critical habitat was assumed to be the unvegetated portion of the dune, supratidal, and gulfward intertidal habitats. The intertidal habitats, such as the beaches, mudflats, and sand flats, provide vital foraging grounds for the plover. Unvegetated dune and supratidal habitats function as suitable roosting and sheltering areas. The predicted critical habitat acres are provided in Tables 6-1 through 6-4.

Table 6-1. Predicted Critical Habitat Acreages for Raccoon Island

	Critical Habitat (acres)								
	TY0	TY1	TY5	TY10	TY20	TY30[1]	TY31	TY40	TY50
FWOP[2]	61	61	43	23	10	6	6	0	0
FWP[3]	61	680	295	348	339	183	276	139	133
Net[4]	0	619	253	325	329	178	270	139	133

[1]Renourishment occurs at TY30
[2]FWOP – future without project (i.e. no action)
[3]FWP – future with project
[4]Net = FWP - FWOP

Table 6-2. Predicted Critical Habitat Acreages for Whiskey Island

	Critical Habitat (acres)									
	TY0	TY1	TY5	TY10	TY20[1]	TY21	TY30	TY40[1]	TY41	TY50
FWOP[2]	221	220	91	64	47	46	37	0	0	0
FWP[3]	221	843	236	223	127	615	212	89	464	118
Net[4]	0	624	146	159	80	569	174	89	464	118

[1]Renourishment occurs at TY20 and TY40
[2]FWOP – future without projects (i.e. no action)
[3]FWP – future with project
[4]Net = FWP - FWOP

Table 6-3. Predicted Critical Habitat Acreages for Trinity Island

	Critical Habitat (acres)									
	TY0	TY1	TY5	TY10	TY20	TY25[1]	TY26	TY30	TY40	TY50
FWOP[2]	158	149	110	60	10	6	6	3	0	0
FWP[3]	158	583	238	232	154	123	626	277	170	87
Net[4]	0	434	128	172	145	116	620	274	170	87

[1]Renourishment occurs at TY25
[2]FWOP – future without projects (i.e. no action)
[3]FWP – future with project
[4]Net = FWP - FWOP

Table 6-4. Predicted Critical Habitat Acreages for Timbalier Island

	Critical Habitat (acres)								
	TY0	TY1	TY5	TY10	TY20	TY30[1]	TY31	TY40	TY50
FWOP[2]	256	258	187	201	99	30	28	5	0
FWP[3]	256	2312	983	1152	1006	587	867	381	227
Net[4]	0	2053	796	952	907	557	839	376	227

[1]Renourishment occurs at TY30
[2]FWOP – future without project (i.e. no action)
[3]FWP – future with project
[4]Net = FWP - FWOP

If the NER plan is not constructed and the islands are allowed to erode at their current rate, the majority of the critical habitat on each of these four islands is expected to disappear by TY40.

As seen in Tables 6-1 through 6-4, the NER plan is expected to substantially increase the amount of critical habitat on the islands for each target year in the period of analysis. However, unavoidable short term impacts to the critical habitat would result from the placement of sediments onto existing beach and dune habitats during construction and renourishment. These activities would smoother existing populations of benthic prey species. Prey species smothered by dune and beach creating activities would re-colonize in these areas within two years once construction activities cease (USFWS, 2010a). The critical habitat values do not account for the required recovery time of these prey species. For example, there will be approximately 867 acres of critical habitat on Timbalier Island immediately after renourishment (i.e. TY31). However, the island will not reach optimal conditions for the piping plover until TY33, once the benthic species have recovered.

Any impacts that would occur to existing designated critical habitat would be temporary, and would provide for the long-term maintenance and/or enhancement of critical habitat within the Project Boundary. There would be no permanent impacts to critical habitat that would change the ecological processes that maintain it. However, because an entire island would be affected during a construction event, and because adjacent islands may undergo construction within two years or less, the ability of those islands to provide enough suitable foraging habitat to piping plovers will likely be affected until all construction is completed (USFWS 2010a). Based on these factors, it is the Corps' determination that the NER plan is likely to adversely affect piping plover and its critical habitat.

Species Impacts

Under optimal conditions, impacts to piping plovers could be avoided by conducting the proposed activities outside the wintering season. However, construction of the Project is likely to occur while plovers are present because construction of the NER is anticipated to take 2,480 days. Due to the magnitude of erosion and land-loss rates, delaying the project to the non-wintering season could result is considerable degradation to the island foundation and thus significant increases in fill volume requirements. Furthermore, delays would be extremely risky because the existing habitats would be more vulnerable to hurricane forces. Therefore, the risks associated with delaying the project are not justified based on the temporary nature of the disturbance.

Due to their mobility, piping plovers would be able to avoid areas of temporary disturbance using the abundance of suitable foraging and roosting areas adjacent to the Project Boundary. For example, East Island, which is a continuation of Trinity Island, currently supports 272 acres of critical habitat. East Timbalier Island and Wine Island collectively provide 259 acres of suitable habitat for piping plover, although the islands have not been technically designated as critical habitat. These three islands are located within the Isle Deneires and Timbalier Island Ranges, immediately adjacent to the islands in the NER plan. There is also a considerable amount of critical habitat near the Project Boundary. For example, West Belle Pass, Elmers Island, and East Grand Terre are located approximately 15 miles, 25 miles, and 40 miles east of Timbalier Island, respectively (Figure 6-1). Locust Bayou and the Atchafalaya Delta offer additional critical habitat west of Raccoon Island (Figure 6-2). Suitable habitat can also be found at Point au Fer Island and at the numerous pockets and sand and mudflats along Coastal Louisiana.

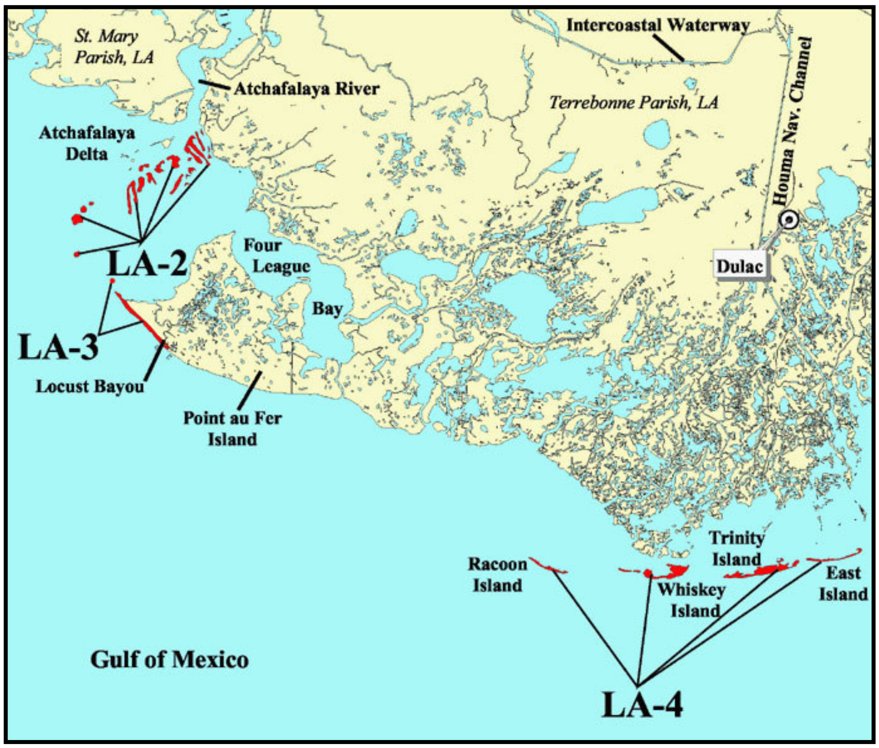

Figure 6-1. Piping Plover Critical Habitat West of Raccoon Island

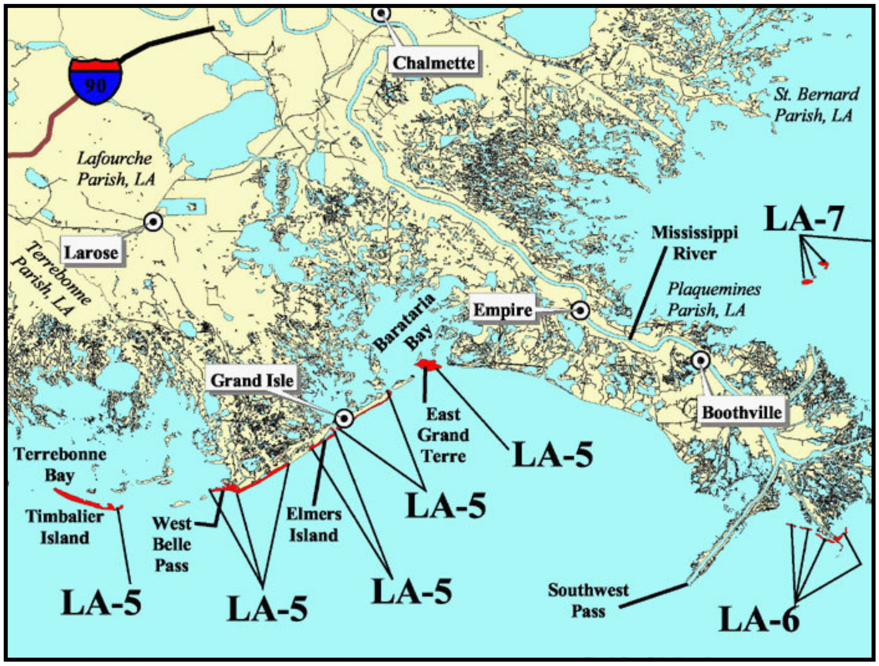

Figure 6-2. Piping Plover Critical Habitat East of Timbalier Island

During the Preliminary Engineering and Design (PED) phase, the USACE will assess the feasibility of staggering the construction of the islands such that only one island is disturbed at any point in time. Furthermore, the USACE will attempt to adopt an "every other island" approach to construction. For example, Timbalier Island would be constructed after Whiskey, followed by Trinity and then Raccoon. This will minimize disturbance to the piping plover during construction and maintain an abundance of critical habitat within the immediate vicinity of the disturbed island. By staggering the initial construction of the islands in the NER plan, the renourishment events would also be staggered. However, constructing the islands in series could significantly delay the completion of the project and inflate project costs.

The current WRDA 2007 authorization will only support the construction of the first component of construction (Whiskey Island Plan C). Therefore, this island will likely be built first while the USACE is seeking additional authorization to construct the other three islands in the NER plan. The proposed beach and dune components of Whiskey Island will be constructed before the marsh templates. During marsh construction, the benthic organisms on the beaches would begin to recover. Raccoon, Trinity, East, and Timbalier Island would remain undisturbed during sediment placement on Whiskey and thus would provide critical habitat for displaced plovers. If and when Congress grants additional authorization, the benthic organisms on Whiskey Island would be in the recovery phase and would likely be able to support displaced plovers during the construction of the three other islands in the NER plan. If economically feasible, the remaining three islands would be constructed in series.

Due to the temporary impacts to the critical habitat and the associated benthic communities during the construction and restoration of the islands, it is the Corps' determination that the proposed NER plan is likely to adversely affect piping plover.

Oil Spill-related Impacts

The Deepwater Horizon was an ultra-deepwater offshore rig that was conducting exploratory drilling off the Coast of Louisiana. On April 20, 2010, the drill breached a pocket of high-pressure methane gas which ignited and created an explosion on the platform. The explosion and ensuing fire caused eleven deaths and eventually capsized the rig, creating a massive oil spill in the Gulf of Mexico. The sunken rig is located approximately 125 miles southeast of Timbalier Island.

Since the spill, oil has been found on the gulfward shorelines of each island in the Isle Dernieres and Timbalier Island reaches. The quantity of oil washed on to the shorelines was approximated using Shoreline Cleanup Assessment Technique (SCAT) data (NOAA, 2010). Oil impacts were categorized as heavy, moderate, light, very light, tar balls, and no oil observed. The oil impacts for the four islands in the NER plan are presented in figures 6-3 through 6-6.

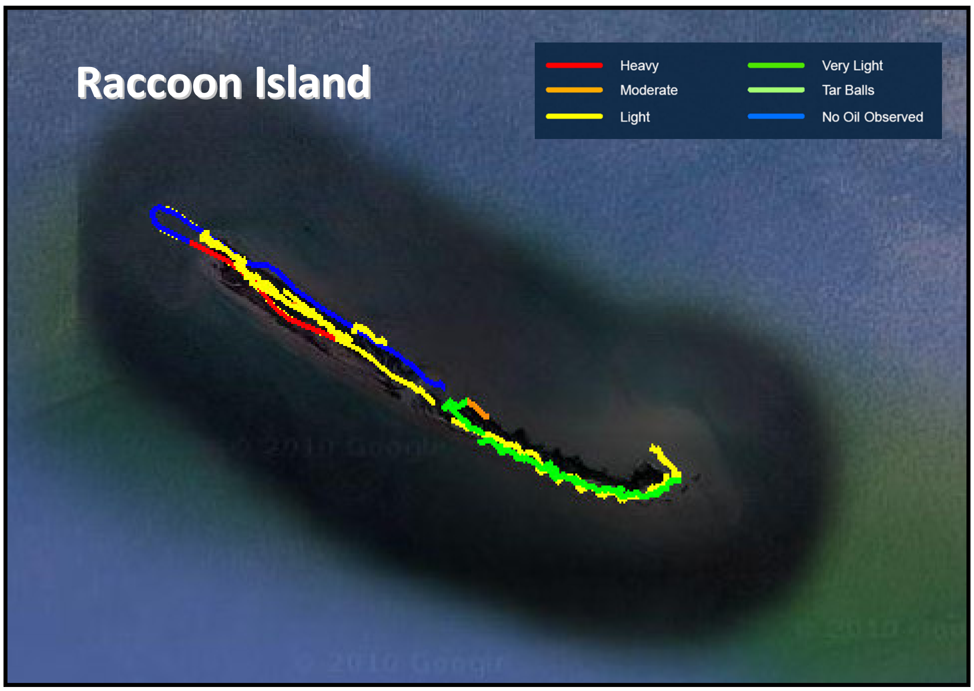

Figure 6-3. Deepwater Horizon Oil Spill Impact on Raccoon Island (NOAA, 2010)

Figure 6-4. Deepwater Horizon Oil Spill Impact on Whiskey Island (NOAA, 2010)

Figure 6-5. Deepwater Horizon Oil Spill Impact on Trinity Island (NOAA, 2010)

Figure 6-6. Deepwater Horizon Oil Spill Impact on Timbalier Island (NOAA, 2010)

Oil has also been found on Atchafalaya, Locust Bayou, West Belle Pass, Elmer's Island, and East Grand Terre, all of which support critical habitat adjacent to the Project Boundary.

Potential piping plover impacts associated with the oil spill primarily consist of a reduction in available food supply. Piping plovers primarily feed on benthic organisms found in intertidal beaches, mudflats, sand flats, algal flats, and washover passes. The effects of oil on the health of benthic communities can be both acute and chronic in nature. According to the USFWS, oil can be directly toxic to these organisms or impact them through physical smothering, altering metabolic and feeding rates, and altering shell formation. Intertidal benthic communities may be particularly vulnerable when oil becomes highly concentrated in narrow bands along the shoreline (USFWS, 2004). Barnacles and other sessile species are vulnerable to smothering by heavy oils while the physiological effects of the hydrocarbons can considerably reduce the mobility of the more mobile species (University of Delaware, 2010). Additionally, sediments can become reservoirs for the spilled petroleum. Some benthic invertebrates can survive the initial exposure, but may accumulate high levels of contaminants in their bodies that can be passed on to predators (USFWS, 2004).

The magnitude of the impacts is also a function of the characteristics of oil spilled. For example, a study conducted on the Amoco Cadiz spill in 1978 revealed that "light oil" resulted in considerable detrimental impacts to the benthic communities. However, a separate study revealed that the benthic organisms were contaminated, but were not adversely impact, from a spill of heavy crude (University of Delaware, 2010).

In 2003, Donlan et al. assessed the impacts of the North Cape oil spill on communities of piping plover in Rhode Island. The study first examined the abundance of prey species on Moonstone Beach (the oiled island) and compared it to that of an adjacent, un-oiled beach (Goosewing). Although the abundance of benthic organisms was not significantly different between the two beaches, the species composition was considerably dissimilar. For example, only two

Amphilporeia were found in the sampling station on Moonstone, compared to 456 at Goosewing. This reinforced the common belief that amphipods are the first group of organisms to disappear and one of the last to recolonize once exposed to oil. Based on this information, the authors concluded that the piping plovers' food supply may have been reduced because of the oil spill. The authors also noted a decline in the number of fledgings produced per nesting pair between 1995 and 1996 (the year of the spill). This reduction was attributed to the lack of available prey species in the intertidal zone, which caused plovers to travel longer distances and expend more energy when feeding (Donlan et al., 2003).

Between 1990 and 1995, Jewett et al. assessed the impacts of the Exxon Valdez oil spill on the benthic communities in Prince Williams Sound, Alaska. The metrics of the study included concentrations of hydrocarbons and benthic community composition, diversity, biomass, and abundance. These metrics were compared between a number of reference sites and oiled sites. The comparison was conducted in 1990 (approximately 16 months after the spill), 1991, 1993, and 1995.

According to the authors, the "total abundance and biomass of epifauna were generally higher at oiled sites, primarily because of higher densities of epifaunal bivalves. Otherwise, there were few consistent community-wide responses to oiling in diversity, richness, total abundance, total biomass, or the abundances of major taxonomic groups (e.g. polychaetes or bivalves)." The lack of a stronger community-wide response was attributed to the varying sensitivities of benthic organisms. For example, oil-sensitive amphipods such as Isaeidaes and Phoxocephalidaes were found in lower concentrations at the oiled sites. These impacts were evident throughout the duration of the study (i.e. 6 years after the spill). However, stress-tolerant and opportunistic organisms such as polychaetes were found in higher concentrations at the oiled sites due to organic enrichment. The study also revealed that hydrocarbon concentrations in the sediment were high (up to 15,300 ng/g) in eel grass beds immediately adjacent to the oiled shorelines, but sharply declined after 1990 (Jewett et all, 1999). Although the benthic organisms and habitat types within Prince Williams Sound vary from that of the Project Area (eelgrass beds versus sand beds and mud flats), the study does provide an indication of the resiliency and recovery rates of benthic communities as a whole. Furthermore, the results of the study indicate that the species composition of the benthic communities is expected to shift as a result of the Deepwater Horizon oil spill. For example, amphipods, which are favored by the piping plover, are expected to decrease in number while other less-favorable species may increase.

As previously stated, the NER plan will likely impact benthic communities by smothering them during fill placement. In the short term, this could further stress the oil-impacted benthic organisms that are currently on the island. However, sediment used for fill placement would be tested to ensure that it is free of oil before it is placed on the island. Placement of clean sediment on the islands could potentially improve the quality of the benthic habitat by diluting concentrations of oil in the island's intertidal zone. This could, in turn, speed up the recovery time of the oil-impacted benthic communities.

6.1.2 West Indian Manatee

Manatee occurrences have been regularly reported in the canals and coastline of Louisiana. Collision with boats and barges is one of the primary anthropogenic causes of manatee mortalities. To avoid any impacts to the West Indian Manatee, all contract personnel associated with the Project will be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel will be required to monitor all water-related activities for the presence of manatee(s). Temporary signs will be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign will be placed where it is visible to the vessel operator. Siltation barriers, if used by the contractor, will be made of material in which manatees could not become entangled, and will be properly secured per technical specifications provided by the manufacture. If a manatee is sighted within 100 yards of the active work zone, special operating conditions will be implemented, including:

- No operation of moving equipment within 50 feet of a manatee
- All vessels will operate at no wake/idle speeds within 100 yards of the work area
- Siltation barriers, if used, will be monitored and re-secured as necessary

Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations will resume. Care will also be taken to avoid entrapment of individuals if any structure is to be installed that could be a barrier or impediment to manatee movement.

By implementing the above-mentioned manatee monitoring and avoidance program, it is the Corps' determination that the proposed NER plan "*may affect, but will not likely adversely affect*" the endangered West Indian Manatee.

6.1.3 Sea Turtles

Based on professional experience and related CWPPRA project construction methods, it is anticipated that the contractor will use a hydraulic cutterhead dredge and booster pump(s) to excavate sediment from the available offshore borrow area(s) and directly transport it via a submerged sediment pipeline to the islands. Environmental laws protecting sea turtles could possibly require the cessation of work for a limited time if the allowable number of sea turtles mortalities is exceeded during dredging. However, turtles are typically able to avoid cutterhead dredge intakes because the dredges move along the seabed at such a slow speed. Sediment used to construct the containment dikes will be dredged from existing material inside the marsh creation area rather than from offshore borrow areas. Therefore, dredging operations associated with the containment dikes are not expected to adversely impact sea turtles.

In summary, it is the Corps' determination that the borrow area dredging operations "*may affect, but will not likely adversely affect*" populations of sea turtles in the Project Boundary. Impacts associated with the actual placement of fill on the islands are discussed below for each species of threatened/endangered sea turtles identified by USFWS.

Green Sea Turtle

Due to the lack of extensive seagrass beds throughout much of coastal Louisiana, and the low incidence of sightings and strandings, it is the Corps' determination that placement of fill on four islands in the NER is expected to have "*no effect*" on the green sea turtle population.

Hawksbill Sea Turtle

It is the Corps' determination that placement of fill on the four islands in the NER will have "*no effect*" on hawksbill populations due to its rarity along the Louisiana coast.

Kemp's Ridley Sea Turtle

The proposed NER plan would provide more suitable inshore habitat for foraging. This habitat type is characterized by lower salinity and high turbidity and organic content, where shrimp and blue crabs are abundant Therefore, it is the Corps' determination that placement of fill on the four islands in the NER plan "*may affect, but will not likely adversely affect*" populations of Kemp's ridley sea turtles.

Leatherback Sea Turtle

This pelagic species typically occupies oceanic waters of more than 160 feet (50 m) in depth. Therefore, it is the Corps' determination that placement of fill on the four islands in the NER plan is expected to have "*no effect*" on Leatherback sea turtle populations.

Loggerhead Sea Turtle

Nesting loggerhead sea turtles have historically used barrier islands; however, it is doubtful that loggerhead sea turtles nest anywhere on the Louisiana coast. The restoration of Raccoon, Whiskey, Trinity, and Timbalier Island may or may not provide suitable nesting habitat, but suitable nesting habitat is nearly nonexistent due to the current degraded state of these islands. The NER plan would not negatively affect loggerheads and could potentially provide some benefit to the species by restoring nesting habitat. Therefore, it is the Corps' determination that placement of fill on the four islands in the NER plan "*may affect, but will not likely adversely affect*" populations of Loggerhead sea turtles.

6.1.4 Brown Pelican

Suitable brown pelican feeding and/or nesting habitat occurs along the barrier islands, sand spits, and mud lumps throughout the Project Boundary. Pelicans and their nest sites may be impacted by barrier island restoration activities or noise disturbance from work activities. Unavoidable short term impacts to brown pelicans include placement of sediment within foraging or roosting areas in or near the Project Boundary. Additional impacts could result from equipment noise and increased human activity on the islands. As previously stated, it is not feasible to delay project construction until after the nesting season. However, there is an abundance of suitable habitat available nearby should the birds be temporarily displaced. Furthermore, the sequencing of construction will allow the pelicans to relocate to adjacent suitable habitat within the Project Boundary (Section 6.3). Once construction activities are complete, any birds disturbed by the activities are expected to return to the area.

The proposed barrier island restoration activities for the four islands in the NER are likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. In addition, restoration of barrier habitat and salt marsh would provide nursery and grow-out areas for the aquatic life upon which pelicans feed (USFWS 2010c). Therefore, it is the Corps' determination that the proposed NER plan "*may affect, but will not likely adversely affect*" the brown pelican.

6.1.5 Colonial Nesting Birds

The bird count survey conducted by LDWF in 2008 revealed the presence of various species of colonial nesting waterbirds on Raccoon, Whiskey, and Trinity Islands (Section 5.9). As with the brown pelican, unavoidable short term impacts would include placement of sediment within foraging or roosting areas in or near the Project Boundary. However, the proposed barrier island restoration activities for the four islands in the NER are likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. Furthermore, there is abundant suitable habitat in the vicinity of islands that can host temporally displaced colonial nesting birds during construction. Sequencing of construction will also help to minimize impacts to the nesting birds. Therefore, it is the Corps' determination that the proposed NER plan "*may affect, but will not likely adversely affect*" colonial nesting birds.

6.2 First Component of Construction

The first component of construction, which consists of Whiskey Island Plan C, is a subset of the NER plan and is therefore expected to experience similar impacts. However, since only one island is being restored rather than four, construction related impacts are not expected to be as severe. The following sections describe the impacts of the first component of construction on threatened and endangered species, as well as the species of special interest.

6.2.1 Piping Plover

<u>Critical Habitat Impacts</u>

As with the NER Plan, beneficial impacts to the piping plover and its critical habitat include the restoration of habitat and prolonged life of Whiskey Island, as well as creating new barriers or structures that would function to protect critical habitat. The implementation of first component of construction would also increase sediment available to Raccoon Island because the long shore sediment movement is westward. The predicted critical habitat acres on Whiskey Island are provided in Table 6-5.

Table 6-5. Predicted Critical Habitat Acreages for Whiskey Island

	Critical Habitat (acres)									
	TY0	**TY1**	**TY5**	**TY10**	**TY20[1]**	**TY21**	**TY30**	**TY40[1]**	**TY41**	**TY50**
FWOP[2]	221	220	91	64	47	46	37	0	0	0
FWP[3]	221	843	236	223	127	615	212	89	464	118
Net[4]	0	624	146	159	80	569	174	89	464	118

[1]Renourishment occurs at TY20 and TY40
[2]FWOP – future without projects (i.e. no action)
[3]FWP – future with project
[4]Net = FWP - FWOP

Whiskey Island is expected to disappear considerably sooner than the other islands in the Isles Dernieres and Timbalier Island Ranges. The island currently lacks dune habitat. If no action is taken on the island, supratidal and intertidal habitat is expected to disappear by TY17 and TY31, respectively (compared to TY33 and TY40 for Trinity Island).

As seen in Table 6-5, the first component of construction is expected to substantially increase the amount of critical habitat on Whiskey Island for each target year in the period of analysis. However, as with the NER plan, unavoidable short term impacts to the critical habitat would result from the placement of sediments onto existing beach and dune habitats during construction and renourishment. These activities would smother existing populations of benthic prey species. However, any impacts that would occur to existing designated critical habitat would be temporary, and would provide for the long-term maintenance and/or enhancement of critical habitat within the Project Boundary. There would be no permanent impacts to critical habitat that would change the ecological processes that maintain it.

However, because the entire island would be affected during a construction event, and because adjacent islands may undergo construction within two years or less, the ability of those islands to provide enough suitable foraging habitat to piping plovers will likely be affected until all construction is completed (USFWS 2010a). Based on these factors, it is the Corps' determination that the construction of the first component of construction is likely to adversely affect piping plover and its critical habitat.

Species Impacts

As with the NER plan, construction of the Project is likely to occur while plovers are present. However, due to their mobility, piping plovers would be able to avoid areas of temporary disturbance using the abundance of suitable foraging and roosting areas adjacent to the Project Boundary. For example, Raccoon, Trinity, East, and Timbalier Islands currently support a total of 1318 acres of critical habitat. East Timbalier Island and Wine Island collectively provide 259 acres of suitable habitat for piping plover, although the islands have not been technically designated as critical habitat. These six islands are located within the immediate vicinity of Whiskey Island.

However, due to the temporary impacts to the critical habitat and the associated benthic communities during the construction and restoration of Whiskey Island, it is the Corps' determination that the construction of the first component of construction is likely to adversely affect piping plover.

Oil Spill-related Impacts

The oil spill-related impacts related to the first component of construction are similar to those discussed for the NER plan (see Section 6.1.1).

6.2.2 West Indian Manatee

The potential impacts of the first component of construction on the West Indian Manatee are similar to that of the NER plan. By implementing the manatee monitoring and avoidance program discussed in Section 6.1.2, it is the Corps' determination that the proposed Project "*may affect, but will not likely adversely affect*" the endangered West Indian Manatee.

6.2.3 Sea Turtles

The potential dredging impacts of the first component of construction on Sea Turtles are similar to that of the NER plan. However, since the first component of construction is a single island, it will require much less dredged material then the NER plan, thus reducing the probability of turtle impacts. As with the NER plan, a cutterhead dredge will be used in the initial construction and restoration of the island. It is the Corps' determination that the borrow area dredging operations "*may affect, but will not likely adversely affect*" populations of sea turtles in the Project Boundary. Impacts associated with the actual placement of fill on Whiskey Island are discussed below for each species of threatened/endangered sea turtles identified by USFWS.

Green Sea Turtle

Due to the lack of extensive seagrass beds throughout much of coastal Louisiana, and the low incidence of sightings and strandings, it is the Corps' determination that placement of fill on Whiskey Island is expected to have "*no effect*" on the green sea turtle population.

Hawksbill Sea Turtle

It is the Corps' determination that placement of fill on Whiskey Island will have "*no effect*" on hawksbill populations due to its rarity along the Louisiana coast.

Kemp's Ridley Sea Turtle

The proposed first component of construction would provide more suitable inshore habitat for foraging. This habitat type is characterized by lower salinity and high turbidity and organic content, where shrimp and blue crabs are abundant Therefore, it is the Corps' determination that placement of fill on Whiskey Island "*may affect, but will not likely adversely affect*" populations of Kemp's ridley sea turtles.

Leatherback Sea Turtle

This pelagic species typically occupies oceanic waters of more than 160 feet (50 m) in depth. Therefore, it is the Corps' determination that placement of fill on Whiskey Island is expected to have "*no effect*" on Leatherback sea turtle populations.

Loggerhead Sea Turtle

Nesting loggerhead sea turtles have historically used barrier islands; however, it is doubtful that loggerhead sea turtles nest anywhere on the Louisiana coast. The restoration of Whiskey Island may or may not provide suitable nesting habitat, but suitable nesting habitat is nearly nonexistent due to the current degraded state of these islands. The first component of construction plan would not negatively affect loggerheads and could potentially provide some benefit to the species by restoring nesting habitat. Therefore, it is the Corps' determination that placement of fill on Whiskey Island "*may affect, but will not likely adversely affect*" populations of Loggerhead sea turtles.

6.2.4 Brown Pelican

The proposed barrier island restoration activities for the first component of construction are likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. In addition, restoration of barrier habitat and salt marsh would provide nursery and grow-out areas for the aquatic life upon which pelicans feed (USFWS 2010c). Therefore, it is the Corps' determination that construction of the first component of construction "*may affect, but will not likely adversely affect*" the brown pelican.

6.2.5 Colonial Nesting Birds

As with the brown pelican, unavoidable short term impacts would include placement of sediment within foraging or roosting areas in or near the Project Boundary. However, the proposed barrier island restoration activities for the first component of construction is likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. Furthermore, there is abundant suitable habitat in the vicinity of islands that can host temporally displaced colonial nesting birds during construction. Therefore, it is the Corps' determination that construction of the first component of construction *"may affect, but will not likely adversely affect"* colonial nesting birds.

6.2.6 Brown Pelican and Colonial Nesting Bird Protection Plan

Throughout PED, consultation will continue with the LDWF, USFWS, and NMFS on detailed contract specifications to avoid and minimize potential impacts to the brown pelican and colonial nesting waterbirds. The total construction duration of the NER is 2,480 days, not including mobilization and demobilization.

Proactive measures will be taken to prevent brown pelicans and colonial nesting waterbirds from nesting within the Study Area prior to and during construction. These measures may include deterrents such as propane cannons, predator decoys, or other approved bird repellant devices. These repellent devices will be placed in designated areas within the Study Area prior to the nesting periods. Nesting periods are April 2 through September 15 for gulls terns, and/or black skimmers; February 16 through August 31 for nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants; and April 1 through September 14 for brown pelicans. The contractor will coordinate closely with the LDWF, USFWS, and NMFS on the timing and placement of the deterrent devices. The USACE understands the importance of preventing nesting activities within the Study Area that is under constructions as there is no provision for "incidental take" in the Migratory Bird Treaty Act of 1918

Prior to any work, qualified personnel will conduct surveys in all potential nesting bird habitats within the Study boundaries that may be impacted by construction or preconstruction activities. These surveys will be conducted for both brown pelicans and colonial nesting waterbirds. Data collection protocols will be established through close coordination with the LDWF, USFWS, and NMFS.

- Nesting periods are April 2 through September 15 for gulls terns, and/or black skimmers; February 16 through August 31 for nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants; and April 1 through September 14 for brown pelicans.
- Nesting season surveys shall be conducted in all potential nesting bird habitats within the Study boundaries that may be impacted by construction or preconstruction activities during the nesting season. Portions of the Study area in which there is no potential for project-related activity during the nesting season may be excluded.
- Surveys for detecting new nesting activity will be completed on a daily basis prior to movement of equipment, operation of vehicles, or other activities that could potentially disrupt nesting behavior or cause harm to the birds their eggs or young.

- Surveys should be conducted by walking the length of the Study area and visually inspecting, using binoculars or spotting scope, for the presence of shorebirds exhibiting breeding behavior. If an ATV or other vehicle is needed to cover large Study areas, the vehicle must be operated at a speed of <6 mph, shall be run at or below the high tide line, and the Bird Monitor will stop at no greater than 200-meter intervals to visually inspect for nesting activity.
- Daily summaries of shorebird/brown pelican abundance, location of the birds and their activity (e.g., foraging, resting, nesting, courtship behavior), and summaries of any nests observed including the number of eggs and fledglings, shall be provided on the next business day on an approved report form.
- The Bird Monitor shall communicate the results of their survey to the contractor daily.
- If breeding is confirmed by the presence of a scrape, eggs, or young, the Bird Monitor will immediately notify the appropriate personnel at the LDWF and USFWS.

If nesting occurs during construction within the Study area, the contractor shall establish a 650-ft buffer zone around colonies containing nesting gulls, terns, and/or black skimmers; a 1,000-ft buffer around colonies of nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants; and a 2,000-ft buffer around nesting colonies of brown pelicans.

- The designated buffer zones shall be posted with clearly marked signs around the perimeter. These markings shall be maintained until nesting is completed or terminated. In the case of solitary nesters, nesting is not considered to be completed until all chicks have fledged.
- No construction activities, movement of vehicles, or stockpiling of equipment shall be allowed within the buffer area unless authorized by LDWF, USFWS, and NMFS.
- LDWF/USFWS/NMFS-approved travel corridors shall be designated and marked outside the buffer areas. Heavy equipment, vehicles, and pedestrians may transit past nesting areas in these corridors. However, other activities such as stopping or turning shall be prohibited within the designated travel corridors adjacent to the nesting site.
- Where such a travel corridor must be established within the Study Area, it shall avoid critical areas for shorebirds (known nesting sites, designated critical wildlife habitat, and designated critical piping plover habitat) as much as possible, and be marked with signs clearly delineating the travel corridor from the shorebird buffer areas described above.

If shorebird or pelican nesting occurs within the Study Area, a bulletin board will be placed and maintained in the construction area with the location map of the construction site showing the bird nesting areas and a warning, clearly visible, stating the "bird nesting areas are protected by the Federal Migratory Bird Treaty Act."

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TERREBONNE BASIN BARRIER SHORELINE RESTORATION

APPENDIX A
BIOLOGICAL ASSESSMENT

ANNEX A1
USFWS LETTERS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

March 4, 2010

Colonel Alvin Lee
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee:

Please reference Aaron Bass' March 3, 2010, electronic mail concerning the Louisiana Coastal Area (LCA) – Louisiana, Terrebonne Basin Barrier Shoreline Restoration Feasibility Study. That email requested information regarding threatened and endangered species and other species of concern that are located within the study area and that may be impacted by the proposed project. The U.S. Fish and Wildlife Service (Service) offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.).

Federally listed as an endangered species, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

To avoid any impacts to that species the Service recommends the following measures be incorporated into all contracts for this project. All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel are responsible for observing water-related activities for the presence of manatee(s). Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations should be resumed. Care should also be taken to avoid entrapment of individuals if any structure is to be installed that could be a barrier or impediment to manatee movement. Any manatee sighting should be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

Federally listed as a threatened species, the piping plover (*Charadrius melodus*), as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months annually. They arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers.

Based on the information that the Corps has provided to the Service regarding the subject project, the timing of construction between the islands (regardless of whether an island is in Phase I or II of the project) would likely affect the recovery time of benthic communities within the intertidal zones of those islands. Piping plovers feed upon benthic invertebrates and invertebrates found in organic material remaining after high tide events (i.e., wrack). The best available science indicates that benthic communities within the intertidal zones of barrier islands may take anywhere from 6 months to 2 years to fully recover, if there is a nearby source from which they can re-colonize an affected area. Because an entire island would be affected during one construction event, and because adjacent islands may undergo construction within 2 years or less, the ability of those islands to provide enough suitable foraging habitat to piping plovers will likely be affected until all construction is completed. The Service, therefore, recommends that the Corps assess potential direct and indirect impacts to the piping plover and associated critical habitat within a biological assessment (BA) and determine whether the proposed project "is (or is not) likely to adversely affect" both the species and its designated critical habitat.

Endangered and threatened sea turtles forage in the nearshore waters, bays and sounds of Louisiana. The National Marine Fisheries Service (NMFS) is responsible for aquatic marine threatened or endangered species (i.e., Kemp's riddle and loggerhead sea turtles). Please contact Eric Hawk (727/824-5312) at the NMFS Regional Office in St. Petersburg, Florida, for information concerning those species in the aquatic environment. When sea turtles leave the aquatic environment and come onshore to nest, however, the Service is responsible for consultation. Consultation regarding nesting sea turtles should be conducted with this office.

The Kemp's ridley (*Lepidochelys kempii*) is an endangered sea turtle that occurs mainly in the coastal areas of the Gulf of Mexico and northwestern Atlantic Ocean. Juveniles and sub-adults occupy shallow, coastal regions and are commonly associated with crab-laden, sandy or muddy water bottoms. Small turtles are generally found in nearshore areas of the Louisiana coast from May through October. Adults may be abundant near the mouth of the Mississippi River in the spring and summer. Adults and juveniles move offshore to deeper, warmer water during the winter. Between the East Gulf Coast of Texas and the Mississippi River Delta, Kemp's ridleys use nearshore waters, ocean sides of jetties, small boat passageways through jetties, and dredged and nondredged channels. Kemp's ridley are not known to nest in Louisiana, however, their nesting range is apparently expanding. Major threats to this species include over-exploitation on their nesting beaches, drowning in fishing nets, and pollution.

Federally listed as a threatened species, loggerhead sea turtles (*Caretta caretta*) nest within the coastal United States from Louisiana to Virginia, with major nesting concentrations occurring on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida. In Louisiana, loggerheads have been known to nest on the Chandeleur Islands. Nesting and hatching dates for the loggerhead in the northern Gulf of Mexico are from May 1 through November 30. Threats to this species include destruction of nesting habitat and drowning in fishing nets. When loggerhead sea turtles leave the aquatic environment and come onshore to nest the Service is responsible for consultation. Accordingly, we recommend that you address potential impacts to this species within the aforementioned BA if your activities would occur on beach areas during the loggerhead nesting season.

The proposed project would be located in an area where colonial nesting waterbirds are known to be present. To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

1. For colonies containing nesting brown pelicans, all activity occurring within 2,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31). Nesting periods vary considerably among Louisiana's brown pelican colonies, however, so it is possible that this activity window could be altered based upon the dynamics of the individual colony. The Louisiana Department of Wildlife and

Fisheries' Fur and Refuge Division should be contacted to obtain the most current information about the nesting chronology of individual brown pelican colonies. Brown pelicans are known to nest on barrier islands and other coastal islands in Lafourche and Terrebonne parishes.

2. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

3. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present).

In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season. Because of the extent of the proposed restoration project (i.e., entire and multiple island designs/phases) we understand that it may not be feasible to conduct all construction related activities outside of pertinent nesting seasons. The Service fully supports this restoration effort and is committed to working with your agency during project planning to resolve any potential conflicts that could occur as a result of migratory bird use of the proposed project area.

We appreciate the Corps' continued cooperation in the conservation of threatened and endangered species. If your staff needs further assistance in this matter, please have them contact Karen Soileau (337/291-3132) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: NMFS, Baton Rouge, LA
EPA, Dallas, TX
OCPR, Baton Rouge, LA (Attn: Wes Leblanc)
LDWF, Natural Heritage Program, Baton Rouge, LA
SJB Group, Baton Rouge, LA (Attn: Aaron Bass)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Suite 400
Lafayette, Louisiana 70506

August 12, 2010

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

This letter acknowledges that the U.S. Fish and Wildlife Service (Service) received your August 9, 2010, letter and attached biological assessment (BA) via electronic mail on that same date. Your letter requests initiation of formal section 7 consultation under the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq*.). The consultation regards the possible effects of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration (TBBSR) project in Terrebonne Parish, Louisiana, on the threatened piping plover (*Charadrius melodus*) and its designated critical habitat.

All information required of the Corps to initiate consultation was included in the BA attached to your letter. We have assigned log number 43440-2010-F-2769 to this consultation. Please refer to that number in future correspondence on this consultation. Section 7 allows the Service up to 90 calendar days to conclude formal consultation with your agency and an additional 45 calendar days to prepare our biological opinion (unless we mutually agree to an extension). Therefore, we expect to provide you with our biological opinion no later than December 22, 2010. However, we recognize that the legislative mandated study schedule was developed to respond to the significant and ongoing rapid loss of coastal habitats; therefore, we remain committed to working closely with the Corps to meet those deadlines and ensure that the authorization of those coastal restoration projects is achieved.

As a reminder, the Act requires that after initiation of formal consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice ensures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

If you have any questions or concerns about this consultation or the consultation process in general, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

TERREBONNE BASIN BARRIER SHORELINE RESTORATION

APPENDIX A
BIOLOGICAL ASSESSMENT

ANNEX A2
USFWS BIOLOGICAL OPINION

Louisiana Coastal Area
Terrebonne Basin Barrier Shoreline Restoration Project
Terrebonne Parish, Louisiana

43440-2010-F-2769
Final Biological Opinion
September 23, 2010

Prepared by:
U.S. Fish and Wildlife Service
646 Cajundome Boulevard, Suite 400
Lafayette, LA

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Acronyms

Act	Endangered Species Act
BA	Biological Assessment
BO	Biological Opinion
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
DPS	Distinct Population Segment
EPA	Environmental Protection Agency
FR	Federal Register
GPS	Global Positioning System
IPPC	International Piping Plover Census
LCA	Louisiana Coastal Area
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
MBTA	Migratory Bird Treaty Act
MLLW	Mean Low Low Water
NAVD	North American Vertical Datum
NER	National Ecosystem Restoration
NMFS	National Marine Fisheries Service
NPS	National Park Service
ORV	Off-road Vehicle
PCB	Polychlorinated Biphenol
PCE	Primary Constituent Element
RPMs	Reasonable and Prudent Measures
SCAT	Shoreline Cleanup Assessment Team
Service	U.S. Fish and Wildlife Service
SEIS	Supplemental Environmental Impact Statement
TBBSR	Terrebonne Basin Barrier Shoreline Restoration
TSP	Tentatively Selected Plan
TY	Target Year
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service

United States Department of the Interior
FISH AND WILDLIFE SERVICE
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Lafayette, Louisiana 70506

September 23, 2010

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration (TBBSR) project that would be located in Terrebonne Parish, Louisiana, and its effects on the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq*.). Your August 9, 2010, request for formal consultation was received via electronic mail on that same date.

This biological opinion is based on information provided in the Corps' August 9, 2010, biological assessment (BA); the Corps' June 1, 2010, Draft Supplemental Environmental Impact Statement (SEIS); meetings; telephone conversations; electronic mails; field investigations; and other sources of information. A complete administrative record of this consultation (Service Log No. 43440-2010-F-2769) is on file at the Service's Lafayette, Louisiana, Field Office.

The Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the endangered West Indian manatee (*Trichechus manatus*) because: (1) the project area does not contain suitable foraging habitat for that species; and (2) the Corps would implement, as part of the project construction plan, standard conditions for in-water work in the presence of manatees (Appendix C). Federally listed sea turtles (i.e., Kemp's ridley, Hawksbill, Loggerhead, Leatherback, and Green sea turtles) are not currently known to nest in Louisiana. It is our understanding that the Corps has conducted a separate consultation with the National Marine Fisheries Service (NMFS) regarding project-related effects to sea turtles offshore. Accordingly, none of the species mentioned in this paragraph will be discussed further in this biological opinion.

Table 1. Species and critical habitat evaluated for effects from the proposed action but not discussed further in this biological opinion.

Species or Critical Habitat	**Present in Action Area**	**Present in Action Area but "Not Likely to Adversely Affect"**
West Indian manatee	Yes	Yes

Consultation History

On January 21, 2009, the Service provided a list of federally threatened and endangered species to the Corps in response to their Notice of Intent to prepare a SEIS.

On March 4, 2010, the Service provided an updated list of federally threatened and endangered species to the Corps. That letter included species-specific recommendations for avoiding and/or minimizing project-related impacts.

In May 2010, the Service provided a draft Fish and Wildlife Coordination Act Report to the Corps regarding project-related effects to Service trust resources and our recommendations for avoiding and/or minimizing impacts. That report also included species-specific recommendations for avoiding and/or minimizing project-related impacts to federally listed species.

On July 19, 2010, the Service provided comments to the Corps on the Draft SEIS and their June 17, 2010, biological assessment (Appendix A of the Draft SEIS). The Service did not concur with the Corps' determination that the proposed action was not likely to adversely affect the piping plover or its critical habitat and recommended that the Corps initiate formal consultation.

On July 23, 2010, the Service requested additional information from the Corps regarding their June 17, 2010, BA. On August 9, 2010, the Corps provided the Service with a revised BA which contained the information required to complete formal consultation and requested initiation of formal consultation. On August 12, 2010, the Service provided confirmation to the Corps that all information had been received and that a biological opinion would be issued no later than December 22, 2010.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

According to the BA (Corps 2010), the National Ecosystem Restoration (NER) plan (Figure 1) consists of Raccoon Island Plan E with a terminal groin, Whiskey Island Plan C, Trinity Island Plan C, and Timbalier Island Plan E. After construction is complete (i.e., Target Year 1 (TY1)), the NER plan would result in an additional 3,283 acres of habitat (dune, intertidal, and supratidal) on the existing island footprints of Raccoon, Whiskey, Trinity, and Timbalier Islands, increasing the total size of the islands to 5,840 acres. This includes approximately 472 acres of dune, 4,320 acres of supratidal habitat, and 1,048 acres of intertidal habitat. Each of the islands in the NER plan will require at least one beach/dune renourishment event in order to maintain their geomorphologic form and ecologic function throughout the 50-year period of analysis. Marsh renourishment was not included since the initial restoration plan provides for significant intertidal habitat throughout the 50 year period of analysis. The individual island plans are described in detail below.

1. <u>Raccoon Island Plan E with Terminal Groin</u> (Figure 2): The dune would be constructed to a height of +7.7 feet North American Vertical Datum 1988 (NAVD 88) with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 1.7 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The marsh fill is proposed on the landward side of the dune at an elevation of +3.7 feet NAVD 88. The dune and marsh elevations are considerably higher than those planned for Trinity and Whiskey Islands for two reasons: (1) Plan E is

designed to withstand 25 years rather than 5 years of additional background erosion; and (2) the higher elevation of the 25-year plan results in a higher compaction rate. Fill quantities for the dune/beach and marsh components are 5.2 million and 5.1 million cubic yards, respectively. For the dune area, the material will be dredged from the Ship Shoal Outer Continental Shelf (OCS) area. For the marsh area, the material will be dredged from the Raccoon Island TE-48 borrow area; however, the borrow area does not have enough material to construct the marsh in its entirety. Therefore, approximately 2.7 million cubic yards of sand will be dredged from Ship Shoal to provide a base layer for the marsh. Approximately 11,912 feet of sand fencing will be installed along the dune to promote deposition of windblown sand. At TY1, this plan would add 554 acres of habitat (dune, intertidal, and supratidal) to the existing 235-acre island footprint, increasing the size of the island to 789 acres. The result would be 63 acres of dune, 688 acres of supratidal, and 38 acres of intertidal habitat. This plan would require one renourishment interval at TY30 that would consist of a lesser amount of sediment placement.

In 1997, eight detached and segmented breakwaters were installed along the Gulf shoreline of Raccoon Island as part of a Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) project (TE-29) to reduce shoreline retreat, promote sediment deposition along the beach, and to protect shorebird habitat. Due to the success of the TE-29 breakwaters, eight additional breakwaters were constructed to the west of the original breakwaters as part of a separate CWPPRA project (TE-48) that was completed in 2007. Project TE-48 also included the creation of approximately 60 acres of emergent and intertidal back-barrier marsh, which has yet to be constructed. Raccoon Plan E was designed to complement the marsh creation portion of TE-48 and to avoid impacting approximately 58 acres of existing mangroves adjacent to project TE-48. A terminal groin will also be constructed as part of Raccoon Island Plan E. The terminal groin will be approximately 1,200-feet-long and 75-feet-wide and will be installed at the western terminus of the island to prevent sediment migration out of the Isles Dernieres system.

2. <u>Whiskey Island Plan C</u> (Figure 3): The dune would be constructed to a height of +6.4 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 0.4 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The marsh fill is proposed on the landward side of the dune at an elevation of +2.4 feet NAVD 88. Although the design elevation for the marsh is 1.6 feet NAVD 88, the marsh will be constructed at a higher elevation to account for initial vertical adjustments. The plan will utilize beach/dune material from the Ship Shoal OCS borrow area and marsh material from the Whiskey 3A borrow area. Fill quantities for the initial construction of the dune/beach and marsh components are 8.3 million and 0.6 million cubic yards, respectively. Approximately 18,075 feet of sand fencing will be installed along the dune to promote deposition of windblown sand. This plan was designed to avoid impacting approximately 286 acres of existing mangroves on the island in order to minimize the ecological impact during construction. At TY1 this plan would restore a total of 1,272 acres of dune, supratidal, and intertidal habitat. This plan will require two renourishment intervals. The first would occur at TY20 that would consist of the same amount of dune and supratidal beach habitat that was originally created in TY1. The second renourishment interval would occur at TY40 that would consist of a lesser amount of sediment placement.

3. Trinity Island Plan C (Figure 4): The dune would be constructed to a height of +6.4 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 0.4 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The marsh fill is proposed on the landward side of the dune at an elevation of +2.5 feet NAVD 88, and accounts for vertical adjustments (e.g., higher compaction rates due to the existing topography of this island) occurring after the first six months of construction. This plan will also utilize beach/dune material from Ship Shoal OCS and marsh materials from the Whiskey 3A borrow area. Fill quantities for the initial construction of the dune/beach and marsh components of Trinity Plan C are 3.1 million and 4.0 million cubic yards, respectively. Approximately 22,467 feet of sand fencing will be installed along the dune to promote deposition of windblown sand. At TY1, this plan would add 585 acres of habitat (dune, intertidal, and supratidal) to the existing 564-acre island footprint, increasing the size of the island to 1,149 acres. The result would be 129 acres of dune, 456 acres of supratidal, and 564 acres of intertidal habitat. (Please note that this project design does not include the eastern portion of the island located east of New Cut, which is also called "East Island." The islands are no longer separated by New Cut because the cut began filling in naturally and was further restored by a CWPPRA project in 2007.) This plan would require one renourishment interval at TY25 that would consist of the same amount of dune and supratidal beach habitat that was originally created in TY1.

4. Timbalier Island Plan E (Figure 5): The dune would be constructed to a height of +7.1 feet NAVD 88 with a dune crown width of 100 feet. The dune elevation takes into account that there will be approximately 1.1 feet of vertical adjustments (eustatic sea level rise, subsidence, and compaction) occurring during the first six months after construction. At the end of the six-month period, the dune should reach the design elevation of 6 feet NAVD 88. The marsh fill is proposed on the landward side of the dune at an elevation of +3.2 feet NAVD 88. The dune and marsh elevations are considerably higher than those planned for Trinity and Whiskey Islands for two reasons: (1) Plan E is designed to withstand 25 years rather than 5 years of additional background erosion, and (2) the higher elevation of the 25-year plan results in a higher compaction rate. Fill quantities for the dune/beach and marsh components of Timbalier Plan E are 10.7 million and 9.1 million cubic yards, respectively. Timbalier Plan E will utilize beach/dune material from the South Pelto OCS area and marsh materials from the Whiskey 3A borrow area. However, the marsh borrow area does not have adequate material to construct the marsh in its entirety. Therefore, approximately 8.6 million cubic yards of sand will be dredged from the South Pelto OCS area, the sandy portions of the Whiskey 3A borrow area, and the New Cut borrow area to provide a base layer for the marsh. The marsh material from the Whiskey 3A borrow area will be deposited on the sand material to provide an adequate foundation for the marsh. Approximately 35,425 feet of sand fencing will be installed. At TY1, this would add 1,675 acres of habitat (dune, intertidal, and supratidal) to the existing 955-acre island footprint, increasing the size of the island to 2,630 acres. The result would be 215 acres of dune, 2,346 acres of supratidal, and 69 acres of intertidal habitat. This plan would require one renourishment interval at TY30 that would consist of a lesser amount of sediment placement.

Dredging of offshore borrow areas would be conducted using a hydraulic cutter-head dredge, for which the Corps has already conducted section 7 consultation with the NMFS. The dredged material would be transported to an island using a booster pump(s) and submerged sediment pipeline. Borrow locations are located sufficient distance from the restoration sites that they will not impact littoral drift or project longevity. The following specific construction actions would be implemented for all four island plans:

a) For the dune areas, the dredged material would be deposited on the beach and re-worked by bulldozers and front-end loaders.
b) For the marsh creation areas, containment dikes would be constructed around its perimeter using existing material dredged from inside that marsh creation area using either a bucket dredge or a track hoe.
c) All dredging and discharge operations will be completed in a manner that will minimize turbidity of the water at the dredge site and the discharge site.
d) Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.
e) Vegetative plantings will include a variety of native dune and marsh grass species, and the recommended planting density is no greater than 8-foot centers.

Construction for the initial NER plan would be divided into two separate contracts. Contract 1 would consist of Whiskey, Trinity, and Raccoon Islands for which total construction time is estimated at approximately 4 years (49.2 months). Contract 2 would consist of Timbalier Island for which total construction time is estimated at approximately 3.5 years (40.1 months). According to the BA, the NER plan cannot be constructed all at once because it exceeds the authorized cost in the Water Resources Development Act of 2007; however, the Corps plans to seek authorization to eventually restore all four islands. Consequently, the Corps plans to only construct a subset of that plan (i.e., Whiskey Island Plan C only) which is recommended as the Tentatively Selected Plan (TSP). Construction for the TSP would consist of one contract for Whiskey Island Plan C for which total construction time is estimated at approximately 16.6 months. The Corps anticipates beginning construction of the TSP in June 2012.

Since Whiskey Island is considered a valuable wildlife habitat (as part of the Isles Dernieres Barrier Islands Wildlife Refuge) and the Louisiana Department of Wildlife and Fisheries (LDWF) is reestablishing a pelican rookery on the island, maintaining adequate areas of healthy beach, dune, and marsh is particularly important for the island. The island is also designated as critical habitat for the piping plover and contains valuable stopover habitat for migratory birds.

Although the project footprints of the Corps' plans for Raccoon, Whiskey, and Trinity Islands would not encompass the entire islands (in contrast, all of Timbalier Island would be affected), project effects would occur along the entire island chain due to the dynamic nature of coastal processes and the long-transport of sediments within the subject barrier island system. All of the project-area islands are also designated as piping plover critical habitat (described in detail in the **Species/critical habitat description** and **Status of the species within the action area** sections of this document). Therefore, the Service has described the action area to include all of Whiskey, Raccoon, Trinity/East, and Timbalier Islands and their associated sand and mud flats for reasons that will be explained and discussed in detail in the **EFFECTS OF THE ACTION** section of this consultation.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

The piping plover is a small, pale sand-colored shorebird, about seven inches long with a wingspan of about 15 inches (Palmer 1967). On January 10, 1986, the piping plover was listed as endangered in the

Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the Act reflects the species' precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the United States (U.S.) from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig and Elliott-Smith 2004). Piping plover subspecies are phenotypically indistinguishable, and most studies in the nonbreeding range report results without regard to breeding origin. Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist. Therefore, information summarized here pertains to the species as a whole (i.e., all three breeding populations), except where a particular breeding population is specified (Figure 6).

The Service has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations. Critical habitat for the Great Lakes breeding population was designated May 7, 2001 (66 Federal Register (FR) 22938; Service 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002 (67 FR 57637; Service 2002). The Service designated critical habitat for wintering piping plovers on July 10, 2001 (66 FR 36038; Service 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast.

Designated wintering piping plover critical habitat originally included 142 areas (the rule states 137 units; this is in error) encompassing about 1,793 miles of mapped shoreline and 165,211 acres of mapped areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. Since the designation of wintering critical habitat, 19 units (TX-3,4,7-10, 14-19, 22, 23, 27,28, and 31-33) in Texas have been vacated and remanded back to the Service for reconsideration by Court order (Texas General Land Office v. U.S. Department of Interior, Case No. V-06-CV-00032). On May 19, 2009, the Service published a final rule designating 18 revised critical habitat units in Texas, totaling approximately 139,029 acres (74 FR 23476). The Courts also vacated and remanded back to the Service for reconsideration, four units in North Carolina (Cape Hatteras Access Preservation Alliance v. U.S. Department of Interior, 344 F. Supp. 2d 108 (D.D.C. 2004)). The four critical habitat units vacated were NC-1, 2, 4, and 5, and all occurred within Cape Hatteras National Seashore (CAHA). A revised designation for these four units was published on October 21, 2008 (73 FR 62816).

The primary constituent elements (PCEs) for piping plover wintering habitat are those biological and physical features that are essential to the conservation of the species. The PCEs are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. These areas typically include coastal areas that support intertidal beaches and flats and associated dune systems and flats above annual high tide (Service 2001a). PCEs of wintering piping plover critical habitat include sand or mud flats (or both) with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers (Service 2001a). Important components of the beach/dune ecosystem include surf-cast algae, sparsely vegetated back beach and salterns, spits, and washover areas. Washover areas are broad, unvegetated zones, with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. The units designated as critical habitat are those areas that have consistent use by piping plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 FR 36038 (Service 2001a).

Activities that affect PCEs include those that directly or indirectly alter, modify, or destroy the processes that are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. Those processes include erosion, accretion, succession, and sea-level change. The integrity of the habitat components also depends upon daily tidal events and regular sediment transport processes, as well as episodic, high-magnitude storm events (Service 2001b).

Life History

Piping plovers live an average of five years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years. Breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al. 1990; Cross 1990; Goldin et al. 1990; MacIvor 1990; Hake 1993). Plovers are known to begin breeding as early as one year of age (MacIvor 1990; Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Piping plovers generally fledge only a single brood per season, but may re-nest several times if previous nests are lost.

The most consistent finding in the various population viability analyses conducted for piping plovers indicates that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Ryan et al. 1993; Melvin and Gibbs 1996; Plissner and Haig 2000; Wemmer et al. 2001; Larson et al. 2002; Amirault et al. 2005; Calvert et al. 2006; Brault 2007). A banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1994; Service 1996), Maryland (Loegering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase in abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al. 2005). Simply stated, this suggests that maximizing productivity does not ensure population increases.

Efforts to partition survival within the annual cycle are beginning to receive more attention, but current information remains limited. Drake et al. (2001) observed no mortality among 49 radio-marked piping plovers (total of 2,704 transmitter days) in Texas in 2007-2008. Cohen et al. (2008a) documented no mortality of 7 radio-tracked wintering piping plovers at Oregon Inlet from December 2005 to March 2006. They speculate their high survival rate was attributed to plover food availability much of the day as well as the low occurrence of days below freezing and infrequent wet weather. Analysis of South Carolina resighting data for 87 banded piping plovers (78 percent Great Lakes breeders) in 2006-2007 and 2007-2008 found 100 percent survival from December to April[1] (Cohen pers. comm. 2009). Noel et al. (2007) inferred two winter (November to February) mortalities[2] among 21 banded (but not radio-

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[1] However, of those birds, one unique and one non-uniquely banded piping plover were seen in the first winter and were resighted multiple times in the second fall at the same location but were not seen during the second winter; whether these two birds died in the fall or shifted their wintering location is unknown (Maddock et al. 2009).

[2] Noel et al. (2007) inferred mortality if a uniquely banded piping plover with multiple November to February sightings on the survey site disappeared during that time and was never observed again in either it's nonbreeding or breeding range. Note that most of these birds were from the Great Lakes breeding population, where detectability during the breeding season is very high.

tagged) overwintering piping plovers in 2003-2004 and 9 mortalities among 19 overwintering birds during the winter of 2004-2005 at Little St. Simons Island, Georgia. LeDee (2008) found higher apparent survival[3] rates during breeding and southward migration than during winter and northward migration for 150 adult (i.e., after-hatch year) Great Lakes piping plovers.

Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2009) found that apparent adult survival declined in four populations and increased in none over the life of the studies[4]. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. However, very little to no information exists specifically for birds wintering along the northern Gulf of Mexico.

Migration

Plovers depart their breeding grounds for their wintering grounds from July through late August, but southward migration extends through November. Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (Service 1996). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (Noel et al. 2005; Stucker and Cuthbert 2006). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). The source breeding population of a given wintering individual cannot be determined in the field unless it has been banded or otherwise marked. Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree. See the “Status and Distribution” section for additional information pertaining to population distribution on the wintering grounds. While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species’ life cycle.

Foraging

Behavioral observation of piping plovers on the wintering grounds suggests that they spend the majority of their time foraging (Nicholls and Baldassarre 1990a; Drake 1999a, 1999b). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994; Zonick 1997), and at all stages in the tidal cycle (Goldin 1993; Hoopes 1993). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and occasionally bivalve mollusks (Bent 1929; Nicholls 1989; Zonick and Ryan 1996). They peck these

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[3] “Apparent survival” does not account for permanent emigration. If marked individuals leave a survey site, apparent survival rates will be lower than true survival. If a survey area is sufficiently large, such that emigration out of the site is unlikely, apparent survival will approach true survival.
[4] Data were analyzed for 3 to 11 years per breeding area, all between 1998 and 2008.

invertebrates on top of the soil or just beneath the surface. Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, shorelines of coastal ponds, lagoons, ephemeral pools and adjacent to salt marshes (Gibbs 1986; Zivojnovich 1987; Nichols 1989; Nicholls and Baldassarre 1990a; Nicholls and Baldassarre 1990b; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Wilkinson and Spinks 1994; Zonick 1997; Service 2001a). Studies from the coastal breeding range have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986; Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993). Cohen et al. (2006) documented more abundant prey items and biomass on sound island and sound beaches than the ocean beach. On the wintering grounds, Ecological Associates, Inc. (2009) observed that during piping plover surveys at St. Lucie Inlet, Martin County, Florida, intertidal mudflats and/or shallow subtidal grass flats appear to have greater value as foraging habitat than the unvegetated intertidal areas of a flood shoal.

Roosting

Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Lott et al. (2009) found greater than 90 percent of roosting piping plovers in southwest Florida in old wrack with the remainder roosting on dry sand. In South Carolina, 45 percent of roosting piping plovers were in old wrack, and 18 percent were in fresh wrack. The remainder of roosting birds used intertidal habitat (22 percent), backshore (defined as zone of dry sand, shell, cobble and beach debris from mean high water line up to the toe of the dune)(8 percent), washover and ephemeral pools 2 percent and 1 percent respectively (Maddock et al. 2009). Thirty percent of roosting piping plovers in northwest Florida were observed in wrack substrates with 49 percent on dry sand and 20 percent using intertidal habitat (Smith 2007). In Texas, sea grass debris (bay-shore wrack) was an important feature of piping plover roost sites (Drake 1999b). Mean abundance of two other plover species in California, including the listed western snowy plover (*Charadrius alexandrinus nivosus*), was positively correlated with abundance of wrack during the nonbreeding season (Dugan et al. 2003).

Natural protection

Cryptic coloration is a primary defense mechanism for this species. Nests, adults, and chicks all blend in with their typical beach surroundings. Piping plovers on wintering and migration grounds respond to intruders (pedestrian, avian and mammalian) usually by squatting, running, and flushing (flying).

Habitat

Wintering piping plovers prefer coastal habitat that include sand spits, islets (small islands), tidal flats, shoals (usually flood tidal deltas), and sandbars that are often associated with inlets (Harrington 2008). Sandy mud flats, ephemeral pools, and overwash areas are also considered primary foraging habitats. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds (Cohen et al. 2006). Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990a).

Recent study results in North Carolina, South Carolina, and Florida complement information from earlier investigations in Texas and Alabama (summarized in the 1996 Atlantic Coast and 2003 Great

Lakes Recovery Plans) regarding habitat use patterns of piping plovers in their coastal migration and wintering range. Maddock et al. (2009) observed shifts to roosting habitats and behaviors during high-tide periods in South Carolina. In South Carolina, exposed intertidal areas were the dominant foraging substrate (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009). As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. In northwest Florida, however, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf of Mexico (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96 percent of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75 percent of foraging piping plovers on intertidal substrates.

Atlantic Coast and Florida studies highlighted the importance of inlets for non-breeding piping plovers. Almost 90 percent of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers were among seven shorebird species found more often than expected ($p = 0.0004$; Wilcoxon Scores test) at inlet locations versus non-inlet locations in an evaluation of 361 International Shorebird Survey sites from North Carolina to Florida (Harrington 2008).

Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers and washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels) into major bay systems (Arvin 2008). Earlier studies in Texas have drawn attention to washover passes, which are commonly used by piping plovers during periods of high bay-shore tides and during the spring migration period (Zonick 1997; Zonick 2000). Cobb (*in* Elliott-Smith et al. 2009) reported piping plover concentrations on exposed sea grass beds and oyster reefs during seasonal low water periods in 2006.

The effects of dredge-material deposition merit further study. Drake et al. (2001) concluded that conversion of southern Texas mainland bay-shore tidal flats to dredged material impoundments results in a net loss of habitat for wintering piping plovers, because impoundments eventually convert to upland habitat not used by piping plovers. Zonick et al. (1998) reported that dredged material placement areas along the Intracoastal Waterway in Texas were rarely used by piping plovers, and noted concern that dredge islands block wind-driven water flows, which are critical to maintaining important shorebird habitats. By contrast, most of the sound islands used by foraging piping plovers at Oregon Inlet, North Caroline, were created by the Corps by deposition of dredged material in the subtidal bay bottom, with the most recent deposition ranging from 28 to less than 10 years prior to the study (Cohen et al. 2008a).

Mean home range size (95 percent of locations) for 49 radio-marked piping plovers in southern Texas in 1997-98 was 12.6 square-kilometers (km^2) (3,113 acres), mean core area (50 percent of locations) was 2.9 km^2 (717 acres), and mean linear distance moved between successive locations (1.97 $\pm$ 0.04 days apart), averaged across seasons, was 3.3 km (2.1 miles) (Drake 1999b; Drake et al. 2001). Seven radio-tagged piping plovers used a 20.1 km^2 (4,967 acres) area (100 percent minimum convex polygon) at Oregon Inlet in 2005-2006, and piping plover activity was concentrated in 12 areas totaling 2.2 km^2 (544 acres) (Cohen et al. 2008a). Noel and Chandler (2008) observed high fidelity of banded piping plovers to 1 km to 4.5 km (0.62 to 2.8 miles) sections of beach on Little St. Simons Island, Georgia.

Population dynamics

The 2006 Piping Plover Breeding Census, the last comprehensive survey throughout the breeding grounds, documented 3,497 breeding pairs with a total of 8,065 birds throughout Canada and U.S (Elliott-Smith et al. 2009).

Northern Great Plains Population

The Northern Great Plains plover breeds from Alberta to Manitoba, Canada, and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado. The decline of piping plovers on rivers in the Northern Great Plains has been largely attributed to the loss of sandbar island habitat and forage base due to dam construction and operation. Nesting occurs on sand flats or bare shorelines of rivers and lakes, including sandbar islands in the upper Missouri River system, and patches of sand, gravel, or pebbly-mud on the alkali lakes of the northern Great Plains. Plovers do nest on shorelines of reservoirs created by the dams, but reproductive success is often low and reservoir habitat is not available in many years due to high water levels or vegetation. Dams operated with steady constant flows allow vegetation to grow on potential nesting islands, making these sites unsuitable for nesting. Population declines in alkali wetlands are attributed to wetland drainage, contaminants, and predation.

The International Piping Plover Census (IPPC), conducted every five years, also estimates the number of piping plover pairs in the Northern Great Plains. As illustrated in Table 2, none of the IPPC estimates of the number of pairs in the U.S. suggests that the Northern Great Plains population has yet satisfied the recovery criterion of 2,300 pairs (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009). The IPPC count in prairie Canada reported 1,703 adult birds in 2006, which is also short of the goal of 2,500 adult piping plover as stated in the Service's Recovery Plan (Service 1988).

Table 2. The number of adult piping plovers and breeding pairs reported in the U.S. Northern Great Plains by the IPPC efforts. (Sources: Plissner and Haig 1997, Ferland and Haig 2002, Elliot-Smith et al. 2009)

Year	Adults	Pairs Reported by the Census
1991	2,023	891
1996	1,599	586
2001	1,981	899
2006	2,959	1,212

The IPPC indicates that the U.S. population decreased between 1991 and 1996, then increased in 2001 and 2006. The Canadian population showed the reverse trend for the first three censuses, increasing slightly as the U.S. population decreased, and then decreasing in 2001. Combined, the IPPC numbers suggest that the population declined from 1991 through 2001, then increased almost 58 percent between 2001 and 2006 (Elliott-Smith et al. 2009).

The increase in 2006 is likely due in large part to a multi-year drought across much of the region starting in 2001 that exposed thousands of acres of nesting habitat. The Corps ran low flows on the riverine stretches of the Missouri River for most of the years between censuses, allowing more habitat to be exposed and resulting in relatively high fledging ratios (Corps 2009). The Corps also began to construct habitat using mechanical means (dredging sand from the riverbed) on the Missouri River in 2004, providing some new nesting and foraging habitat. The drought also caused reservoir levels to drop on many reservoirs throughout the Northern Great Plains (e.g., Missouri River Reservoirs in North and South Dakota, and Lake McConaughey in Nebraska), providing previously unavailable shoreline habitat. The population increase may also be partially due to more intensive management activities on the alkali lakes, with increased management actions to improve habitat and reduce predation pressures.

While the IPPC provides an index to the piping plover population, the design does not always provide sufficient information to understand the population's dynamics. The five-year time interval between IPPC efforts may be too long to allow managers to get a clear picture of what the short-term population trends are and to respond accordingly if needed. As noted above, the first three IPPCs (1991, 1996, and 2001) showed a declining population, while the fourth (2006) indicated a dramatic population rebound of almost 58 percent for the combined U.S. and Canada Northern Great Plains population between 2001 and 2006. With only four data points over 15 years, it is impossible to determine if and to what extent the apparent upswing reflects a real population trend versus error(s) in the 2006 census count and/or a previous IPPC. The 2006 IPPC included a detectability component, in which a number of pre-selected sites were visited twice by the same observer(s) during the two-week window to get an estimate of error rate. This study found an approximately 76 percent detectability rate through the entire breeding area, with a range of between 39 percent to 78 percent detectability among habitat types in the Northern Great Plains.

Such a reported large increase in population may indeed indicate a positive population trend, but with the limited data available, it is impossible to determine how much. Furthermore, with the next IPPC not scheduled until 2011, there is limited feedback in many areas on whether this increase is being maintained or if the population is declining in the interim. Additionally, the results from the IPPC have been slow to be released, adding to the time lag between data collection and possible management response.

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario. Great Lakes piping plovers nest on wide, flat, open, sandy or cobble shoreline with very little grass or other vegetation. Reproduction is adversely affected by human disturbance of nesting areas and predation by foxes, gulls, crows and other avian species. Shoreline development, such as the construction of marinas, breakwaters, and other navigation structures, has adversely affected nesting and brood rearing.

The Recovery Plan (Service 2003) sets a population goal of at least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.

The Great Lakes piping plover population, which has been traditionally represented as the number of breeding pairs, has increased since the completion of the recovery plan in 2003 (Cuthbert and Roche 2006, 2007; Westbrock et al. 2005; Stucker and Cuthbert 2004; Stucker et al. 2003). The Great Lakes piping plover recovery plan documents the 2002 population at 51 breeding pairs (Service 2003). The most recent census conducted in 2008 found 63 breeding pairs, an increase of approximately 23 percent. Of these, 53 pairs were found nesting in Michigan, while 10 were found outside the state, including six pairs in Wisconsin and four in Ontario, Canada. The 53 nesting pairs in Michigan represent approximately 50 percent of the recovery criterion. The 10 breeding pairs outside Michigan in the Great Lakes basin, represents 20 percent of the goal, albeit the number of breeding pairs outside Michigan has continued to increase over the past five years. The single breeding pair discovered in 2007 in the Great Lakes region of Canada represented the first confirmed piping plover nest there in over 30 years, and in 2008 the number of nesting pairs further increased to four.

In addition, the number of non-nesting individuals has increased annually since 2003. Between 2003-2008 an annual average of approximately 26 non-nesting piping plovers were observed, based on limited data from 2003, 2006, 2007, and 2008. Although there was some fluctuation in the total population from 2002 to 2008 the overall increase from 51 to 63 pairs combined with the increased observance of non-breeding individuals indicates the population is increasing.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20^{th} Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Reports of local or statewide declines between 1950 and 1985 are numerous, and many are summarized by Cairns and McLaren (1980) and Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New York, the 1989 population estimate was 191 pairs (Service 1996). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Piping plover surveys in the early years of the recovery effort found that counts of these cryptically colored birds sometimes went up with increased census effort, suggesting that some historic counts of piping plovers by one or a few observers may have underestimated the piping plover population. Thus, the magnitude of the species decline may have been more severe than available numbers imply.

Annual estimates of breeding pairs of Atlantic Coast piping plovers are based on multiple surveys at most occupied sites. Sites that cannot be monitored repeatedly in May and June (primarily sites with few pairs or inconsistent occupancy) are surveyed at least once during a standard nine-day count period (Hecht and Melvin 2009).

Since its 1986 listing under the ESA, the Atlantic Coast population estimate has increased 234 percent, from approximately 790 pairs to an estimated 1,849 pairs in 2008, and the U.S. portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,596 pairs. Even discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (Service 1996), the population nearly doubled between 1989 and 2008. The largest population increase between 1989 and 2008 has occurred in New England (245 percent), followed by New York-New Jersey (74 percent). In the Southern (DE-MD-VA-NC) Recovery Unit, overall growth between 1989 and 2008 was 66 percent, but almost three-quarters of this increase occurred in just two years, 2003 to 2005. The eastern Canada population fluctuated from year to year, with increases often quickly eroded in subsequent years; net growth between 1989 and 2008 was 9 percent.

The overall population growth pattern was tempered by periodic rapid declines in the Southern and Eastern Canada Recovery Units. The eastern Canada population decreased 21 percent in just three years (2002 to 2005), and the population in the southern half of the Southern Recovery Unit declined 68 percent in seven years (1995 to 2001). The recent 64 percent decline in the Maine population, from 66 pairs in 2002 to 24 pairs in 2008, following only a few years of decreased productivity, provides another example of the continuing risk of rapid and precipitous reversals in population growth.

Status and distribution

Nonbreeding (migrating and wintering) Range

Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Migration stopovers by banded piping plovers from the Great Lakes have been documented in New Jersey, Maryland, Virginia, and North Carolina (Stucker and Cuthbert 2006). Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). As many as 85 staging piping plovers have been tallied at various sites in the Atlantic breeding range (Perkins 2008 pers. communication), but the composition (e.g., adults that nested nearby and their fledged young of the year versus migrants moving to or from sites farther north), stopover duration, and local movements are unknown. Review of published records of piping plover sightings throughout North America by Pompei and Cuthbert (2004) found more than 3,400 fall and spring stopover records at 1,196 sites. Published reports indicated that piping plovers do not concentrate in large numbers at inland sites and that they seem to stop opportunistically. In most cases, reports of birds at inland sites were single individuals. In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remains poorly understood.

Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Four range-wide, mid-winter (late January to early February) population surveys, conducted at five-year intervals starting in 1991, are summarized in Table 3. Total numbers have fluctuated over time, with some areas experiencing increases and others decreases. In 2001, 2,389 piping plovers were located during a winter census, accounting for only 40 percent of the known breeding birds recorded during a breeding census (Ferland and Haig 2002). About 89 percent of birds that are known to winter in the U.S. do so along the Gulf Coast (Texas to Florida), while 8 percent winter along the Atlantic Coast (North Carolina to Florida).

Table 3. Results of the 1991, 1996, 2001, and 2006 International Piping Plover Winter Censuses (Haig et al. 2005; Elliott-Smith et al. 2009).

Location	**1991**	**1996**	**2001**	**2006**
Virginia	not surveyed (NS)	NS	NS	1
North Carolina	20	50	87	84
South Carolina	51	78	78	100
Georgia	37	124	111	212
Florida	551	375	416	454
-Atlantic	*70*	*31*	*111*	*133*
-Gulf	*481*	*344*	*305*	*321*
Alabama	12	31	30	29
Mississippi	59	27	18	78
Louisiana	750	398	511	226
Texas	1,904	1,333	1,042	2,090
Puerto Rico	0	0	6	NS
U.S. Total	3,384	2,416	2,299	3,355
Mexico	27	16	NS	76
Bahamas	29	17	35	417
Cuba	11	66	55	89
Other Caribbean Islands	0	0	0	28
GRAND TOTAL	3,451	2,515	2,389	3,884
Percent of Total International Piping Plover Breeding Census	62.9%	42.4%	40.2%	48.2%

Regional and local fluctuations may reflect the quantity and quality of suitable foraging and roosting habitat, which vary over time in response to natural coastal formation processes as well as anthropogenic habitat changes (e.g., inlet relocation, dredging of shoals and spits). See, for example, discussions of survey number changes in Mississippi, Louisiana, and Texas by Winstead, Baka, and Cobb, respectively, *in* Elliott-Smith et al. (2009). Fluctuations may also represent localized weather conditions (especially wind) during surveys, or unequal survey coverage. For example, airboats facilitated first-time surveys of several central Texas sites in 2006 (Cobb *in* Elliott-Smith et al. 2009). Similarly, the increase in the 2006 numbers in the Bahamas is attributed to greatly increased census efforts; the extent of additional habitat not surveyed remains undetermined (Maddock and Wardle *in* Elliott-Smith et al. 2009). Changes in wintering numbers may also be influenced by growth or decline in the particular breeding populations that concentrate their wintering distribution in a given area. Major opportunities to locate previously unidentified wintering sites are concentrated in the Caribbean and Mexico (see pertinent sections in Elliott-Smith et al. 2009). Further surveys and assessment of seasonally emergent habitats (e.g., sea grass beds, mudflats, oyster reefs) within bays lying between the mainland and barrier islands in Texas are also needed.

Mid-winter surveys may substantially underestimate the abundance of nonbreeding piping plovers using a site or region during other months. In late September 2007, 104 piping plovers were counted at the south end of Ocracoke Island, North Carolina (NPS 2007), where none were seen during the 2006 International Piping Plover Winter Census (Elliott-Smith et al. 2009). Noel et al. (2007) observed up to 100 piping plovers during peak migration at Little St. Simons Island, Georgia, where approximately 40 piping plovers wintered in 2003 to 2005. Differences among fall, winter, and spring counts in South Carolina were less pronounced, but inter-year fluctuations (e.g., 108 piping plovers in spring 2007 versus 174 piping plovers in spring 2008) at 28 sites were striking (Maddock et al. 2009). Even as far south as the Florida Panhandle, monthly counts at Phipps Preserve in Franklin County ranged from a mid-winter low of four piping plovers in December 2006 to peak counts of 47 in October 2006 and March 2007 (Smith 2007). Pinkston (2004) observed much heavier use of Texas Gulf Coast (ocean-facing) beaches between early September and mid-October (approximately 16 birds per mile) than during December to March (approximately two birds per mile).

Local movements of nonbreeding piping plovers may also affect abundance estimates. At Deveaux Bank, one of South Carolina's most important piping plover sites, five counts at approximately 10-day intervals between August 27 and October 7, 2006, oscillated from 28 to 14 to 29 to 18 to 26 (Maddock et al. 2009). Noel and Chandler (2008) detected banded Great Lakes piping plovers known to be wintering on their Georgia study site in 73.8 ± 8.1 percent of surveys over three years.

Abundance estimates for nonbreeding piping plovers may also be affected by the number of surveyor visits to the site. Preliminary analysis of detection rates by Maddock et al. (2009) found 87 percent detection during the mid-winter period on core sites surveyed three times a month during fall and spring and one time per month during winter, compared with 42 percent detection on sites surveyed three times per year (Cohen 2009 pers. communication).

Gratto-Trevor et al. (2009; Figure 7) found strong patterns (but no exclusive partitioning) in winter distribution of uniquely banded piping plovers from four breeding populations. All eastern Canada and 94 percent of Great Lakes birds wintered from North Carolina to southwest Florida. However, eastern Canada birds were more heavily concentrated in North Carolina, and a larger proportion of Great Lakes piping plovers were found in South Carolina and Georgia. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast. Although the great majority of Prairie Canada individuals were observed in Texas, particularly southern Texas, individuals from the U.S. Great Plains were more widely distributed on the Gulf Coast from Florida to Texas.

The findings of Gratto-Trevor et al. (2009) provide evidence of differences in the wintering distribution of piping plovers from these four breeding areas. However, the distribution of birds by breeding origin during migration remains largely unknown. Other major information gaps include the wintering locations of the U.S. Atlantic Coast breeding population (banding of U.S. Atlantic Coast piping plovers has been extremely limited) and the breeding origin of piping plovers wintering on the Caribbean islands and in much of Mexico. Banded piping plovers from the Great Lakes, Northern Great Plains, and eastern Canada breeding populations showed similar patterns of seasonal abundance at Little St. Simons Island, Georgia (Noel et al. 2007). However, the number of banded plovers originating from the latter two populations was relatively small at this study area.

This species exhibits a high degree of intra- and inter-annual wintering site fidelity (Nicholls and Baldassarre 1990a; Drake et al. 2001; Noel et al. 2005; Stucker and Cuthbert 2006). Gratto-Trevor et al. (2009) reported that six of 259 banded piping plovers observed more than once per winter moved across boundaries of the seven U.S. regions. Of 216 birds observed in different years, only eight changed regions between years, and several of these shifts were associated with late summer or early spring migration periods (Gratto-Trevor et al. 2009; Figure 7).

Local movements are more common. In South Carolina, Maddock et al. (2009) documented many cross-inlet movements by wintering banded piping plovers as well as occasional movements of up to 18 km (11 miles) by approximately 10 percent of the banded population; larger movements within South Carolina were seen during fall and spring migration. Similarly, eight banded piping plovers that were observed in two locations during 2006-2007 surveys in Louisiana and Texas were all in close proximity to their original location, such as on the bay and ocean side of the same island or on adjoining islands (Maddock 2008).

The 2004 and 2005 hurricane seasons affected a substantial amount of habitat along the Gulf Coast. Habitats such as those along Gulf Islands National Seashore have benefited from increased washover events, which created optimal habitat conditions for piping plovers. Conversely, hard shoreline structures put into place following storms throughout the species range to prevent such shoreline migration prevent habitat creation. Four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Those same storms, however, created habitats such as overwash fans and sand spits on barrier islands and headlands in other portions of Louisiana. (See the Storm events section below for more details on their effects to habitat.)

The Service is aware of the following site-specific conditions that benefit several habitats piping plover use while wintering and migrating, including critical habitat units. In Texas, one critical habitat unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach decreasing the likelihood of automobile disturbance to plovers. Exotic plant removal that threatens to invade suitable piping plover habitat is occurring in a critical habitat unit in South Florida. The Service and other government agencies remain in a contractual agreement with the U.S. Department of Agriculture (USDA) for predator control within limited coastal areas in the Florida panhandle, including portions of some critical habitat units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering and migrating piping plovers. In North Carolina, one critical habitat unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of the nearby inlet channel.

Recovery criteria

Northern Great Plains Population (Service 1988, 1994)

1. Increase the number of birds in the U.S. northern Great Plains states to 2,300 pairs (Service 1994).
2. Increase the number of birds in the prairie region of Canada to 2,500 adult piping plovers (Service 1988).
3. Secure long term protection of essential breeding and wintering habitat (Service 1994).

Great Lakes Population (Service 2003)

1. At least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.

2. Five-year average fecundity within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal.
3. Protection and long-term maintenance of essential breeding and wintering habitat is ensured, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals).
4. Genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term.
5. Agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat.

Atlantic Coast Population (Service 1996)

1. Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among 4 recovery units.

Recovery Unit	Minimum Subpopulation
Atlantic (eastern) Canada	400 pairs
New England	625 pairs
New York-New Jersey	575 pairs
Southern (DE-MD-VA-NC)	400 pairs

2. Verify the adequacy of a 2,000 pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.
3. Achieve a 5-year average productivity of 1.5 fledged chicks per pair in each of the 4 recovery units described in criterion 1, based on data from sites that collectively support at least 90 percent of the recover unit's population.
4. Institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.
5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

Threats to piping plovers/critical habitat

In the following sections, we provide an analysis of threats to piping plovers in their migration and wintering range. We update information obtained since the 1985 listing rule, the 1991 and 2009 status reviews, and the three breeding population recovery plans. Both previously identified and new threats are discussed. With minor exceptions, this analysis is focused on threats to piping plovers within the continental U.S. portion of their migration and wintering range. Threats in the Caribbean and Mexico remain largely unknown.

Present or threatened destruction, modification, or curtailment of its habitat or range

The status of piping plovers on winter and migration grounds is difficult to assess, but threats to piping plover habitat used during winter and migration (identified by the Service during its designation of critical habitat) continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most winter and migration areas. Conservation efforts at some locations have likely resulted in the maintenance or enhancement of wintering habitat.

The 1985 final listing rule stated that the number of piping plovers on the Gulf of Mexico coastal wintering grounds might be declining as indicated by preliminary analysis of Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing, the Texas Parks and Wildlife Department stated that 30 percent of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated that in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover.

The three recovery plans state that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The plans further state that beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, could eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Priority 1 actions in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans identify tasks to protect natural processes that maintain coastal ecosystems and quality wintering piping plover habitat and to protect wintering habitat from shoreline stabilization and navigation projects. The 1988 Northern Great Plains Recovery Plan states that, as winter habitat is identified, current and potential threats to each site should be determined.

Important components of ecologically sound barrier beach management include perpetuation of natural dynamic coastal formation processes. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, beach maintenance and nourishment activities, and seawall installations continue to constrain natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets and directly remove or affect ebb and flood tidal shoal formation. Jetties, which stabilize an island, cause island widening and subsequent growth of vegetation on inlet shores. Seawalls restrict natural island movement and exacerbate erosion. As discussed in more detail below, all these efforts result in loss of piping plover habitat. Construction of these projects during months when piping plovers are present also causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights. Additional investigation is needed to determine the extent to which these factors cumulatively affect piping plover survival and how they may impede conservation efforts for the species.

Any assessment of threats to piping plovers from loss and degradation of habitat must recognize that up to 24 shorebird species migrate or winter along the Atlantic Coast and almost 40 species of shorebirds are present during migration and wintering periods in the Gulf of Mexico region (Helmers 1992). Continual degradation and loss of habitats used by wintering and migrating shorebirds may cause an increase in intra-specific and inter-specific competition for remaining food supplies and roosting habitats. In Florida, for example, approximately 825 miles of coastline and parallel bayside flats (unspecified amount) were present prior to the advent of high human densities and beach stabilization projects. We estimate that only about 35 percent of the Florida coastline continues to support natural coastal formation processes, thereby concentrating foraging and roosting opportunities for all shorebird species and forcing some individuals into suboptimal habitats. Thus, intra- and inter-specific competition most likely exacerbates threats from habitat loss and degradation.

Sand placement projects

In the wake of episodic storm events, managers of lands under public, private, and county ownership often protect coastal structures using emergency storm berms; this is frequently followed by beach nourishment or renourishment activities (nourishment projects are considered "soft" stabilization versus "hard" stabilization such as seawalls). Berm placement and beach nourishment deposit substantial amounts of sand along Gulf of Mexico and Atlantic beaches to protect local property in anticipation of preventing erosion and what otherwise will be considered natural processes of overwash and island migration (Schmitt and Haines 2003). On unpopulated islands, the addition of sand and creation of marsh are sometimes used to counteract the loss of roosting and nesting habitat for shorebirds and wading birds as a result of erosional storm events.

Past and ongoing stabilization projects fundamentally may alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components that piping plovers rely upon. Although impacts may vary depending on a range of factors, stabilization projects may directly degrade or destroy piping plover roosting and foraging habitat in several ways. Front beach habitat may be used to construct an artificial berm that is densely planted in grass, which can directly reduce the availability of roosting habitat. Over time, if the beach narrows due to erosion, additional roosting habitat between the berm and the water can be lost. Berms can also prevent or reduce the natural overwash that creates roosting habitats by converting vegetated areas to open sand areas. The vegetation growth caused by impeding natural overwash can also reduce the maintenance and creation of bayside intertidal feeding habitats. In addition, stabilization projects may indirectly encourage further development of coastal areas and increase the threat of disturbance.

Table 4. Summary of the extent of nourished beaches in piping plover wintering and migrating habitat within the conterminous U.S. Data extracted from Service unpublished data (project files, gray literature, and field observations).

State	Sandy beach shoreline miles available	Sandy beach shoreline miles nourished to date (within critical habitat units)	Percent of sandy beach shoreline affected (within critical habitat units)
North Carolina	301[a]	117[e] (unknown)	39 (unknown)
South Carolina	187[a]	56 (0.6)	30 (0.32))
Georgia	100[a]	8 (0.4)	8 (0.40)
Florida	825[b]	404 (6)[f]	49 (0.72)
Alabama	53[a]	12 (2)	23 (3.77)
Mississippi	110[c]	≥6 (0)	5 (0)
Louisiana	397[a]	Unquantified (generally restoration-oriented)	Unknown
Texas	367[d]	65 (45)	18 (12.26)
Overall Total	2,340 (does not include Louisiana)	≥668 does not include Louisiana (54 in CH)	29% (≥2.31% in CH)

(a) Data from www.50states.com; (b) Clark 1993; (c) N. Winstead, Mississippi Museum of Natural Science, in litt. 2008; (d) www.Surfrider.org; (e) H. Hall, Service, pers. comm. 2009; (f) Partial data from Lott et al. (2007 in review).

At least 668 of 2,340 coastal shoreline miles (29 percent of beaches throughout the piping plover winter and migration range in the U.S.) are bermed, nourished, or renourished, generally for recreational purposes and to protect commercial and private infrastructure. However, only approximately 54 miles or 2.31 percent of these impacts have occurred within critical habitat.

In Louisiana, the sustainability of the coastal ecosystem is threatened by the inability of the barrier islands to maintain geomorphologic functionality (i.e., the Louisiana coastal systems are starved for sediment sources) (Corps 2010). Consequently, most of the planned sediment placement projects are conducted as environmental restoration projects by various Federal and State agencies because without the sediment many areas would erode below sea level. Agencies conducting coastal restoration projects aim to design projects that mimic the natural existing elevations of coastal habitats (e.g., beach, dune, and marsh) in order to allow their projects to work within and be sustained by the natural ecosystem processes that maintain those coastal habitats. Due to the low elevation of barrier islands and coastal headlands, placement of additional sediment in those areas generally does not reach an elevation that would prevent the formation of washover areas or impede natural coastal processes, especially during storm events. Such careful design of these restoration projects allows daily tidal processes or storm events to re-work the sediments to reform the Gulf/beach interface and create washover areas, sand flats, and mud flats on the bay-side of the islands, as well as sand spits on the ends of the islands; thus, the added sediment aids in sustaining the barrier island system.

Sediment placement also temporarily affects the benthic fauna found in intertidal systems by covering them with a layer of sediment. Some benthic species can burrow through a thin layer (varies from 15 to 35 inches for different species) of additional sediment since they are adapted to the turbulent environment of the intertidal zone; however, thicker layers (i.e., greater than 40 inches) of sediment are likely to smother the benthic fauna (Greene 2002). Various studies of such effects indicate that the recovery of benthic fauna after beach renourishment or sediment placement can take anywhere from 6 months to 2 years. Such delayed recovery of benthic prey species temporarily affects the quality of piping plover foraging habitat.

Inlet stabilization/relocation

Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development. Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone to prevent or decrease sand deposition in the channel (Hayes and Michel 2008). Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of long-shore sediment transport and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing down-drift erosion. Sediment is then dredged and added back to the islands which are subsequently widened. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the down-drift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008b).

Using Google Earth© (accessed April 2009), Service biologists visually estimated the number of navigable mainland or barrier island tidal inlets throughout the wintering range of the piping plover in the conterminous U.S. that have some form of hardened structure. This includes seawalls or adjacent development, which lock the inlets in place (Table 5).

Table 5. Visually estimated numbers of navigable mainland and barrier island inlets and hardened inlets by state.

State	Number of navigable mainland and barrier island inlets	Number of hardened inlets	Percent of inlets affected
North Carolina	20	2.5*	12.5%
South Carolina	34	3.5*	10.3%
Georgia	26	2	7.7%
Florida	82	41	50%
Alabama	14	6	42.9%
Mississippi	16	7	43.8%
Louisiana	40	9	22.5%
Texas	17	10	58.8%
Overall Total	249	81	32.5%

*An inlet at the state line is considered to be half an inlet counted in each state.

Tidal inlet relocation can cause loss and/or degradation of piping plover habitat; although less permanent than construction of hard structures, effects can persist for years. For example, a project on Kiawah Island, South Carolina, degraded one of the most important piping plover habitats in the State by reducing the size and physical characteristics of an active foraging site, changing the composition of the benthic community, decreasing the tidal lag in an adjacent tidal lagoon, and decreasing the exposure time of the associated sand flats (Service and Town of Kiawah Island unpublished data). In 2006, pre-project piping plover numbers in the project area recorded during four surveys conducted at low tide averaged 13.5 piping plovers. This contrasts with a post-project average of 7.1 plovers during eight surveys (four in 2007 and four in 2008) conducted during the same months (Service and Town of Kiawah Island unpublished data), indicating that habitat quality was reduced. Service biologists are aware of at least seven inlet relocation projects (two in North Carolina, three in South Carolina, two in Florida), but this number likely under-represents the extent of this activity.

Sand mining/dredging

Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as cause localized erosion (Hayes and Michel 2008). Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur. This number is likely greater than the number of total jettied inlets shown in Table 5, since most jettied inlets need maintenance dredging, but non-hardened inlets are often dredged as well.

Groins

Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins can act as barriers to long-shore sand transport and cause down-drift erosion (Hayes and Michel 2008), which prevents piping plover habitat creation by limiting sediment deposition and accretion. These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover's 1986 listing under the Act, installation of new groins continues to occur.

Seawalls and revetments

Seawalls and revetments are vertical hard structures built parallel to the beach in front of buildings, roads, and other facilities to protect them from erosion. However, these structures often accelerate erosion by causing scouring in front of and down-drift from the structure (Hayes and Michel 2008), which can eliminate intertidal foraging habitat and adjacent roosting habitat. Physical characteristics that determine microhabitats and biological communities can be altered after installation of a seawall or revetment, thereby depleting or changing composition of benthic communities that serve as the prey base for piping plovers. At four California study sites, each comprised of an unarmored segment and a segment seaward of a seawall, Dugan and Hubbard (2006) found that armored segments had narrower intertidal zones, smaller standing crops of macrophyte wrack, and lower shorebird abundance and species richness. Geotubes (long cylindrical bags made of high-strength permeable fabric and filled with sand) are softer alternatives, but act as barriers by preventing overwash. We did not find any sources that summarize the linear extent of seawall, revetment, and geotube installation projects that have occurred across the piping plover's wintering and migration habitat.

Exotic/invasive vegetation

A recently identified threat to piping plover habitat, not described in the listing rule or recovery plans, is the spread of coastal invasive plants into suitable piping plover habitat. Like most invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods.

Beach vitex (*Vitex rotundifolia*) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). In 2003, the plant was documented in New Hanover, Pender, and Onslow counties in North Carolina, and at 125 sites in Horry, Georgetown, and Charleston counties in South Carolina. One Chesapeake Bay site in Virginia was eradicated, and another site on Jekyll Island, Georgia, is about 95 percent controlled (Suiter 2009 pers. communication). Beach vitex has been documented from two locations in northwest Florida, but one site disappeared after erosional storm events. The landowner of the other site has indicated an intention to eradicate the plant, but follow through is unknown (Farley 2009 pers. communication). The task forces formed in North and South Carolina in 2004 and 2005 have made great strides to remove this plant from their coasts. To date, about 200 sites in North Carolina have been treated, with 200 additional sites in need of treatment. Similar efforts are underway in South Carolina.

Unquantified amounts of crowfoot grass (*Dactyloctenium aegyptium*) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (*Casuarina equisetifolia*) also changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation.

The propensity of these exotic species to spread, and their tenacity once established, make them a persistent threat, partially countered by increasing landowner awareness and willingness to undertake eradication activities.

<u>Wrack removal and beach cleaning</u>

Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999a; Smith 2007; Maddock et al. 2009; Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Because shorebird numbers are positively correlated with wrack cover and biomass of their invertebrate prey that feed on wrack (Tarr and Tarr 1987; Hubbard and Dugan 2003; Dugan et al. 2003), beach grooming will lower bird numbers (Defreo et al. 2009).

There is increasing popularity along developed beaches in the Southeast, especially in Florida, for beach communities to carry out “beach cleaning” and “beach raking” actions. Beach cleaning occurs on private beaches, where piping plover use is not well documented, and on some municipal or county beaches that are used by piping plovers. Most wrack removal on state and federal lands is limited to post-storm cleanup and does not occur regularly.

Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach’s natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Nordstrom et al. 2006; Neal et al. 2007). Beach cleaning or grooming can result in abnormally broad unvegetated zones that are inhospitable to dune formation or plant colonization, thereby enhancing the likelihood of erosion (Defeo et al. 2009).

Currently, the Florida Department of Environmental Protection’s Beaches and Coastal Management Systems section has issued 117 permits for beach raking or cleaning to multiple entities. We estimate that 240 of 825 miles (29 percent) of sandy beach shoreline in Florida are cleaned or raked on various schedules (i.e., daily, weekly, monthly) (FDEP 2008). Service biologists estimate that South Carolina mechanically cleans approximately 34 of its 187 shoreline miles (18 percent), and Texas mechanically cleans approximately 20 of its 367 shoreline miles (5.4 percent). In Louisiana, beach raking occasionally occurs on Grand Isle (the state’s only inhabited island) along approximately 8 miles of shoreline, roughly 2 percent of the state's 397 sandy shoreline miles. We are not aware of what percentage of mechanical cleaning occurs elsewhere in piping plover critical habitat.

Tilling beaches to reduce soil compaction, as sometimes required by the Service for sea turtle protection after beach nourishment activities, also has similar impacts. Recently, the Service improved sea turtle protection provisions in Florida; these provisions now require tilling, when needed, to be above the primary wrack line, not within it.

Disease

Neither the final listing rule nor the recovery plans state that disease is an issue for the species, and no plan assigns recovery actions to this threat factor. Based on information available to date, West Nile virus and avian influenza are a minor threat to piping plovers (Service 2009).

Predation

The impact of predation on migrating or wintering piping plovers remains largely undocumented. Except for one incident reported in 2007 by the New York Times involving a cat in Texas, no depredation of piping plovers during winter or migration has been noted, although it would be difficult to document. Avian and mammalian predators are common throughout the species' wintering range. Predatory birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). It has been noted, however, that the behavioral response of crouching when in the presence of avian predators may minimize avian predation on piping plovers (Morrier and McNeil 1991; Drake 1999a; Drake et al. 2001).

The 1996 Atlantic Coast Recovery Plan summarized evidence that human activities affect types, numbers, and activity patterns of some predators, thereby exacerbating natural predation on breeding piping plovers. Nonbreeding piping plovers may reap some collateral benefits from predator management conducted for the primary benefit of other species. In 1997, the USDA implemented a public lands predator control partnership in northwest Florida that included the Department of Defense, National Park Service (NPS), the State of Florida (state park lands) and Service (National Wildlife Refuges and Ecological Services). The program continues with all partners except Florida – in 2008, lack of funding precluded inclusion of Florida state lands (although Florida Department of Environmental Protection staff conduct occasional predator trapping on state lands, trapping is not implemented consistently).

The NPS and individual state park staff in North Carolina participate in predator control programs (Rabon 2009 pers. communication). The Service issued permit conditions for raccoon eradication to Indian River County staff in Florida as part of a coastal Habitat Conservation Plan (Adams 2009 pers. communication). Destruction of turtle nests by dogs or coyotes in the Indian River area justified the need to amend the permit to include an education program targeting dog owners regarding the appropriate means to reduce impacts to coastal species caused by their pets. The Service partnered with Texas Audubon and the Coastal Bend Bays and Estuaries Program in Texas to implement predator control efforts on colonial waterbird nesting islands (Cobb 2009 pers. communication). Some of these predator control programs may provide very limited protection to piping plovers, should they use these areas for roosting or foraging. Table 6 summarizes predator control actions on a state-by-state basis. The Service is not aware of any current predator control programs targeting protection of coastal species in Georgia, Alabama, Mississippi, or Louisiana.

Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. We consider predator control on their wintering and migration grounds to be a low priority at this time.[5]

Table 6. Summary of predator control programs that may benefit piping plovers on winter and migration grounds.

State	Entities with Predator Control Programs
North Carolina	State Parks, Cape Lookout and Cape Hatteras National Seashores.
South Carolina	As needed throughout the state, targets raccoons and coyotes.
Georgia	No programs known.
Florida	Merritt Island NWR, Cape Canaveral AFS, Indian River County, Eglin AFB, Gulf Islands NS, northwest Florida state parks (up until 2008), St. Vincent NWR, Tyndall AFB.
Alabama	Late 1990's Gulf State Park and Orange Beach for beach mice, no current programs known.
Mississippi	No programs known.
Louisiana	No programs known; sporadic predator control by LDWF on islands with colonial nesting bird rookeries.
Texas	Aransas NWR (hog control for habitat protection), Audubon (mammalian predator control on colonial waterbird islands that have occasional piping plover use).

Recreational disturbance

Disturbance (i.e., human and pet presence that alters bird behavior) disrupts piping plovers as well as other shorebird species. Shorebirds are also more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds.

Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000); such energy is needed for migration and subsequent reproduction. Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Pfister et al. (1992) implicate anthropogenic disturbance as a factor in the long-term decline of migrating shorebirds at staging areas. Elliott and Teas (1996) found a significant difference in actions between piping plovers encountering pedestrians and those not encountering pedestrians. Piping plovers encountering pedestrians spend

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[5] The threat of direct predation should be distinguished from the threat of disturbance to roosting and feeding piping plovers posed by dogs off leash.

proportionately more time in non-foraging behavior. This study suggests that interactions with pedestrians on beaches cause birds to shift their activities from calorie acquisition to calorie expenditure. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1996; Zonick 2000). In wintering and migration sites, human disturbance continues to decrease the amount of undisturbed habitat and appears to limit local piping plover abundance (Zonick and Ryan 1996). While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to the wintering season, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle.

Off-road vehicles (ORVs) can also disrupt the birds' normal behavior patterns (Zonick 2000) or can significantly degrade piping plover habitat (Wheeler 1979). The 1996 Atlantic Coast Recovery Plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993; Goldin 1993). The plan also notes that the magnitude of the threat from ORVs is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance will otherwise be very slight. Godfrey et al. (1980 as cited *in* Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of ORVs negatively correlated with abundance of roosting piping plovers on the ocean beach. Cohen et al. (2008a) found that radio-tagged piping plovers using ocean beach habitat at Oregon Inlet in North Carolina were far less likely to use the north side of the inlet where ORV use is allowed, and recommended controlled management experiments to determine if recreational disturbance drives roost site selection. Ninety-six percent of piping plover detections was on the south side of the inlet even though it was farther away from foraging sites (1.8 km from the sound side foraging site to the north side of the inlet versus 0.4 km from the sound side foraging site to the north side of the inlet) (Cohen et al. 2008a).

Based on surveys with land managers and biologists, knowledge of local site conditions, and other information, we have estimated the levels of eight types of disturbance at sites in the U.S. with wintering piping plovers. There are few areas used by wintering piping plovers that are devoid of human presence, and just under half have leashed and unleashed dog presence (Smith 2007; Lott et al. 2009, Service unpublished data 2009; Maddock and Bimbi unpublished data). Table 7 summarizes the disturbance analysis results. Data are not available on human disturbance at wintering sites in the Bahamas, other Caribbean countries, or Mexico.

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Table 7. Percent of known piping plover winter and migration habitat locations, by state, where various types of anthropogenic disturbance have been reported.

	Percent by State							
Disturbance Type	AL	FL	GA	LA	MS	NC	SC	TX
Pedestrians	67	92	94	25	100	100	88	54
Dogs on leash	67	69	31	25	73	94	25	25
Dogs off leash	67	81	19	25	73	94	66	46
Bikes	0	19	63	25	0	0	28	19
ATVs[a]	0	35	0	25	0	17	25	30
ORVs[b]	0	21	0	25	0	50	31	38
Boats	33	65	100	100	0	78	63	44
Kite surfing	0	10	0	0	0	33	0	0

(a) ATV = all terrain vehicle; (b) ORV = off-road vehicle

Although the timing, frequency, and duration of human and dog presence throughout the wintering range are unknown, studies in Alabama and South Carolina suggest that most disturbances to piping plovers occurs during periods of warmer weather, which coincides with piping plover migration (Johnson and Baldassarre 1988; Lott et al. 2009; Maddock et al. 2009). Smith (2007) documents varying disturbance levels throughout the nonbreeding season at northwest Florida sites.

LeDee (2008) collected survey responses in 2007 from 35 managers (located in seven states) at sites that were designated as critical habitat for wintering piping plovers. Ownership included federal, state, and local governmental agencies and non-governmental organizations managing national wildlife refuges; national, state, county, and municipal parks; state and estuarine research reserves; state preserves; state wildlife management areas; and other types of managed lands. Of 44 reporting sites, 40 allowed public beach access year-round and four sites were closed to the public. Of the 40 sites that allow public access, 62 percent of site managers reported greater than 10,000 visitors from September through March, and 31 percent reported greater than 100,000 visitors. Restrictions on visitor activities on the beach included automobiles (at 81 percent of sites), all-terrain vehicles (89 percent), and dogs during the winter season (50 percent). Half of the survey respondents reported funding as a primary limitation in managing piping plovers and other threatened and endangered species at their sites. Other limitations included “human resource capacity” (24 percent), conflicting management priorities (12 percent), and lack of research (3 percent).

Disturbance can be addressed by implementing recreational management techniques such as vehicle and pet restrictions and symbolic fencing (usually sign posts and string) of roosting and feeding habitats. In implementing conservation measures, managers need to consider a range of site-specific factors, including the extent and quality of roosting and feeding habitats and the types and intensity of recreational use patterns. In addition, educational materials such as informational signs or brochures can provide valuable information so that the public understands the need for conservation measures.

In summary, although there is some variability among states, disturbance from human beach recreation and pets poses a moderate to high and escalating threat to migrating and wintering piping plovers. Systematic review of recreation policy and beach management across the nonbreeding range will assist in better understanding cumulative impacts. Site-specific analysis and implementation of conservation measures should be a high priority at piping plover sites that have moderate or high levels of disturbance. The Service and state wildlife agencies should increase technical assistance to land managers to implement management strategies and monitor their effectiveness.

Military Actions

Twelve coastal military bases are located in the Southeast. To date, five bases have consulted with the Service under section 7 of the Act, on military activities on beaches and baysides that may affect piping plovers or their habitat (Table 8). Camp Lejeune in North Carolina consulted formally with the Service in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with the Service on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt with occasional use of motorized equipment on the beaches and associated baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts bi-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to minimize direct disturbance from troop activities. A 2001 consultation with the Navy for one-time training and retraction operations on Peveto Beach, in Cameron Parish, Louisiana, concluded informally.

Table 8. Military bases that occur within the wintering/migration range of piping plovers and contain piping plover habitat.

State	Coastal Military Bases
North Carolina	Camp Lejeune*
South Carolina	No coastal beach bases
Georgia	Kings Bay Naval Base
Florida	Key West Base, Naval Station Mayport*, Cape Canaveral Air Force Station, Patrick AFB, MacDill AFB, Eglin AFB*, Tyndall AFB*
Alabama	No coastal beach bases
Mississippi	Keesler AFB
Louisiana	No coastal beach bases
Texas	Corpus Christi Naval Air Station

* Bases which conduct activities that may affect piping plovers or their habitat.

Overall, project avoidance and minimization actions currently reduce threats from military activities to wintering and migrating piping plovers to a minimal threat level. However, prior to removal of the piping plover from protection under the Act, Integrated Resource Management Plans or other agreements should clarify if and how a change in legal status would affect plover protections.

Contaminants

Contaminants have the potential to cause direct toxicity to individual birds or negatively affect their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985; Gilbertson et al. 1991; Hoffman et al. 1996).

The Great Lakes Recovery Plan states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. They further state that analysis of prey available to piping plovers at representative Michigan breeding sites indicated that breeding areas along the upper Great Lakes region are not likely the major source of contaminants to this population.

Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; Service 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; Amos 2009 pers. communication). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (Lee 2009 pers. communication). Federal and state land managers have protective provisions in place to secure and remove the barrels, thus reducing the likelihood of contamination.

Lightly oiled piping plovers have survived and successfully reproduced (Chapman 1984; Amirault-Langlais et al. 2007; A. Amos pers. comm. 2009). Chapman (1984) noted shifts in habitat use as piping plovers moved out of spill areas. This behavioral change was believed to be related to the demonstrated decline in benthic infauna (prey items) in the intertidal zone and may have decreased the direct impact to the species. To date, no plover mortality has been attributed to oil contamination outside the breeding grounds, but latent effects would be difficult to prove.

Deepwater Horizon Mississippi Canyon Well #252 Oil Spill

The Deepwater Horizon Mississippi Canyon Well #252 oil spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. According to government estimates, the leak released between 100 and 200 million gallons of oil into the Gulf of Mexico due to the Deepwater Horizon accident. The U.S. Coast Guard (USCG) estimates that more than 50 million gallons of oil have been removed from the Gulf, or roughly a quarter of the spill amount. Additional impacts to natural resources may be attributed to the 1.84 million gallons of dispersant that have been applied to the spill. Approximately 625 miles of Gulf of Mexico shoreline is currently oiled (approximately 360 miles in LA, 105 miles in MS, 66 miles in AL and 94 miles in FL) (July 28, 2010 Joint Information Center news release http://app.restorethegulf.gov/go/doc/2931/832251). These numbers reflect a daily snapshot of shoreline currently experiencing impacts from oil; they do not include cumulative impacts to date, or shoreline that has already been cleaned.

At the time of this document's writing, piping plovers are arriving to the Gulf of Mexico shorelines, and no oiled piping plovers have yet to be documented from this spill. However, oiling of designated piping plover critical habitat has been documented. Impacts to the species and its habitat are expected but their extent remains hard to predict. The USCG, the states, and responsible parties form the

Unified Command, with advice from federal and state natural resource agencies, initiated protective measures and clean-up efforts per prepared contingency plans to deal with petroleum and other hazardous chemical spills for each state's coastline. The contingency plans identify sensitive habitats, including all federally listed species' habitats, which receive a higher priority for response actions. Those plans allow for immediate habitat protective measures for clean-up activities in response to large contaminant spills. While such plans usually ameliorate the threat to piping plovers, it is yet unknown how much improvement will result in this case given the breadth of the impacts associated with the Deepwater Horizon incident.

Based on all available data prior to the Deepwater Horizon oil spill, the risk of impacts from contamination to piping plovers and their habitat was recognized, but the safety contingency plans were considered adequate to alleviate most of these concerns. The Deepwater Horizon incident has brought heightened awareness of the intensity and extent to fish and wildlife habitat from large-scale releases. In addition to potential direct habitat degradation from oiling of intertidal habitats and retraction of stranded boom, impacts to piping plovers may occur from the increased human disturbance associated with boom deployment and retraction, clean-up activities, wildlife response, and damage assessment crews working along affected shorelines. Research studies are being initiated to begin documenting the potential expanse of impacts to the piping plover.

Pesticides

In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer, a chemical manufacturer. Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses of the chemical were to end by November 30, 2004 (American Bird Conservancy 2007). All other counties in the U.S. now use less toxic chemicals for mosquito control. It is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico.

Climate Change (sea-level rise)

Over the past 100 years, the globally averaged sea level has risen approximately 10 to 25 centimeters (cm) (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33 percent of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007; CCSP 2008).

Potential effects of sea-level rise on coastal beaches may vary regionally due to subsidence or uplift as well as the geological character of the coast and nearshore (CCSP 2009; Galbraith et al. 2002). In the last century, for example, sea-level rise along the U.S. Gulf Coast exceeded the global average by 13 to 15 cm, because coastal lands west of Florida are subsiding (EPA 2009). Sediment compaction and oil and gas extraction compound tectonic subsidence (Penland and Ramsey 1990; Morton et al. 2003; Hopkinson et al. 2008). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea level. Furthermore, areas with small astronomical tidal ranges (e.g., portions of the Gulf Coast where intertidal range is less than 1 meter) are the most vulnerable to loss of intertidal wetlands and flats induced by sea-level rise (EPA 2009). Sea-level rise was cited as a contributing factor in the 68 percent decline in tidal flats and algal mats in the Corpus Christi area (i.e., Lamar Peninsula to Encinal Peninsula) in Texas between the 1950s and 2004 (Tremblay et al. 2008). Mapping by Titus and Richman (2001) showed that more than 80 percent of the lowest land along the Atlantic and Gulf coasts was in Louisiana, Florida, Texas, and North Carolina, where 73.5 percent of all wintering piping plovers were tallied during the 2006 IPPC (Elliott-Smith et al. 2009).

Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the over-washing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments.

Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20 to 70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively. The 50 percent and 5 percent probability sea level change projections were based on assumed global temperature increases of 2° C (50 percent probability) and 4.7° C (5 percent probability). The most severe losses were projected at sites where the coastline is unable to move inland due to steep topography or seawalls. The Galbraith et al. (2002) Gulf Coast study site at Bolivar Flats, Texas, is a designated critical habitat unit known to host high numbers of piping plovers during migration and throughout the winter (e.g., 275 individuals were tallied during the 2006 IPPC) (Elliott-Smith et al. 2009). Under the 50 percent likelihood scenario for sea-level rise, Galbraith et al. (2002) projected approximately 38 percent loss of intertidal flats at Bolivar Flats by 2050; however, after initially losing habitat, the area of tidal flat habitat was predicted to slightly increase by the year 2100, because Bolivar Flats lacks armoring, and the coastline at this site can thus migrate inland. Although habitat losses in some areas are likely to be offset by gains in other locations, Galbraith et al. (2002) noted that time lags may exert serious adverse effects on shorebird populations. Furthermore, even if piping plovers are able to move their wintering locations in response to accelerated habitat changes, there could be adverse effects on the birds' survival rates or reproductive fitness.

Table 9 displays the potential for adjacent development and/or hardened shorelines to impede response of habitat to sea-level rise in the eight states supporting wintering piping plovers. Although complete linear shoreline estimates are not readily obtainable, almost all known piping plover wintering sites in the U.S. were surveyed during the 2006 IPPC. To estimate effects at the census sites, as well as additional areas where piping plovers have been found outside of the census period, Service biologists reviewed satellite imagery and spoke with other biologists familiar with the sites. Of 406 sites, 204 (50 percent) have adjacent structures that may prevent the creation of new habitat if existing habitat were to become inundated. These threats will be perpetuated in places where damaged structures are repaired and replaced, and exacerbated where the height and strength of structures are increased. Data do not exist on the amount or types of hardened structures at wintering sites in the Bahamas, other Caribbean countries, or Mexico.

Table 9. Number of sites surveyed during the 2006 winter IPPC with hardened or developed structures adjacent to the shoreline. Those marked with an asterisk (*) are additional sites that were not surveyed in the 2006 IPPC.

State	Number of sites surveyed during the 2006 winter Census	Number of sites with some armoring or development	Percent of sites affected
North Carolina	37 (+2)*	20	51
South Carolina	39	18	46
Georgia	13	2	15
Florida	188	114	61
Alabama	4 (+2)*	3	50
Mississippi	16	7	44
Louisiana	25 (+2)*	9	33
Texas	78	31	40
Overall Total	406	204	50

Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle. Ongoing coastal stabilization activities may strongly influence the effects of sea-level rise on piping plover habitat. In Louisiana, Federal and State agencies take into account the effects of sea-level rise and attempt to compensate for those effects in the design of coastal restoration projects. Improved understanding of how sea-level rise will affect the quality and quantity of habitat for migrating and wintering piping plovers remains an urgent need.

Storm events

Although coastal piping plover habitats are storm-created and maintained, the 1996 Atlantic Coast Recovery Plan also notes that storms and severe cold weather may take a toll on piping plovers, and the 2003 Great Lakes Recovery Plan postulates that loss of habitats, such as overwash passes or wrack, where birds shelter during harsh weather, poses a threat. Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced overwash and vegetation removal have been noted in portions of the wintering range. For example, Gulf Islands National Seashore habitats in Florida benefited from increased washover events that created optimal habitat conditions during the 2004 and 2005 hurricane seasons, with biologists reporting piping plover use of these habitats within six months of the storms (Nicholas 2005 pers. communication). Hurricane Katrina (2005) over-washed the mainland beaches of Mississippi, creating many tidal flats where piping plovers were subsequently observed (Winstead 2008). Hurricane Katrina also created a new inlet and improved habitat conditions on some areas of Dauphin Island, Alabama (LeBlanc 2009 pers. communication). Conversely, localized storms, since Katrina, have induced habitat losses on Dauphin Island (LeBlanc 2009 pers. communication).

Noel and Chandler (2005) suspect that changes in habitat caused by multiple hurricanes along the Georgia coastline altered the spatial distribution of piping plovers and may have contributed to winter mortality of three Great Lakes piping plovers. Following Hurricane Ike in 2008, Arvin (2009) reported decreased numbers of piping plovers at some heavily eroded Texas beaches in the center of the storm impact area and increases in plover numbers at sites about 100 miles to the southwest. However, piping plovers were observed later in the season using tidal lagoons and pools that Ike created behind the eroded beaches (Arvin 2009).

The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. For example, four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Comparison of imagery taken three years before and several days after Hurricane Katrina indicated that the Chandeleur Islands lost 82 percent of their surface area (Sallenger et al. 2009), and a review of aerial photography prior to the 2006 IPPC suggested little piping plover habitat remained (Elliott-Smith et al. 2009). However, Sallenger et al. (2009) noted that habitat changes in the Chandeleur Islands stem not only from the effects of these storms but rather from the combined effects of the storms, long-term (i.e., greater than 1,000 years) diminishing sand supply, and sea-level rise relative to the land. Sallenger et al. (2009) went on to explain that although the marsh platform of the Chandeleur Islands continued to erode for 22 months post-Katrina, some sand was released from the marsh sediments which in turn created beaches, spits, and welded swash bars that advanced the shoreline seaward. Thus, although intense erosional forces have affected the Chandeleur Islands, they are still providing high quality shorebird habitat in the form of sand flats, spits, and beaches, until they are eroded below sea level.

Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Such stabilization activities can result in the loss and degradation of feeding and resting habitats. Storms also can cause widespread deposition of debris along beaches. Removal of debris often requires large machinery, which can cause extensive disturbance and adversely affect habitat elements such as wrack. Another example of indirect adverse effects linked to a storm event is the increased access to Pelican Island (LeBlanc 2009 pers. communication) due to merging with Dauphin Island following a 2007 storm (Gibson et al. 2009).

Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity (Emanuel 2005; Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms. Storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris and post-storm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss.

Threats Summary

Habitat loss and degradation on winter and migration grounds from shoreline and inlet stabilization efforts, both within and outside of designated critical habitat, remain a serious threat to all piping plover populations. Modeling strongly suggests that the population is very sensitive to adult and juvenile survival. Therefore, while there is a great deal of effort extended to improve breeding success and thus improve and maintain a higher population over time, it is also necessary to ensure that the wintering habitat, where birds spend most of their time, is secure. On some of the wintering grounds, the shoreline areas used by wintering piping plovers are being developed, stabilized, or otherwise altered, generally making the habitat unsuitable. Even in areas where habitat conditions are appropriate, human disturbance on beaches may negatively impact piping plovers' energy budget, as they may spend more time being vigilant and less time in foraging and roosting behavior. In many cases, the disturbance is severe enough that piping plovers appear to avoid some areas altogether. Threats on the wintering grounds may impact piping plovers' breeding success if they start migration or arrive at the breeding grounds with a poor body condition.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect wintering piping plovers and their habitat, including designated critical habitat in Units LA-4 and LA-5, within the action area. The construction activities may lead to temporarily diminished quantity and quality of intertidal foraging and roosting habitats within the project area and action area, resulting in decreased survivorship of migrating and wintering plovers (potential effects on breeding success from poor body condition) and temporary adverse affects to critical habitat. The length of construction (which varies from 16.6 months to 4 years) may delay the recovery of benthic species due to the prolonged disturbance of the benthic fauna. Ultimately, the project goal is to restore the diversity of coastal barrier island habitats, but the temporary effects of construction will require time for natural recovery and would extend beyond one wintering season. The detailed effects of the proposed action on piping plovers and critical habitat will be considered further in the remaining sections of this opinion.

ENVIRONMENTAL BASELINE

Louisiana's loss of wetlands and barrier islands to open water is now a well-documented fact in numerous studies. Since the 1930s Louisiana has lost 1,900 square miles of land (this includes coastal wetlands). From 1990 to 2000, approximately 24 square miles of coastal land were lost each year. The 2004 Louisiana Coastal Area Ecosystem Restoration Study projected that 513 square miles of land would disappear by 2050, including a gain of 161 square miles from CWPPRA projects (Corps 2004). In Louisiana, barrier island and barrier headland erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand retention, such as sand fencing and vegetative planting, are used to effectively rebuild and maintain such eroded areas.

Louisiana barrier islands are part of a complex and dynamic coastal system that continually respond to tidal passes, tides, wind, waves, erosion and deposition, long-shore sediment transport and depletion, fluctuations in sea level, and weather events. During storm events, overwash across the barrier islands is common, depositing sediments on the bayside, clearing vegetation and increasing the amount of open, sand flat habitat ideal for shoreline dependent shorebirds. The locations and shapes of the islands perpetually adjust to these physical forces. Winds move sediment across the dry beaches forming low dunes and the island interior landscape. The natural communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include fore dunes, occasional primary dunes, salt marsh, and black mangroves.

The TBBSR project area consists of undeveloped barrier islands (Raccoon, Whiskey, Trinity, and Timbalier) that are protected and managed by the LDWF. Human access to the barrier island system is by boat only and direct access on the islands requires a LDWF permit. Occasional disturbance directly on the islands results from IPPC surveys (once every 5 years), breeding bird surveys (annual), winter and summer bird atlas surveys (annual), and banded bird surveys (occasional). Regular boat traffic adjacent to the islands occurs as a result of ongoing recreational and commercial fishing activity, recreational birding, and nearshore and offshore oil and gas activities. As indicated in Table 10 several CWPPRA projects have also been constructed on portions of the islands to restore and maintain the diverse functions of those barrier island habitats. As a result of those projects, the added sediment has been reworked by the dynamic coastal processes of the barrier island system and has resulted in the preservation and maintenance of shorebird and waterbird foraging and nesting habitats.

Table 10. CWPPRA projects that have been constructed on barrier islands within the Terrebonne Basin.

Project (CWPPRA Project No.)	**Federal Agency[a]**	**Construction Completed**	**Net Benefit**
Isles Dernieres Restoration East Island (TE-20)	EPA	1999	9 acres
Vegetative Plantings – Timbalier Island Demonstration (TE-17)	NRCS	1996	N/A[b]
Isles Dernieres Restoration Trinity Island (TE-24)	EPA	1999	109 acres
Whiskey Island Restoration (TE-27)	EPA	2000	1,239 acres
Raccoon Island Breakwaters Demonstration (TE-29)	NRCS	1997	N/A
Timbalier Island Dune and Marsh Creation (TE-40)	EPA	2005	273 acres
New Cut Dune and Marsh Creation (TE-37)	EPA	2007	102 acres
Raccoon Island Shoreline Protection and Marsh Creation (TE-48)	NRCS	Breakwaters–2006; Marsh Creation not yet constructed	71 acres
Ship Shoal: Whiskey West Flank Restoration (TE-47)	EPA	Engineering & Design Phase	195 acres
Whiskey Island Back Barrier Marsh Creation (TE-50)	EPA	Dredging completed 2009; Planting scheduled for summer 2010	316 acres

(a) EPA = Environmental Protection Agency; NMFS = National Marine Fisheries Service; NRCS = Natural Resources Conservation Service; (b) N/A = Not applicable.

Status of the species within the action area

The number of piping plovers within the action area during winter is difficult to assess because the number of birds utilizing the area varies from year to year and throughout the wintering season. Because the islands are only accessible by boat and because winter weather generally provides inclement weather conditions, daily surveys over any length of time during the wintering season are also difficult to coordinate. Consequently, surveys for non-breeding (e.g., over-wintering and migrating) plovers within the action area have been sporadic at best (Table 11). Because the 2005 hurricane season severely damaged much of the piping plover critical habitat across the state, the Service provided funding to the LDWF to conduct hurricane impact assessments of piping plovers and their habitat across the Louisiana coast. The LDWF conducted annual, one-day-count piping plover surveys between January 1 and February 18 from 2007 through 2010. Due to lack of manpower and inclement weather (e.g., dangerous boating conditions) LDWF was unable to survey the Isles Dernieres and Timbalier Islands in 2010. For surveys that have been successful, results indicate that piping plovers utilize any non-vegetated or sparsely vegetated portions of the subject barrier islands. Such habitat consists of sand beaches, spits, and flats, mud flats, shell beaches, and oyster reefs associated with both the Gulf- and bay-sides of the island, as well as wash-over areas created by storm events.

Table 11. Piping plover numbers from sporadic survey results within the action area. The 2010 LDWF survey data are not included here since the subject islands were not surveyed in that year.

Location	**1991 IPPC[a] Survey**	**1996 IPPC Survey**	**2001 IPPC Survey**	**2006 IPPC Survey**	**2006/2007 CWS[b] Survey**	**2007 LDWF[c] Survey**	**2008 LDWF Survey**	**2009 LDWF Survey**
Raccoon Island	43	0	32	39	49	18	53	NS[d]
Trinity/East Island	86	83[e]	73	16	11[f]	20	NS	4
Whiskey Island	NS	22	40	31	48	3	36	NS
Timbalier Island	89	84	78	17	NS	14	39	47

(a) IPPC = International Piping Plover Census; (b) CWS = Canadian Wildlife Service; (c) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (d) NS = Not Surveyed; (e) The value includes counts for both Trinity and East Islands which were surveyed separately during this census year; (f) The value includes East Island only.

Although piping plover numbers fluctuate from survey to survey, Table 11 appears to indicate an overall trend of decreasing piping plover numbers on Trinity and Timbalier Islands over the last 9 surveys. Prior to the 2001 IPPC survey, Trinity and East Islands were two separate islands, and East Island was roughly a large sand flat with very little marsh. According to 2001 satellite imagery, the channel (known as New Cut) between the two islands began to fill in through long-shore transport of sediment, and by 2002, New Cut had naturally filled in to reconnect the two islands. In 2007, a CWPPRA project (TE-37) was completed to restore dune habitat to the naturally created sand flat and provided a bayside marsh platform behind the New Cut area, in order to further tie the two islands together. Meanwhile, suitable habitat on the easternmost end of East Island has continued to erode. Suitable habitat on Timbalier Island appears to be affected by erosion as well. For the surveys conducted in 1991, 1996, and 2001, all of the birds observed were concentrated on a sand spit at the eastern tip of the island. After review of aerial photography from 1998, 2004, 2005, 2008, and 2009, the large sand spit on the eastern tip of Timbalier Island has eroded below sea level. Although we do not know for certain why survey trends are showing a decrease in piping plover numbers for Trinity and Timbalier Islands, review of aerial photography indicate that erosion has caused changes in the availability of suitable habitat on those islands.

All of the islands within the action area are designated critical habitat for the piping plover. Raccoon, Trinity, East, and Whiskey Islands are located within Unit LA-4, while Timbalier Island is located in

Unit LA-5. The Final Determinations of Critical Habitat for Wintering Piping Plovers (Service 2001b) describes critical habitat within those units as ". . . the entire islands where primary constituent elements occur to the MLLW [mean low low water]." At the time of designation, Raccoon, Trinity/East, Whiskey, and Timbalier Islands consisted of an estimated 3,681 acres of barrier island habitat, a portion of which consisted of sparsely vegetated and non-vegetated areas suitable for piping plovers (based upon 1998 aerial photography). Within the proposed project footprints the Corps estimates that approximately 1,315 acres of suitable piping plover habitat currently exist on the islands (Figure 8) based on 2008 aerial photography and excluding densely vegetated areas (e.g., mangroves and saline marsh). An additional 272 acres currently exists on East Island located outside of the project footprint for Trinity Island Plan C but still within the action area.

Table 12. Existing critical habitat acreages within the project footprint for each island of the NER Plan as estimated from 2008 aerial photography. The Corps did not include East Island in these estimates because East Island is not within the project footprint for the Trinity Island plan.

ISLAND	CRITICAL HABITAT (acres)
Raccoon Island	171
Whiskey Island	269
Trinity Island	303
Timbalier Island	572
Total NER Plan	1,315

Factors affecting species environment within the action area

As mentioned previously, the project-area islands remain undeveloped and are relatively isolated from the mainland. Raccoon, Whiskey, and Trinity/East Islands are afforded protection from major disturbance activities as part of the LDWF's Isles Dernieres Barrier Islands Wildlife Refuge. Occasional bird surveying and bird and wetland research are allowed on the islands via LDWF permits, while both recreational birding and commercial and recreational fishing occur along the islands' perimeters. Other than nearby boat traffic from fishing and offshore oil and gas activities, the islands generally do not receive regular visitors. There is one oil and gas platform located offshore of the northeastern end of East Island; however, there is no direct access to the island from that facility. Timbalier Island is mostly owned by the State but several small patches of privately owned marsh persist. There are several existing active oil and gas leases on the island including multiple access canals, and the State also leases two camps on/near the island. Thus, Timbalier Island experiences somewhat regular human disturbance related to oil and gas wells, pipeline maintenance, and boat traffic.

Mammalian predators (e.g., raccoons, coyotes) have access to all of the islands; however, they do not appear to permanently inhabit the islands. Mammalian predators swim back and forth to the islands from the mainland or adjacent islands, but none of the islands provide enough shelter or forage to sustain a constant predator population, and somewhat regular storm events (e.g., flooding) tend to discourage mammals from persisting on the islands. Avian predators may also be present throughout the year but likely peak during fall and spring migration periods.

The Deepwater Horizon Mississippi Canyon Well #252 oil spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. The LDWF confirmed the presence of oil on the project-area islands on or about May 20, 2010. Shoreline Cleanup Assessment Team (SCAT) reports throughout the duration of the spill documented various degrees of oiling on each of the islands (Table 13). At the time this document is being written, oil spill response efforts are ongoing in the form of continued SCAT surveys, Stage III cleanup efforts, and Natural Resources Damage and Assessment Restoration (NRDAR) surveys and data collection.

At this time, it is unknown if there are any current or lasting affects to the inter-tidal invertebrate food source used by piping plovers from either oil or oil dispersants and resulting cleanup activities within the action area. A greater impact to the piping plover and its habitat might be the increased human disturbance activities associated with cleanup, wildlife response, and damage assessment crews highly visible on the shorelines and ongoing surveys.

Table 13. Results of the SCAT reports for the Deepwater Horizon Mississippi Canyon Well #252 oil spill and follow-up cleanup activities on Isles Dernieres and Timbalier Island.

Location	Extent of Oil	Cleanup Actions Proposed or Implemented
Raccoon Island	Oiled vegetation on bayside; tar balls on beach	Manual cleanup with shovels; removal of oiled wrack
Whiskey Island	Large tar balls, mousse, tar mats on beach; oiled vegetation on bayside	Manual cleanup with shovels; removal of oiled wrack
Trinity/East Island	Oil, tar balls, tar patties, tar mats on beach; tar patties and mats extending into vegetation on eastern end	Manual cleanup with shovels; removal of oiled wrack
Timbalier Island	Oil, mousse, tar balls and patties on beach; oil on vegetation on bayside	Manual cleanup with shovels; removal of oiled wrack

EFFECTS OF THE ACTION

The proposed action includes marsh creation and dune and beach restoration of four barrier islands. The proposed project intends to lengthen and widen each island in order to add much-needed sediment to the barrier island system, prolong the existence of the islands, and restore barrier island habitat, function, and morphology. Much of the proposed project would occur in habitat that is used regularly by piping plovers and designated as critical habitat for the species. Construction of the fully proposed NER Plan will overlap with multiple piping plover wintering seasons, while construction of only the TSP (i.e., Whiskey Island Plan C) will overlap with two wintering seasons. Short-term and temporary construction impacts to piping plovers will occur when the birds are roosting and feeding in the area. The deposition of sand and marsh material will temporarily deplete the intertidal food base along the Gulf beach and bay-side flats, respectively, and temporarily disturb roosting birds during project construction on the islands. The shaping and grading of the newly created beach and dune will temporarily disturb any wrack that has accumulated on the Gulf-side of the island. This also affects feeding and roosting habitat for piping plovers, since they often use wrack for cover and foraging. The construction of the marsh creation area will cover any existing bay-side flats used by foraging plovers and will render that area unusable until natural processes re-work the sediments, overwash areas and bay-side flats are again created by tidal and storm events, and benthic prey species re-colonize those areas. Similar effects to the beach and dune portions of the islands will occur again on the Gulf-side of the islands during renourishment periods (see project plan descriptions on pages 2 through 4 for target years) and extend for 2 years beyond the renourishment period until the benthic fauna recovers. The temporary increase in human presence and construction activity on the islands may also disturb piping plovers from utilizing adjacent areas outside of the project footprints, such as nearby sand spits and East Island (not included in the Trinity Island Plan C portion of the action).

The geomorphic characteristics of barrier islands, dunes, overwash fans, and inlets are critical to a variety of natural resources and influence a barrier island's ability to respond to wave action, including storm overwash and sediment transport. The protection or persistence of these important natural processes and wildlife resources are part of the goal of this restoration project. The newly created beach, dune, and marsh will not impede overwash but may temporarily consist of less than optimal roosting and foraging habitat until natural wrack is restored, the benthic prey base is able to recover from the construction activities, and overwash areas are again created by natural tidal and weather events. The newly added sediment will be reworked by natural wind and wave processes which will, given time, create sand spits and flats on the ends and bay-sides of the islands, or as sediment is lost from one island, it will be carried by long-shore transport to another island. Thus, piping plover foraging, roosting, and critical habitat will continue to be lost and created through the natural processes associated with daily tidal events and future storm events.

Factors to be considered

Proximity of the action

Lack of regular surveys and fluctuation of use by piping plovers from year to year make it difficult to measure the number of birds actually using any particular island (Gulf- or bay-side) within the action area. We expect direct short-term effects in the form of: (1) disturbance during sediment placement, dune construction, marsh creation, and vegetative planting; and (2) a temporary loss of food base within the project footprint on each island for up to 2 years following completion of sediment placement until the benthic community re-colonizes the project area. The footprints of each island plan occur within critical habitat Units LA-4 and LA-5. East Island (i.e., the eastern portion of Trinity Island; see Figure 1) would not be included within any project footprint and would provide available habitat during project construction. However, human presence/activity within the project footprint on Trinity Island may potentially disturb birds foraging or roosting on East Island due to the proximity of the project footprint.

Distribution

The Corps proposes project construction activities on the Gulf- and bay-sides of Raccoon, Whiskey, Trinity, and Timbalier Islands within Terrebonne Parish. We expect direct effects to wintering piping plovers along existing sand beaches, spits, and flats, mud flats, shell beaches, oyster reefs, and washover areas associated with both the Gulf- and bay-sides of the islands as a result of human activity and ground disturbance on the islands. Similar temporary disturbance would occur again during a renourishment cycle on the Gulf-side of the island only.

Timing

Construction of the NER Plan will overlap with multiple piping plover wintering/migrating seasons (mid-July to late April), while construction of only the TSP (i.e., Whiskey Island Plan C) will overlap with two wintering/migrating seasons.

Nature of the effect

The effects to piping plover may be direct, indirect, and short-term. We anticipate a temporary (i.e., up to 2 years post-construction) decrease in benthic prey species within existing piping plover habitat as a result of sand and marsh material placement on the four islands. A decrease in survival of birds on migrating or wintering grounds due to lack of optimal habitat contribute to decreased survival rates, decreased productivity on the breeding grounds, and therefore increased vulnerability to any of the three piping plover populations. We expect concurrent short-term impacts from human disturbance during project construction to both the bird and its habitat. Activities that impact or alter the use of optimal habitat or increase disturbance to the species may decrease the survival and recovery potential of the piping plover.

The effects to critical habitat Units LA-4 and LA-5 are activities that impact or alter the PCEs (disturbance to the species) which may decrease the survival and recovery potential of the piping plover. Such effects consists of temporary reductions in the value of the units from disturbance to foraging and roosting piping plovers due to human activity during construction, a temporary decrease in benthic prey species due to sand and marsh material placement, and vegetative planting of newly created dune and marsh areas. In addition, existing washover areas would be covered by placement of new material until natural coastal processes (e.g., daily tidal events, storm events, etc.) are allowed to re-work the additional sediment to create new sand and mud flats.

Duration

For the NER Plan, construction would be completed in approximately 4 years, while the TSP-only option would require 16.6 months for construction. The activities associated with construction of the marsh creation are a one-time occurrence for each island. Construction of the dune and beach would initially occur at TY1 for each island; however, one renourishment event would occur for Raccoon (at TY30), Trinity (at TY25), and Timbalier (at TY30) Islands and two renourishment events (at TY20 and TY40) would occur for Whiskey Island. Each activity may vary in duration for each island depending on the amount of work needed, weather conditions, and equipment mobilization and maintenance. The Corps anticipates beginning construction on the TSP (i.e., Whiskey Island Plan C) in June 2012; construction of the remaining islands would occur later in time as additional authorizations are approved. We do not expect long-term, permanent alteration of the natural coastal processes and the renourishment events would result in a pulse effect that would temporarily disturb the Gulf-side of each island while the bay-side of each island would remain untouched after initial construction. The addition of sand and marsh material on critical habitat Units LA-4 and LA-5 is expected to decrease the quality of foraging habitat from 6 months up to 2 years until the intertidal benthic fauna recovers to normal population levels on each island.

Disturbance frequency, intensity, and severity

We expect short-term disturbance from construction activities and short-term effects of sand and marsh material placement. Direct effects to critical habitat Units LA-4 and LA-5 would include temporary smothering of intertidal benthic prey species at TY1 (on both sides of the islands) and again at the target year of a renourishment cycle (only on the Gulf-side of the islands). We anticipate construction activities to have short-term and temporary effects on piping plover populations. We anticipate that piping plovers located within the construction area would move outside of the construction zone due to disturbance. We anticipate that the intertidal benthic fauna would recover within 2 years of each disturbance event. We do not anticipate any permanent adverse changes to barrier island morphology because initial construction elevations and follow-up renourishment elevations would not prevent island washover during storm events and the created marsh platform would allow for natural island retreat or "rollover." There would not be any increased or continual disturbance within critical habitat Units LA-4 and LA-5 as a result of the project. Over the long-term the additional sediment would allow for creation of piping plover habitat on the islands as natural processes re-work the sediment to create sand flats, mud flats, and sand spits.

Analysis for the effects of the action

Direct effects

Direct effects are those direct or immediate effects of a project on the species or its habitat. The construction window (i.e., disposal of sand and marsh material) will extend through several piping plover migration and wintering seasons for the proposed NER Plan and two piping plover migration and wintering seasons for the TSP. Heavy machinery and equipment (e.g., ORVs and bulldozers operating on project area beaches and bay-side sand and mud flats, the placement of the dredge pipeline along the beach, and sand and marsh material disposal) may adversely affect migrating and wintering piping plovers in the project area by disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere.

Burial and suffocation of invertebrate intertidal prey species will occur during sand and marsh material placement and follow-up renourishment events. Impacts will affect the project footprint on each island as well as some down-drift areas. Timeframes projected for benthic recruitment and re-establishment following sand and marsh material placement are from 6 months up to 2 years. Due to the duration of project construction and depending on actual recovery rates, impacts will occur even if renourishment events occur outside the plover migration and wintering seasons.

Direct effects to critical habitat Units LA-4 and LA-5 consist of sand and marsh material placement over existing habitat areas on the Gulf- and bay-sides of the islands at TY1 and along the Gulf-side of the islands for follow-up renourishment at different target years, temporary loss of washover areas, vegetative plantings, and burial and suffocation of intertidal benthic prey species.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Reducing the potential for the formation of optimal habitats (such as overwash or ephemeral pool formations) is a possible indirect effect. The piping plover's rapid response (within 6 months) to habitats formed by washover areas demonstrates the importance of overwash created sand and mud flats for wintering and migrating piping plovers. Implementation of the proposed project will temporarily cover existing overwash habitat on the islands. However, given time, the intertidal zone along the islands will re-establish and with daily tidal processes and occasional storm events natural overwash and ephemeral pool habitat would again be recreated on the islands. Thus, the indirect effect will not be permanent for the life of the project.

The project life and expected future re-nourishment activities do not increase the likelihood of long-term increased human disturbance or that the LDWF or other entities would initiate construction of new infrastructure or upgrade existing facilities, such as camps or oil and gas infrastructure within or adjacent to the project area. The LDWF is committed to managing and maintaining the islands as a wildlife refuge area and improving shorebird nesting, roosting, and foraging habitats within minimal human disturbance.

Beneficial effects

Beneficial effects are wholly positive without any adverse effects. We expect the prolonged existence and creation of foraging and roosting habitat for piping plovers within critical habitat Units LA-4 and LA-5 as an overall result of the proposed TBBSR project. The additional sediment (within the sediment-starved system) would be re-worked by natural processes to allow for island "rollover" as well as the formation of optimal piping plover habitat in the form of sand flats, mud flats, and sand spits. The Corps has estimated that without the project there would be no piping plover critical habitat remaining on the islands at TY50, but with the project, Raccoon Island would retain 133 acres of critical habitat, Whiskey Island would retain 118 acres, Trinity Island would retain 87 acres (does not include East Island), and Timbalier Island would retain 227 acres (Corps 2010).

Species response to the proposed action

This biological opinion is based on direct and indirect effects that are anticipated to piping plovers (wintering and migrating) and designated critical habitat as a result of restoring beach, dune, and marsh on four barrier islands and concurrent temporary disruption of existing plover foraging and roosting habitat for the long-term benefit of maintaining existing barrier island habitat. In the context of migrating and wintering piping plovers, it is anticipated that an unquantifiable number of piping plovers utilizing the four barrier islands and up to 1,315 acres of existing critical habitat will be impacted by (1) construction disturbance within the action area, and (2) temporary habitat loss within the project footprint on each island for the duration of construction activities (4 years for the NER Plan and 16.6 months for the TSP) and up to 2 years post construction for the recovery of intertidal benthic prey species.

The Service anticipates temporary adverse affects to piping plovers and their critical habitat throughout the action area from increased human activity during construction. The nearest suitable habitats into which piping plovers can disperse are located on Wine Island (located between Trinity/East and Timbalier Islands, see Figure 1) and East Timbalier Island (located 6.5 miles east of Timbalier Island). The next closest suitable habitat areas consist of West Belle Pass (part of critical habitat Unit LA-5) to the east and the eastern shoreline of Point au Fer Island (critical habitat Unit LA-3) to the west; both of which are greater than 10 miles away from the action area. However, all of those areas have been impacted by the Deepwater Horizon oil spill, and foraging and roosting habitat in those areas are recovering from ongoing oil spill cleanup activities and NRDAR surveys and data collection. The duration of disturbance and effects to piping plovers from the oil spill are ongoing for an unknown period of time.

The closest non-oiled impacted habitat would be the Atchafalaya River Delta which is located greater than 30 miles west of the action area. Critical habitat Unit LA-2 consists of the deltaic splay and the dredge disposal islands occurring east and southeast of the main navigation channel of the Atchafalaya River. At this time, there have been no reported impacts to those areas as a result of the oil spill. Table 14 depicts the results of sporadic winter surveys of the Atchafalaya River Delta over the last 19 years.

Table 14. Piping plover numbers from winter surveys within the Atchafalaya River Delta.

Location	1991 IPPC[a] Survey	1996 IPPC Survey	2001 IPPC Survey	2006 IPPC Survey	2006/2007 CWS[b] Survey	2007 LDWF[c] Survey	2008 LDWF Survey	2009 LDWF Survey	2010 LDWF Survey
Atchafalaya River Delta	27	0	21	6	NS[d]	NS	27	0	NS

(a) IPPC = International Piping Plover Census; (b) CWS = Canadian Wildlife Service; (c) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (d) NS = Not Surveyed.

The Service has documented that critical habitat within the action area has been oiled and is experiencing ongoing disturbance by oil spill cleanup activities; such disturbance will continue for an unknown period of time. The proposed action would also involve anywhere from 16.6 months to 4 years of disturbance activities for the construction period, plus an additional 2 years of recovery for the intertidal benthic community following TY1. However, it is possible that the proposed action would ameliorate some effects associated with the oil spill by providing for maintenance of the existing habitat and creation of new habitat in the future as sediments are re-worked by wind and wave action. In addition, the project would not result in permanent changes to the natural processes that maintain the PCEs of critical habitat. Daily tidal processes and occasional storm events would also re-work the additional sediment to recreate overwash areas, sand and mud flats, and sand spits. Without the additional sediment from the project, critical habitat on the subject islands would eventually erode below sea level.

Although restoration of the four barrier islands would follow on the heels of the Deepwater Horizon oil spill and would result in temporary disturbance within the action area, in time the proposed action would ultimately benefit the piping plover and its critical habitat by restoring diverse barrier island habitats used by the piping plover. The proposed action would also allow for the continued existence and creation of habitat within critical habitat Units LA-4 and LA-5 throughout the project life.

CUMULATIVE EFFECTS

The proposed project would occur on State-owned lands and/or water bottoms, except for a few small areas of marsh on Timbalier Island which are privately owned. Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

It is unknown how much influence the proposed project would contribute to the recreational use of the barrier islands; regardless, the LDWF restricts human access to the islands throughout the year. Overall recreational use of the islands is restricted to nearby birding and fishing, and because of their remoteness, there is little human disturbance on the islands. Any future proposed actions that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service to be covered under the Act.

Impacts to the action area from the Deepwater Horizon Mississippi Canyon Well #252 oil spill includes Stage III cleanup actions for weathered oil, tar balls, tar mats, tar patties, oil mousse, oiled wrack, ongoing NRDAR surveys and studies, dispersants in the water, and increased human disturbance from those cleanup and monitoring activities. The final breadth of the oil spill impacts to the shoreline and shoreline-dependent species remains unknown; however, at the conclusion of the emergency event, section 7 consultation will be completed with the lead Federal agency, the U.S. Coast Guard.

CONCLUSION

After reviewing the current status of the piping plover wintering population of the northern Great Plains, the Great Lakes, and the Atlantic Coast; the environmental baseline for the action area; the effects of the proposed TBBSR project; and cumulative effects, it is the Service's biological opinion that implementation of the TBBSR project, as proposed, is not likely to jeopardize the continued existence of non-breeding piping plover. As noted previously, the overall status of the listed species is stable, if not increasing.

The survival and recovery of all breeding populations of piping plovers are fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., survival of adults and fledged juveniles). Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2009) found that apparent adult survival declined in four populations and increased in none over the life of the studies. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. Progress towards recovery (which is attained primarily through intensive protections to increase productivity on the breeding grounds) would be quickly slowed or reversed by even small sustained decreases in survival rates during migration and wintering.

Critical Habitat

Critical habitat for this species has been designated within the project area and the action area. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat in 50 Code of Federal Regulations (C.F.R.) 402.02. Instead, it relies upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

The proposed project has been designed to mimic natural barrier island habitat and, in the long-term, would aid natural processes in creating and maintaining the PCEs of critical habitat by providing sediment within the sediment-starved barrier island system. The amount of critical habitat in Units LA-4 and LA-5 directly affected from the project is approximately 1,315 acres of sparsely and non-vegetated barrier island habitat. The project area would be temporarily disturbed during construction activities which would impede piping plovers attempting to roost and forage in the area during the migration and wintering months that coincide with construction. Temporary disturbance to 1,315 acres of Units LA-4 and LA-5 equates to 5.3 percent of designated critical habitat in Louisiana and 0.76 percent of all designated critical habitat throughout the Southeast (i.e., North Carolina to Texas). Because the effects to critical habitat would be temporary in nature and the overall project would be beneficial in the long-term, it is the Service's biological opinion that implementation of the TBBSR project is not likely to destroy or adversely modify designated critical habitat Units LA-4 and LA-5.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any contract, grant, or permit issued to the Corps' contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, grant, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and/or its contractor must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I) (3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of piping plovers will be difficult to detect because: (1) harassment to the level of harm (e.g., poor body condition due to loss of foraging opportunities) may only be apparent on the breeding grounds or during migration the following year; (2) movement and use of habitat by individual piping plovers or disturbance to individual birds would be difficult to quantify as birds may move in, out, or through the action area during winter months; and (3) loss of individual birds may be masked by fluctuations in piping plover numbers within the action area between wintering seasons. However, the level of take of this species can be anticipated by the temporary effects to the PCEs within 1,315 acres of designated critical habitat because:

1. Piping plovers winter in the action area.
2. The initial effects of project activities would occur over multiple migration and wintering seasons until construction is complete.
3. Temporarily increased levels of human disturbance are expected for the duration of construction activities.
4. A temporary reduction of food base will occur due to sand and marsh material placement. That temporary reduction in benthic prey species can last anywhere from 6 months to 2 years.

The Service has reviewed the biological information and other information relevant to the proposed action. The take is expected in the form of harm and harassment because of: (1) temporary decreased fitness and survivorship of wintering plovers; and (2) temporary decreased fitness and survivorship of plovers attempting to migrate to breeding grounds, due to temporary loss of and disturbance to foraging and roosting habitat. Incidental take covers take of the species within the action area. Consultation must be reinitiated if one or more of the following conditions occur:

1. The Corps expands the project scope outside of the described action area (e.g., restoration of Wine or East Timbalier Islands), or adds additional project features (e.g., rock breakwaters) that create effects to the species or its critical habitat that are not already considered in this biological opinion.
2. Monitoring indicates that piping plovers fail to reoccupy the project footprint within 2 years post construction (i.e., TY3).
3. Monitoring indicates that the benthic fauna within the project footprint do not recover to baseline conditions by 2 years post construction (i.e., TY3).

Table 15. How the incidental take will be monitored if the specific number of individuals cannot be determined. This will be based on the best available commercial and scientific information.

Species	Critical Habitat	Habitat Conditions and Quality
Piping Plover	1,315 acres	1. Prior to initiating construction activities, the project footprints on each island would be delineated using a GPS[a] unit.
		2. Piping plover usage of the project area would be monitored during and for 2 years post construction (i.e., TY3).
		3. Monitoring of benthic fauna should indicate recovery to baseline conditions within the project footprint by 2 years post construction (i.e., TY3).

(a) GPS = global positioning system.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the piping plover species or destruction or adverse modification of its critical habitat. Incidental take of piping plovers is anticipated to occur within 1,315 acres of barrier island habitat on Raccoon, Whiskey, Trinity/East, and Timbalier Islands during project construction and up to 2 years following construction until the intertidal benthic community recovers.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take on non-breeding piping plovers during implementation of the proposed TBBSR project within the action area.

1. A baseline piping plover survey shall be conducted within the migrating and wintering season immediately prior to initial construction within the action area. As part of that survey, the project footprint should be delineated using a global position system (GPS) unit and appropriately marked/flagged for future survey reference and data collection.
2. A survey of the intertidal benthic prey species community shall be conducted within the migrating and wintering season immediately prior to initial construction, at the same time as

the plover distribution surveys, in order to establish a baseline of benthic prey species diversity and abundance.

3. Piping plover monitoring surveys shall be conducted during the migrating and wintering seasons throughout initial project construction and three consecutive years following completion of initial construction.
4. To confirm re-establishment of suitable foraging habitat for migrating and wintering plovers, monitoring surveys of the intertidal benthic prey species community shall be conducted each year following completion of initial construction for three consecutive years, preferably at the same time as the bird surveys.
5. The Service shall be notified in writing at least 3 months prior to a renourishment event for each island. If renourishment events are conducted during the migrating and wintering season, piping plover monitoring surveys shall be conducted for the duration of construction activities following the survey schedule outlined in Appendix B.
6. A comprehensive report describing the actions taken to implement the RPMs and terms and conditions associated with this incidental take statement (including data sheets from surveys conducted) shall be submitted to the Service by June 1 of the year following completion of all required surveys.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall execute the following terms and conditions, which implement the RPMs, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Monitoring Requirements

1. <u>Requirements for piping plover surveys</u>

   a) A survey schedule (with dates) is listed in Appendix B and the recommendation is for at least 3 survey dates per month; this schedule should be followed as closely as possible. If conditions require a deviation from the recommended survey schedule, such information should be carefully documented, including an explanation why any deviation from the recommended schedule was deemed necessary. The Service recognizes that given the remoteness of the project area and the potential for inclement weather conditions during the plover wintering season, three survey dates per month may be difficult to achieve in Louisiana. Therefore, the Service will require a minimum of two survey dates per month.
   b) Piping plover identification, especially when in non-breeding plumage, can be difficult. Qualified professionals with shorebird/habitat survey experience must conduct the required survey work. Piping plover monitors must be capable of detecting and recording locations of roosting and foraging plovers, and documenting observations in legible, complete field notes. Aptitude for monitoring includes keen powers of observation, familiarity with avian biology and behavior, experience observing birds or other wildlife for sustained periods, tolerance for adverse weather, experience in data collection and management, and patience.
   c) Binoculars, a GPS unit, a 10-60x spotting scope with a tripod, and the Service datasheet (Appendix B) must be used to conduct the surveys.
   d) Negative (i.e., no plovers seen) and positive survey data shall be recorded and reported.
   e) Piping plover locations shall be recorded with a GPS unit set to record in decimal degrees in universal transverse mercator (UTM) North American Datum 1983 (NAD83).

f) Habitat, landscape, and substrate features used by piping plovers when seen shall be recorded. Such features are outlined on the Service data sheet in Appendix B.
g) Behavior of piping plovers (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) shall be documented on the Service data sheet in Appendix B.
h) Color-bands seen on piping plovers shall also be carefully documented, and should also be reported according to the information found at the following websites. Information regarding color-band observations can be found at: http://www.fishwild.vt.edu/piping_plover/Protocols_final_draft.pdf, http://www.waterbirds.umn.edu/Piping_Plovers/piping2.htm, and http://www.fws.gov/northeast/pipingplover/pdf/BahamasBandReporting2010.pdf.

2. Requirements for surveying benthic prey species

a) A qualified professional with sediment/macroinvertebrate sampling experience must conduct the required benthic prey species surveys.
b) A baseline macroinvertebrate survey will be conducted at the same time of the initial piping plover survey during the migrating/wintering season immediately prior to construction. Additional surveys will be conducted during the migrating/wintering season each year post-construction for three consecutive years to determine benthic prey species recovery. Such surveys shall be conducted at the same time as the plover surveys.
c) Sampling will be conducted using a basic before and after control and impact design method. Sampling will be coordinated with piping plover foraging observations based on low tide surveys.
d) In addition to recording benthic species abundance and diversity, a qualitative measure of sediment characteristics (sand, shell, mud) will also be recorded.
e) A detailed sampling methodology shall be developed in coordination with the Service and LDWF prior to initiating surveys.

Reporting Requirements

1. Incorporate all data collected into an appropriate database, preferably one for piping plovers and one for benthic prey species.
2. Annual update reports shall be provided to the Service and LDWF by June 30 of each calendar year once construction begins. Annual update reports should include data sheets, maps, a copy of the database, and the progress and initial findings of piping plover and benthic community surveys, as well as any problematic issues that may hinder future survey efforts.
3. If the Corps foresees any problematic issues that would require a change in the recommended survey schedule due to work conditions or project delays, the Corps should immediately notify the Service so that we can resolve/correct any such issues.
4. A final comprehensive report should be provided to the Service and LDWF by June 30 following the third year of surveys. That final report should include an analysis of all data results from the piping plover and benthic community surveys.
5. At least six months prior to mobilization, the Corps should notify the Service in writing prior to each proposed renourishment event. That notification should include whether there are any changes in the proposed amount of renourishment per island.

Upon locating a dead or injured piping plover that may have been harmed or destroyed as a direct or indirect result of the proposed project, the Corps and/or contractor shall be responsible for notifying the Service's Lafayette, Louisiana, Field Office (337/291-3100) and the LDWF's Natural Heritage

Program (225/765-2821). Care shall be taken in handling an injured piping plover to ensure effective treatment or disposition and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

COORDINATION OF INCIDENTAL TAKE STATEMENT WITH OTHER LAWS, REGULATIONS, AND POLICIES

Migratory Bird Treaty Act (MBTA)

The MBTA implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory bird. Under the provisions of the MBTA it is unlawful "by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Fish and Wildlife Service. The term "take" is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, nest or egg or any migratory bird covered by the conventions or to attempt those activities.

In order to comply with the MBTA and potential for this project to impact nesting shorebirds, the Corps should follow the Service and LDWF's standard guidelines (Appendix D) to protect against impacts to nesting shorebirds during implementation of this project.

The Fish and Wildlife Service will not refer the incidental take of piping plovers for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions specified here.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. The Corps should consider retro-fitting all sand fencing poles with pointy tops or caps to reduce avian predation.

2. As an alternative to installing sand fencing for the TBBSR and future restoration projects, the Corps should evaluate the feasibility of promoting natural dune growth with planting native dune grasses.

3. We encourage the Corps to take a proactive approach via application of their Section 7(a)(1) responsibilities, which would further minimize the issues surrounding the cumulative impacts to listed species resulting from implementation of coastal restoration projects in Louisiana.

4. We encourage the Corps to continue to coordinate with the Service and LDWF during the pre-planning phases of future restoration projects (including any sand placement projects) within piping plover designated critical habitat.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take (i.e., the habitat acreage amount described herein) is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease pending reinitiation.

The above findings and recommendations constitute the report of the Department of the Interior. If you have any questions about this biological opinion, please contact Ms. Brigette Firmin of this office at 337/291-3108.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: FWS, Atlanta, GA (Attn: Ken Graham)
FWS, Panama City, FL (Attn: Patty Kelly)
LDWF, Baton Rouge, LA
LDWF, Natural Heritage Program, Baton Rouge, LA

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APPENDIX A

FIGURES

Figure 1. The proposed National Ecosystem Restoration Plan would encompass the Isles Dernieres Barrier Islands and Timbalier Island in Terrebonne Parish, Louisiana (Corps 2010).

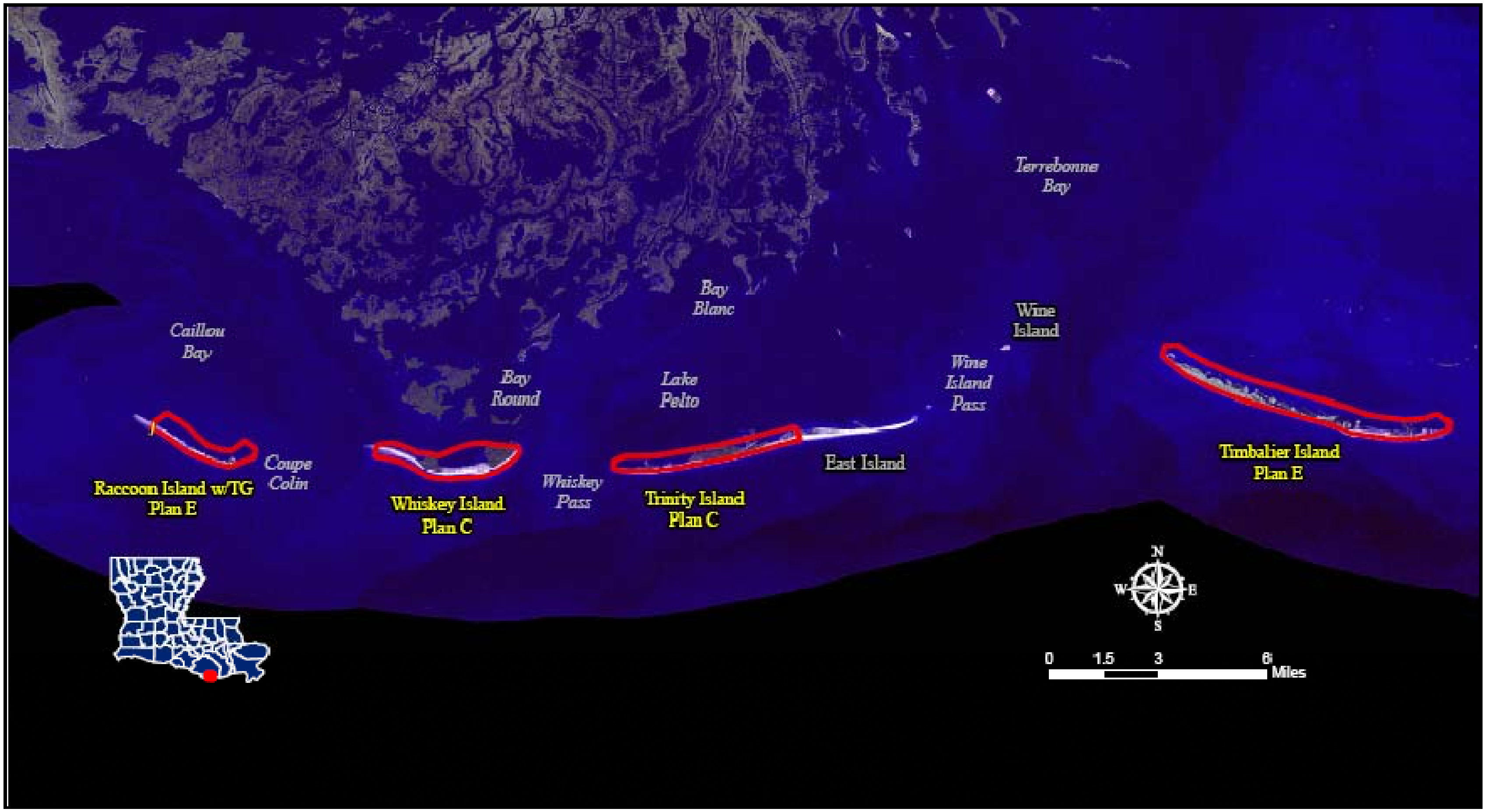


Figure 2. The proposed Raccoon Island Plan E with Terminal Groin would encompass all of Raccoon Island except for a portion of the western sand spit (Corps 2010).

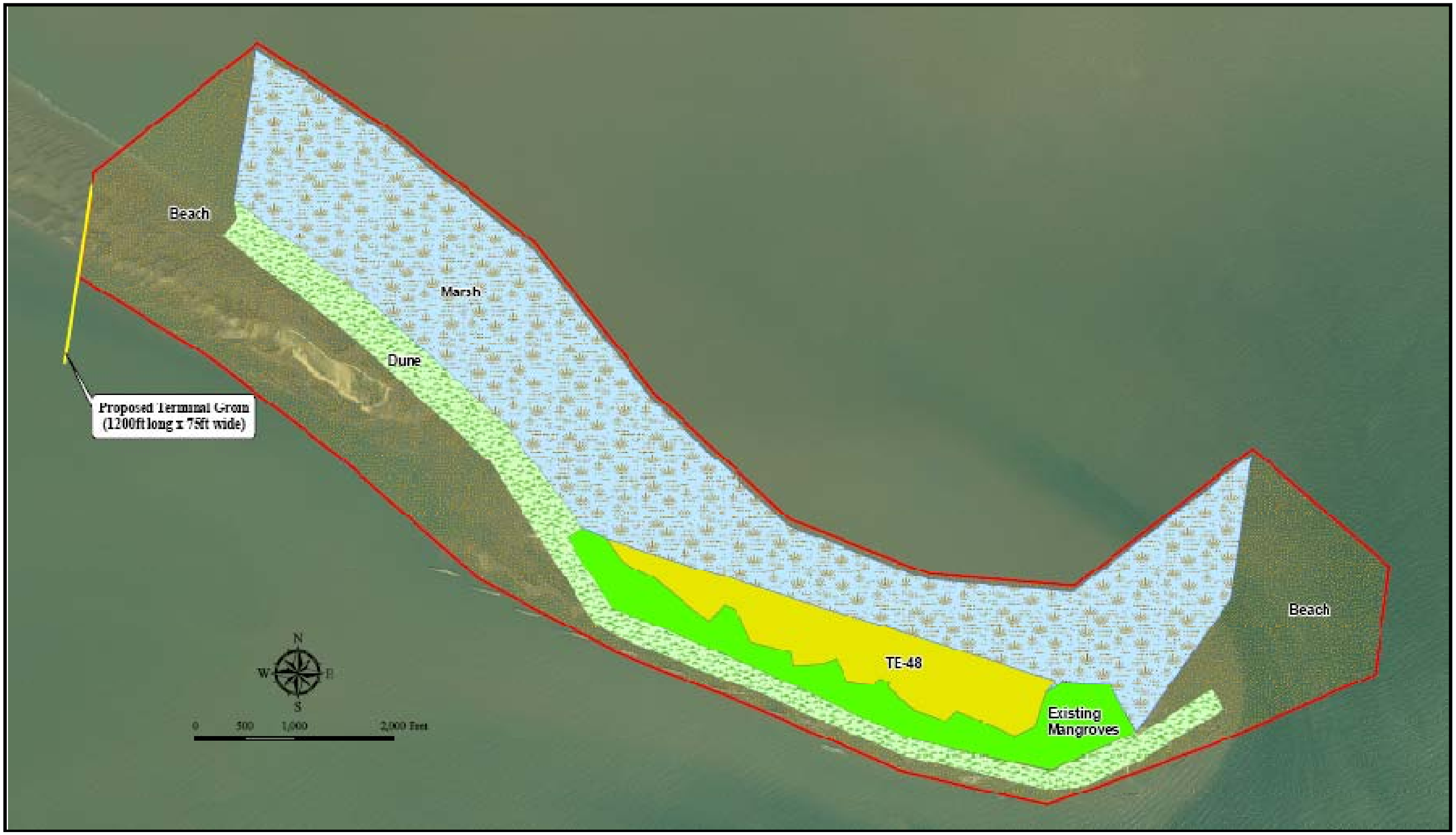


Figure 3. The proposed Whiskey Island Plan C would encompass only portions of Whiskey Island in order to avoid a previous marsh creation area (TE-50) and existing mangrove habitat (Corps 2010).

Figure 4. The Trinity Island Plan C would encompass most of Trinity Island while avoiding New Cut and East Island (Corps 2010).

Figure 5. The Timbalier Island Plan E would encompass all of Timbalier Island (Corps 2010).

Figure 6. Distribution and range of piping plovers (base map from Haig and Elliott-Smith 2004). Conceptual presentation of subspecies and distinct population segments (DPS) ranges are not intended to convey precise boundaries.

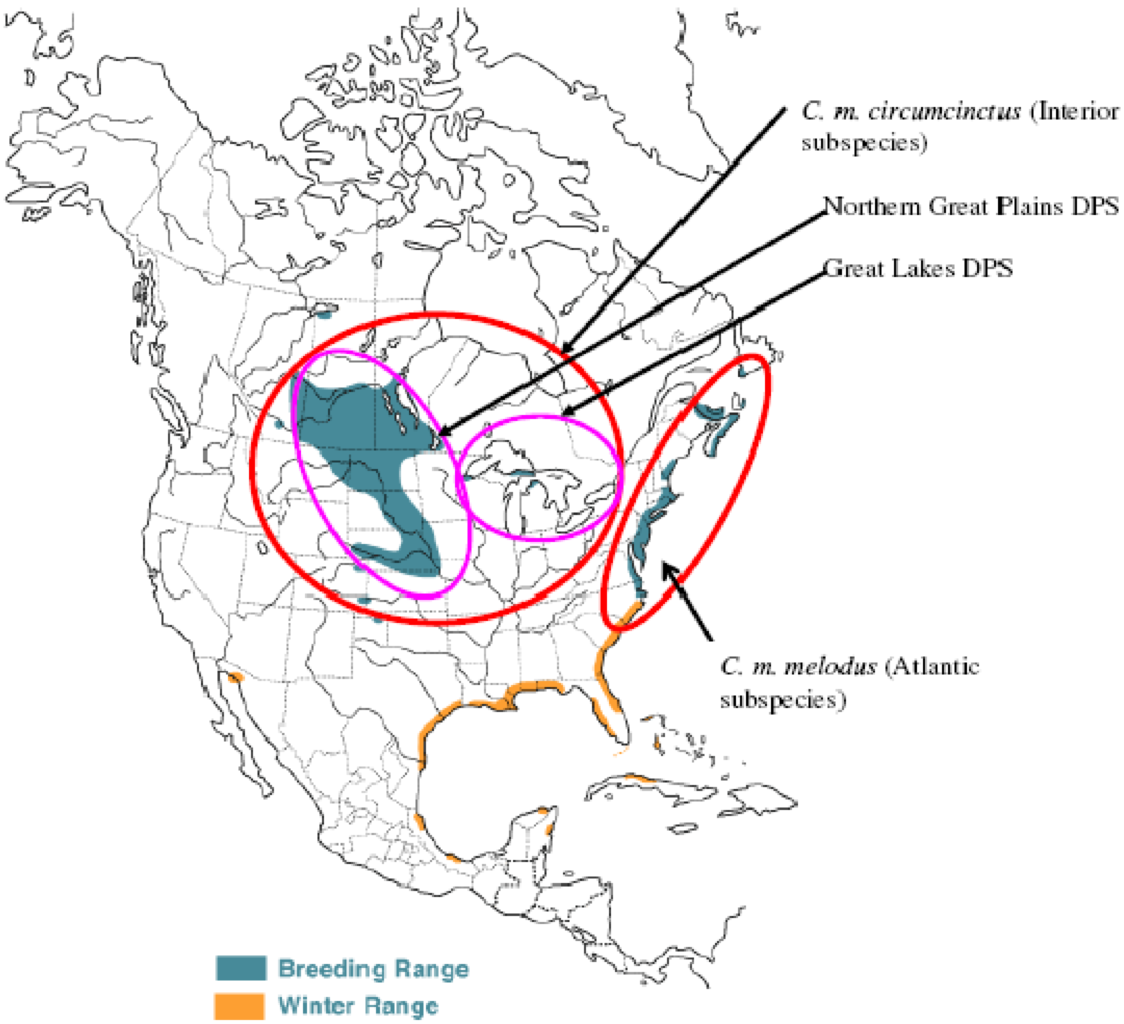
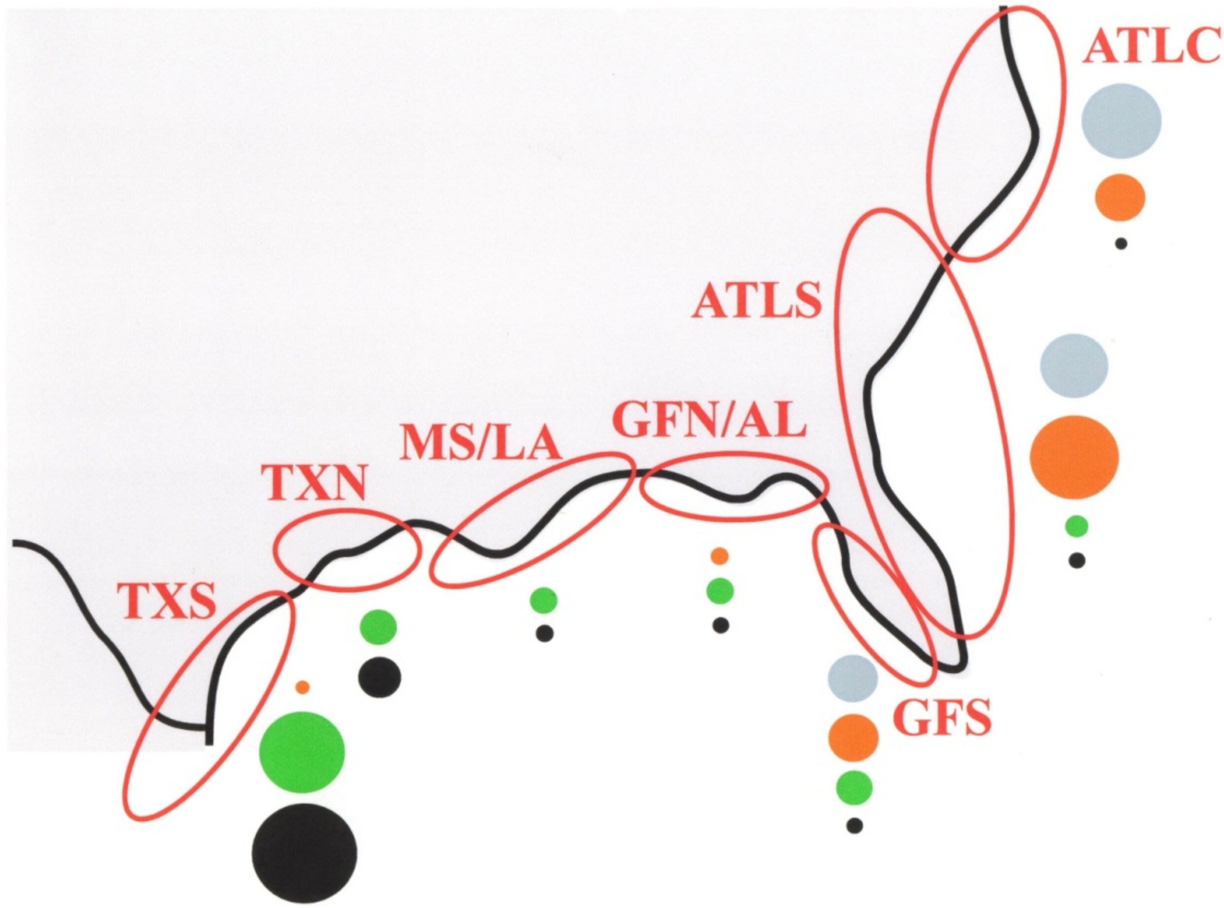


Figure 7. Breeding population distribution* in the wintering/migration range (from Gratto-Trevor et al. 2009, reproduced by permission).



*Regions: ATLC=Atlantic (eastern) Canada; ATLS=Atlantic U.S.; GFS=Gulf Coast of southern Florida; GFN=Gulf Coast of north Florida; AL=Alabama; MS/LA=Mississippi and Louisiana; TXN=northern Texas; and TXS=southern Texas. For each breeding population, circles represent the percentage of individuals reported wintering along the eastern coast of the U.S. from the central Atlantic to southern Texas/Mexico up to December 2008. Each individual was counted only once. Grey circles represent Eastern Canada birds, orange circles for U.S. Great Lakes, green circles for the U.S. Great Plains, and black circles for Prairie Canada. The relative size of the circle represents the percentage from a specific breeding area seen in that winter region. Total number of individuals observed on the wintering grounds was 46 for Eastern Canada, 150 for the U.S. Great Lakes, 169 for the U.S. Great Plains, and 356 for Prairie Canada.

Figure 8. Approximate extent of critical habitat that currently exists on Raccoon, Whiskey, Trinity, and Timbalier Islands. Recent restoration (i.e., CWPPRA) projects are also depicted for Raccoon and Whiskey Islands (Corps 2010).

APPENDIX B

Non-breeding Piping Plover Survey Guidelines

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Non-Breeding Season Survey Guidelines

The purpose of these guidelines is to assess and/or monitor piping plover use of coastal restoration features related to the Terrebonne Basin Barrier Shoreline Restoration Project. Survey locations should include the coastal restoration features plus adjacent suitable shorebird habitat (i.e., intertidal beaches, mud flats, sand flats, algal flats, wash-over passes, and associated dunes and flats above annual high tide). Monitoring should be conducted July 15 through May 15 to follow the International Shorebird Survey (ISS) census dates listed below. The ISS schedule usually results in three surveys per month. If this is not feasible, try to do at least two surveys per month on the ISS census dates. Surveys should be conducted on ISS dates plus or minus two days. For example, a survey scheduled for the 15th could be conducted on any day between the 13th through the 17th of that month.

Spring Migration	Fall Migration	Winter
February 25	July 15	October 15
March 5	July 25	October 25
March 25	August 5	November 5
April 5	August 15	November 15
April 15	August 25	November 25
April 25	September 5	December 5
May 5	September 15	December 15
May 15	September 25	December 25
	October 5	January 5
		January 15
		January 25
		February 5
		February 15

To the extent possible, surveys should be conducted when birds are foraging. The best time is at low tide, but surveys can also be conducted on a falling or rising tide provided that the foraging areas are not completely covered. During high tide, birds will be roosting. Although piping plovers often roost near foraging areas, the birds will be more difficult to locate. Avoid conducting surveys during poor weather conditions (e.g., high winds, rain).

Methods

In most cases surveys will be conducted by foot. All terrain vehicles (ATVs) may be used to expedite the transport of observers over long stretches of liner routes ("leapfrogging" teams down a beach in 0.5 to 1 mile increments), but all bird counting will be conducted while walking. **[Driving on vegetated areas shall not be permitted. Any ATV use should be coordinated with the Louisiana Department of Wildlife and Fisheries' Isles Dernieres Wildlife Refuge management staff.]** Birds on exposed mudflats that may be inaccessible by foot should be counted from boats. Each survey crew should use their best professional judgment on the most efficient way to conduct the survey and should document in detail if any deviations to these guidelines are deemed necessary.

Observers should work in teams of two to four people, depending on the width of the beach and beach/tidal interface. Wide coastal beaches will require a greater number of observers in order to assure that birds are not missed on the back (aft) side of the dune. Observers working on beaches that contain moderate to high dunes should climb them every 0.5 to 1 mile and look for wash-over flats and pools that may not be visible from the beach. Coastal islands will be surveyed on both the Gulf and bay sides (this may require multiple teams of observers in order to finish the surveys in a timely manner).

Piping plover locations will be recorded with global positioning system (GPS) units. GPS locations will be recorded in universal transverse mercator (UTM) map datum NAD 83 CONUS. Each survey team should carry aerial photography of the survey route so that new breaks (cuts) in the beach or island can be noted on the survey maps. Habitat data will also be collected and will include foraging substrate, portion of the beach used and side of the island on which the birds are found (see attached data sheet). These habitat criteria have been adapted from the 2006 International Winter Piping Plover Census organized by the U.S. Geological Survey. Behavioral data (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) of piping plovers when seen should also be documented.

Negative data is as important as positive data. Indicate when surveys have been done and no birds were observed. Although piping plovers are the target species, any additional observations of other species would help the U.S. Fish and Wildlife Service to identify shorebird concentration areas and management needs.

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Survey Form

(Note: Most criteria adopted from the 2006 Wintering Piping Plover Census Form)

A. Total # Piping Plovers Observed: ____

B. Location Description (Name): ____
1. Parish: ____
2. UTM location NAD 83 CONUS (center):
   Northing____________________________ Easting____________________________
3. Land Ownership:
   ___Federal ___State ___Municipal ___Private ___County ___Tribal

C. Date of survey:________________ Time survey conducted: __________to __________

D. Weather Conditions:
1. Tide stage(s): ___Low ___Mid ___High (___Rising / ___Falling)
2. General weather: ___Sunny ___Partly cloudy ___Overcast ___Rain ___Fog
   ___Other (describe):____
3. Approximate temperature: ________Celsius / Fahrenheit (circle one)
4. Wind speed: _____miles/hr Wind direction:_________

E. Description of Habitat Surveyed (check as many as apply). The Code designation will be used in Section F table below:

- **Body of Water Type**:
  ____I. Ocean ____II. Protected bay, harbor, cove, lagoon ____III. Gulf of Mexico
  ____IV. Ocean Inlet ____V. Other (describe)_________________________________

- **Shoreline Type**:
  ____A. Mainland ____B. Barrier Island ____C. Spoil Island ____D. Bar
  ____E. Other Island ____F. Washover area ____G. Other (describe)______________

- **Specific Description**:
  ____1. Sand beach ____2. Sand spit ____3. Sand flat ____4. Sand bar
  ____5. Salt flat ____6. Gravel shore ____7. Oyster reef ____8. Mudflat
  ____9. Vegetation (algal) mat ____10. Vegetated shoreline
  ____11. Other (describe)____

- **Location Description** (criteria for islands only):
  ____ i. Gulf-side of island ____ii. Bay-side of island
  ____a. Tidal interface ____b. Fore dune ____c. Top of dune ____d. Aft dune

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Lafayette, Louisiana

F. Numbers, behaviors, habitat types, and GPS location(s) of piping plovers observed (mark on map if possible).

Number of Plovers Observed	**Behavior Displayed** *(e.g., foraging, roosting, preening, walking, flying, aggression, etc.)*	**Habitat Type where Plovers were found** *(use designations from Section E above, e.g.,* IIC8ii, IIIB9ia*)*	**UTM location NAD 83 CONUS**	
			Northing	*Easting*

G. Mode(s) of transportation:
____Foot ____Car/Truck ____ATV ____Boat ____Airboat ____Other__________

H. Habitat (shoreline) covered: _______miles (please calculate using aerial photograph's scale)

I. Observers: ____
____
____

J. Additional comments or notes:____
____
____
____

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

K. Additional species encountered (for flying flocks lump as peeps and estimate number). Species of special interest are listed below; please add any additional species.

OTHER SPECIES	**TOTAL#**	**OTHER SPECIES**	**TOTAL#**
Reddish Egret			
Marbled Godwit			
Red Knot			
Western Sandpiper			
Stilt Sandpiper			
Short-billed Dowitcher			
Snowy Plover			
Wilson's Plover			
Long-billed Curlew			
American Oystercatcher			

APPENDIX C

Standard Conditions for In-water Work in the Presence of Manatees

Guidelines for Activities in Proximity to Manatees and Their Habitat

A. All personnel associated with the project should be informed of the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. Such personnel instruction should also include a discussion of the civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

B. All contract and/or construction personnel are responsible for observing water-related activities for the presence of manatee(s).

C. Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator.

D. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and regularly monitored. Barriers should not impede manatee movement.

E. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed.

F. Any manatee sighting should be immediately reported to the U.S. Fish and Wildlife Service's (Service) Lafayette, Louisiana, Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries (LDWF), Natural Heritage Program (225/765-2821).

APPENDIX D

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

Nesting colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

1. For colonies containing nesting brown pelicans, all activity occurring within 2,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31). Nesting periods vary considerably among Louisiana's brown pelican colonies, however, so it is possible that this activity window could be altered based upon the dynamics of the individual colony. The Louisiana Department of Wildlife and Fisheries' Fur and Refuge Division should be contacted to obtain the most current information about the nesting chronology of individual brown pelican colonies. Brown pelicans are known to nest on barrier islands and other coastal islands in St. Bernard, Plaquemines, Jefferson, Lafourche, and Terrebonne Parishes, and on Rabbit Island in lower Calcasieu Lake, in Cameron Parish.

2. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

3. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present).

Below is a table explaining the nesting chronology of species that are known to nest in Louisiana. The table is an excerpt from page 31 of:

Martin, R.P., and G.D. Lester. 1990. The Atlas and Census of Wading Bird and Seabird Nesting Colonies of Louisiana: 1990. Louisiana Department of Wildlife and Fisheries – Louisiana Natural Heritage Program. Special Publication No. 3 for the U.S. Department of Interior – Fish and Wildlife Service. Contract No. 14-16-0004-89-963.

Table 8. Nesting chronology for colonial-nesting waterbirds in Louisiana with suggested activity windows.[a]

Species	Incubation Season	Incubation Period (days)	Days to Fledging	Activity[b] Window
Brown Pelican	1 Nov to 15 Jun	28-30	74-76	1 Aug to 31 Oct
Olivaceous Cormorant	15 Mar to 15 Apr	23-26	35-42	1 Jul to 1 Mar
American Anhinga	15 Mar to 15 Apr	25-28	?	1 Jul to 1 Mar
Great Blue Heron	1 Mar to 30 Apr	25-29	58-62	1 Aug to 15 Feb
Great Egret	1 Mar to 31 May	23-24	40-44	1 Aug to 15 Feb
Snowy Egret	16 Mar to 15 Jun	17-19	20-25	1 Aug to 1 Mar
Little Blue Heron	16 Mar to 15 Jun	22-24	28-32	1 Aug to 1 Mar
Tricolored Heron	16 Mar to 15 Jun	20-22	?	1 Aug to 1 Mar
Reddish Egret	16 Mar to 15 Jun	23-26	?	1 Aug to 1 Mar
Cattle Egret	16 Apr to 30 Jun	21-24	35-40	1 Sep to 1 Apr
Green-backed Heron	1 Apr to 30 Jun	19-21	16-17	1 Sep to 15 Mar
Black-crowned Night-Heron	16 Mar to 15 Jun	24-26	40-42	1 Sep to 1 Mar
Yellow-crowned Night-Heron	1 Apr to 15 Jun	?	?	1 Sep to 15 Mar
White Ibis	16 Apr to 30 Jun	21-23	35-42	1 Sep to 1 Apr
Glossy/White-faced Ibis	16 Apr to 30 Jun	21-23	42-49	1 Sep to 1 Apr
Roseate Spoonbill	16 Apr to 15 Jun	23-24	49-56	1 Aug to 1 Apr
Laughing Gull	16 Apr to 15 Jun	23-25	35-45	1 Aug to 1 Apr
Gull-billed Tern	16 May to 15 Jul	22-23	28-35	16 Sep to 1 May
Caspian Tern	1 May to 15 Jul	26-28	36-48	16 Sep to 15 Apr
Royal Tern	1 May to 15 Jul	28-31	36-48	16 Sep to 15 Apr
Sandwich Tern	1 May to 15 Jul	23-25	22-33	16 Sep to 15 Apr
Common Tern	1 May to 15 Jul	21-25	23-27	16 Sep to 15 Apr
Forster's Tern	1 Apr to 31 May	25-29	23-27	1 Aug to 15 Mar
Least Tern	1 May to 15 Jul	20-25	19-23	16 Sep to 15 Apr
Sooty Tern	16 May to 15 Jul	22-23	30-35	16 Sep to 15 Apr
Black Skimmer	16 May to 15 Jul	22-23	30-35	16 Sep to 1 May

[a] Data are compiled from Bent (1921), Bent (1926), Palmer (1962), Harrison (1975), Portnoy (1977) and Terres (1980).

[b] Suggested project initiation and completion dates to minimize disturbance to nesting birds.