### ALABAMA BARRIER ISLAND RESTORATION ASSESSMENT COST APPENDIX



Appendix K May 2020









#### **Table of Contents**

<b>1.</b> ]	Executive	Summary	5
<b>2.</b> ]	Backgrou	nd	5
2.1	l. Study	Purpose, Goals, and Objectives	6
2.2	2. Form	at and Basis	6
2.3	B. Prese	ntation	7
3.	Alterr	native Evaluations	9
	3.1.1.	Task 6.1 – Alternative Formulation and Evaluation	10
	3.1.2.	Formulation and Cost Estimation of Restoration Measures	12
	3.1.2.1.	Ebb Tidal Shoal Measures	12
	3.1.2.1.1.	Measure 3 Pelican Island Southeast Nourishment	12
	3.1.2.1.2.	Measure 7 Sand Island Platform Nourishment and Sand Bypassing	15
	3.1.2.2.	Gulf Beach Measures	16
	3.1.2.2.1.	Measure 8 East End Beach and Dune Restoration	16
	3.1.2.2.2.	Measure 5 West End Beach and Dune Nourishment (No Buyouts)	18
	3.1.2.2.3.	Measure 6 West End Beach and Dune Nourishment (with Voluntary	
	Buyouts)	20	
	3.1.2.2.4.	Measure 4 West End and Katrina Cut Beach and Dune Restoration (with	
	Voluntary	y Buyouts)	21
	3.1.2.2.5.	Measure 17 Katrina Cut Structure Removal	23
	3.1.2.3.	Back Barrier and Marsh Restoration Measures	24
	3.1.2.3.1.	Measure 9 2010 Borrow Pits Restoration	24
	3.1.2.3.2.	Measure 10 Marsh Habitat Restoration Behind Katrina Cut	26
	3.1.2.3.3.	Measure 12 Aloe Bay Beneficial Use Marsh Restoration	28
	3.1.2.3.4.	Measure 11 Graveline Bay Marsh Restoration	29
	3.1.2.3.5.	Measure 18 West End Back Barrier Herbaceous Dune Plant Restoration .	31
	3.1.2.4.	Land Acquisition Measures	32
	3.1.2.4.1.	West End Land Acquisition (Interim Project ID #17)	32
	<b>3.1.2.4.2.</b>	Mid-Island Land Acquisition and Management Phase I (Interim Project I	D
	#3) 2 1 2 4 2	33 U.S. Caract Connerl Duran anter A constitution (Interview Device t ID #21)	24
	3.1.2.4.3. 2 1 2 4 4	U.S. Coast Guard Property Acquisition (Interim Project ID #21)	34
	3.1.2.4.4. (Intonim I	Dauphin Island 59 Parcel Property Acquisition: Parcel A – west End	25
	(Internii I 2 1 2 4 5	Dounkin Island 20 Dougol Bronorty Acquisitions Dougol D. Crosseling Dov	. 33
	J.1.2.4.J. (Intorim I	Dauphin Island 57 Farcel Froperty Acquisition. Farcel D – Gravenne Day Project ID #72b)	36
	31246	Dounhin Island 30 Parcel Pronerty Acquisition: Parcel C – Alee Bay	50
	J.1.2.7.0. (Intorim I	Drojact ID #72c)	37
	31247	Daunhin Island 39 Parcel Pronerty Acquisition: Parcel D – Little Daunhi	n
	Island Ra	v (Interim Project ID #22d)	38
	3.1.2.4.8	Daunhin Island 39 Acquisition: Parcel E – East End (Interim Project ID	20
	#22e)	39	
	3.1.2.4.9	Tupelo Gum Swamp Land Acquisition (Interim Project ID #18)	40
	3.1.2.4.10.	Gorgas Swamp Land Acquisition (Interim Project ID #19)	41
	3.1.2.4.11	Steiner Property Acquisition (Interim Project ID #20)	42
		r	_

### List of Figures

Figure 1: Dauphin Island Location Map	6
Figure 2: Potential Interim Projects Considered by the USACE, State of Alabama, and	
Evaluation Support Panel	. 11
Figure 3. Pelican Island Southeast Nourishment Measure	. 13
Figure 4. Petit Bois Pass Relic Sand Deposits and Mobile Ebb Tidal Shoal Borrow(SIBUA-	
South) Sources	. 13
Figure 5. Alabama-Tombigbee River Sand Borrow Sources example	. 14
Figure 6. Sand Island Platform Nourishment	. 16
Figure 7. East End Beach and Dune Restoration Measure	. 17
Figure 8. West End Beach and Dune Nourishment (No Buyouts) Measure	. 19
Figure 9. West End Beach and Dune Nourishment (with Voluntary Buyouts) Measure	. 20
Figure 10. West End and Katrina Cut Beach and Dune Restoration (with Voluntary Buyouts)	
Measure	. 22
Figure 11. Katrina Cut Structure Removal Measure	. 23
Figure 12. 2010 Borrow Pit Restoration Measure	. 25
Figure 13. Dauphin Island Village Channel and GIWW Borrow Sources	. 26
Figure 14. Marsh Habitat Restoration behind Katrina Cut	. 27
Figure 15. Aloe Bay Beneficial Use Marsh Restoration	. 29
Figure 16. Graveline Bay Marsh Restoration	. 30
Figure 17. West End Back Barrier Herbaceous Dune Plant Restoration Measure	. 31
Figure 18. West End Land Acquisition	. 33
Figure 19. Mid-Island Land Acquisition and Management Phase 1	. 34
Figure 20. U.S. Coast Guard Property Acquisition Location	. 35
Figure 21. Dauphin Island 39 Parcel Property Acquisition: Parcel A – West End Location	. 36
Figure 22. Dauphin Island 39 Parcel Property Acquisition: Parcel B – Graveline Bay Location	1 37
Figure 23. Dauphin Island 39 Parcel Property Acquisition: Parcel C – Aloe Bay Location	. 38
Figure 24. Dauphin Island 39 Parcel Property Acquisition: Parcel D – Little Dauphin Island B	ay
Location	. 39
Figure 25. Dauphin Island 39 Parcel Property Acquisition: Parcel E – East End Location	. 40
Figure 26. Tupelo Gum Swamp Land Acquisition Location	. 41
Figure 27. Gorgas Swamp Land Acquisition Location	. 42
Figure 28. Steiner Property Acquisition Location	. 43

#### List of Tables

Table 1: Cost Estimates for Measures.	7
Table 2. Present Value Costs for the Pelican Island Southeast Nourishment Measure	15
Table 3. Present Value Costs for the Sand Island Platform Nourishment Measure	16
Table 4. Present Value Costs for the East End Beach and Dune Restoration Measure	18
Table 5. Present Value Costs for the West End Beach and Dune Restoration (No Buyouts)	
Measure	19

Buyouts) Measure       21         Table 7. Present Value Costs for the West End and Katrina Cut Beach and Dune Restoration       23         (with Voluntary Buyouts) Measure       23         Table 8. Present Value Costs for the Katrina Cut Structure Measure       24         Table 9. Present Value Costs for the 2010 Borrow Pits Restoration Measure       26         Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cut Measure       27         Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure       29         Table 12. Present Value Costs for the Graveline Bay Marsh Restoration       31         Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restoration       32	Table 6. Present Value Costs for the West End Beach and Dune Nourishment (with Voluntary	,
Table 7. Present Value Costs for the West End and Katrina Cut Beach and Dune Restoration(with Voluntary Buyouts) Measure23Table 8. Present Value Costs for the Katrina Cut Structure Measure24Table 9. Present Value Costs for the 2010 Borrow Pits Restoration Measure26Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cut Measure27Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure29Table 12. Present Value Costs for the Graveline Bay Marsh Restoration31Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restoration32	Buyouts) Measure	. 21
<ul> <li>(with Voluntary Buyouts) Measure</li></ul>	Table 7. Present Value Costs for the West End and Katrina Cut Beach and Dune Restoration	
Table 8. Present Value Costs for the Katrina Cut Structure Measure24Table 9. Present Value Costs for the 2010 Borrow Pits Restoration Measure26Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cut Measure27Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure29Table 12. Present Value Costs for the Graveline Bay Marsh Restoration31Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restoration32	(with Voluntary Buyouts) Measure	. 23
Table 9. Present Value Costs for the 2010 Borrow Pits Restoration Measure26Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cut Measure27Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure29Table 12. Present Value Costs for the Graveline Bay Marsh Restoration31Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restoration32	Table 8. Present Value Costs for the Katrina Cut Structure Measure	. 24
Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cut Measure 27Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure 29Table 12. Present Value Costs for the Graveline Bay Marsh Restoration	Table 9. Present Value Costs for the 2010 Borrow Pits Restoration Measure	. 26
Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure 29Table 12. Present Value Costs for the Graveline Bay Marsh Restoration	Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cut Measure	27
Table 12. Present Value Costs for the Graveline Bay Marsh Restoration	Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure	. 29
Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restoration	Table 12. Present Value Costs for the Graveline Bay Marsh Restoration	. 31
	Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restorati	on
		. 32

#### Draft Alabama Barrier Island Restoration Cost Appendix

#### 1. Executive Summary

Historic and more recent coastal storm and manmade disasters such as Hurricanes Ivan (2004), Katrina (2005), Isaac (2012) and the Deep Water Horizon (DWH) oil spill (2010) have caused substantial ecological changes on Dauphin Island, Alabama. Additionally, residential and commercial development on the barrier island and the surrounding area since the 1950s have resulted in the loss, degradation, and/or encroachment of natural habitats including wetlands, seagrasses, oyster reefs, beach/dune habitats, and maritime forest. Climatic events, including sea level change (SLC) and coastal storms, continue to erode, degrade, and threaten further loss of these habitats as well as threaten the ecological function of the Mississippi Sound and Heron Bay wetlands on the Alabama mainland. Given these influences on these valuable resources and the species that rely on them, there is a need to protect, restore, and enhance ecological resiliency and function of the island.

The main report describes the comprehensive work completed by the U.S. Geological Survey (USGS) and the U.S. Army Corps of Engineers (USACE) under a grant from the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund. It outlines potential restoration measures based on the available scientific information that if implemented, would aim to restore, preserve, and enhance Dauphin Island's natural habitat for decades to come.

This appendix discusses the methodology used and the assumptions made to develop cost estimates for each of the measures described in the main report. The cost estimate serves two purposes, it allows the costs for different measures to be compared and presents a budget estimate for funds requests and other project planning activities.

#### 2. Background

Dauphin Island, Alabama, is a strategically significant barrier island along the northern Gulf of Mexico. It serves as the only barrier island providing protection to much of the state of Alabama's coastal natural resources (Figure 1). With an average elevation of 7.2 feet, Dauphin Island is highly susceptible to rising sea levels. The size of the system spans over 3,500 acres of barrier island habitat including beach, dune, overwash fans, intertidal flats, intertidal wetlands, maritime forest, and freshwater ponds and lakes. In addition, Dauphin Island provides shelter to approximately one-third of the Mississippi Sound and estuarine habitats including oyster reefs, marshes, and seagrasses. It serves as one of the most important bird sanctuaries in the Southeast and supports an important recreational and commercial fishing industry.



Figure 1: Dauphin Island Location Map

#### 2.1. Study Purpose, Goals, and Objectives

As described in the main report, the overall purpose of this study is to investigate sustainable options through a feasibility study based on science and technical expertise/evaluation that provides the ability to effectively evaluate the natural resource benefits and impacts of restoration activities and measures. The study includes modeling the island to evaluate: (1) beneficial use options and other sand placement activities; and (2) other resilient and sustainable island restoration activities in support of critical habitats and resources.

The goal of this study cost appendix is to document the decisions made in the development of reasonable and reliable cost estimates for each of the measures and options developed as a part of this study. This appendix contains the general basis for all the estimates and includes the details for each measure in a format matching that of the main report Task 6.1. A copy of the estimates presented for use in the alternative assessment tool described in Appendix J is included as Table 1 of this appendix.

#### 2.2. Format and Basis

Cost were developed accordance with USACE ER 1110-2-1302 with the support of the study team. The cost estimates and supporting documentation were reviewed internally by study team members and by members of the Mobile District Operations Division. The cost estimating effort for this study resulted in a group of class 4 alternative cost estimates reported in FY2020 dollars.

Since all of the construction efforts are relatively small durations of less than 2 years, escalation to midpoint of construction was not included in any of the initial construction estimates.

Operations and Maintenance (O&M) costs were calculated and presented separately from the initial costs. The O&M costs were estimated based on the nourishment cycles times and quantities designed. The O&M costs are lifecycle costs, with a 20 year life. The costs were converted to net present value (NPV) and reported as a single amount in FY2020 dollars. Scope, design, and construction methods were developed for each measure. Although the acquisition methods for these measures were not determined, common acquisition methods for appropriate scales are accounted for since the cost estimates include historical data from similar projects.

Contingency was included for each cost, both initial construction and O&M, at a mark-up rate of 10%. This contingency, being uniform, obviously does not differentiate the amount of uncertainty in each measure and option. Since the work for these measures is relatively straightforward dredging and planting, a contingency lower than typical for a class 4 estimate is appropriate for these measures. The contingency is meant only to account for the inherent variability in pricing for construction contracts. Possible changes to scope or sizes made during design or implementation of any of these measures are not accounted for in these estimates. Monitoring and adaptive management costs were prepared based on 3% of the construction contracts. These costs were not included in the costs reported for the alternatives assessment tool or in Table 1.

#### 2.3. Presentation

The summary of costs presented in Table 1 are shown as described above. The table includes the initial construction cost for each measure and option, if applicable, then lists the O&M NPV for that measure. Both 20 year life cycle and 50 year life cycle O&M costs are presented for each measure. For measures that have multiple options, the initial construction options and O&M options for that measure are independent. Any of the O&M options could be paired with any initial construction option for the same measure.

Measure	Option	Cost
Measure 3 -Pelican Island Southeast Nourishment (Scenario ST2_SL1_R2)	Option 1	\$79,413,000
Measure 3 -Pelican Island Southeast Nourishment (Scenario ST2_SL1_R2)	Option 2	\$72,908,000
Measure 3 -Pelican Island Southeast Nourishment (Scenario ST2_SL1_R2)	Option 3	\$119,032,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$2,986,000
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$8,541,000

Table 1: Cost Estimates for Measures.

Measure 4 -West End and Katrina Cut Beach and Dune	Option 1	\$211,045,000
Nourishment with Buyout (Scenario ST2_SLI_K7)		
Measure 4 -West End and Katrina Cut Beach and Dune Nourishment with Buyout (Scenario ST2_SL1_R7)	Option 2	\$206,391,000
Cost for O&M (Net Present Value) 20 Year Life Cycle	Option 1	\$84,360,000
Cost for O&M (Net Present Value) 20 Year Life Cycle	Option 2	\$158,432,000
Cost for O&M (Net Present Value) 50 Year Life Cycle	Option 1	\$241,222,000
Cost for O&M (Net Present Value) 50 Year Life Cycle	Option 2	\$453,020,000
Measure 5 -West End Beach and Dune Nourishment no Buyout (Scenario ST2_SL1_R4)	Option 1	\$78,720,000
Measure 5 -West End Beach and Dune Nourishment no Buyout (Scenario ST2_SL1_R4)	Option 2	\$73,000,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$52,007,000
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$148,712,000
Measure 6 -West End Beach and Dune Nourishment with Buyout (Scenario ST2_SL1_R6)	Option 1	\$147,778,000
Measure 6 -West End Beach and Dune Nourishment with Buyout (Scenario ST2_SL1_R6)	Option 2	\$142,914,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$51,951,000
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$148,549,000
Measure 7 -Sand Island Platform Nourishment and Sand Bypassing (Scenario ST2_SL1_R3)	Option 1	\$103,065,000
Measure 7 -Sand Island Platform Nourishment and Sand Bypassing (Scenario ST2_SL1_R3)	Option 2	\$81,987,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$10,381,000
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$29,681,000
Measure 8 -East End Beach and Dune Restoration (Scenario ST2_SL1_R4)	Option 1	\$28,202,000
Measure 8 -East End Beach and Dune Restoration (Scenario ST2_SL1_R4)	Option 2	\$29,790,000
Measure 8 -East End Beach and Dune Restoration (Scenario ST2_SL1_R4)	Option 3	\$35,198,000
Cost for O&M (Net Present Value) 20 Year Life Cycle	Options 1 & 2	\$5,823,000
Cost for O&M (Net Present Value) 20 Year Life Cycle	Option 3	\$7,937,000
Cost for O&M (Net Present Value) 50 Year Life Cycle	Options 1 & 2	\$23,823,000
Cost for O&M (Net Present Value) 50 Year Life Cycle	Option 3	\$32,462,000

Measure 9 -Back Barrier Tidal Flats and Marsh Habitat Restoration - 2010 Borrow Pits Restoration (Scenario ST2_SL1_R5)	Option 1	\$5,159,000
Measure 9 -Back Barrier Tidal Flats and Marsh Habitat Restoration - 2010 Borrow Pits Restoration (Scenario ST2_SL1_R5)	Option 2	\$6,411,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$0
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$0
Measure 10 -Back Barrier Tidal Flats and Marsh Habitat Restoration- Marsh Habitat Restoration behind Katrina Cut (Scenario ST2_SL1_R5)	Option 1	\$28,487,000
Measure 10 -Back Barrier Tidal Flats and Marsh Habitat Restoration- Marsh Habitat Restoration behind Katrina Cut (Scenario ST2_SL1_R5)	Option 2	\$41,160,000
Measure 10 -Back Barrier Tidal Flats and Marsh Habitat Restoration- Marsh Habitat Restoration behind Katrina Cut (Scenario ST2_SL1_R5)	Option 3	\$35,914,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$0
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$0
Measure 11 - Back Barrier Tidal Flats and Marsh Habitat Restoration- Graveline Bay Marsh Restoration (Scenario ST2_SL1_R5)		\$5,351,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$17,621,000
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$30,920,000
Measure 12 - Aloe Bay Marsh Restoration		\$4,432,000
Measure 12 - Aloe Bay Marsh Restoration		\$5,025,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$0
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$0
Measure 17 - Katrina Cut Sand Berm Nourishment - Removal of Katrina Cut Rubble Mound Structure (Scenario ST2_SL1_R1)		\$7,684,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$0
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$0
Measure 18 - West End Backbarrier Herbaceous Dune Plant Restoration		\$1,460,000
Cost for O&M (Net Present Value) 20 Year Life Cycle		\$0
Cost for O&M (Net Present Value) 50 Year Life Cycle		\$0

#### **3.** Alternative Evaluations

The overarching goal of the Alabama Barrier Island Restoration Assessment was to investigate viable options for restoration of natural and nature based features along Dauphin Island that can

increase island sustainability and restore vital habitats for species affected by the Deepwater Horizon Oil Spill.

Restoration measures to achieve this goal were formulated based on science and technical expertise and evaluated using the suite modeling tools and products to include decadal hydrodynamic and geomorphic, water quality, and habitat modeling developed as part of this study to determine how various measures may affect the habitat composition, sustainability, and resiliency of Dauphin Island under varying potential future scenarios. Details on the alternative formulation and evaluation process and the assessment tools utilized to determine how well each measure meets restoration objectives are described in other sections of this report, Details for the costs of the restoration measures are provided in the following sections.

#### 3.1.1. Task 6.1 – Alternative Formulation and Evaluation

The Alternative Formulation and Evaluation task consisted of two basic components. The first (Task 6.1a) was the identification of viable measures that could be implemented in the short-term without needing detailed analysis to meet restoration objectives of NFWF and State of Alabama (these are called Interim Projects for the purposes of this report). This effort was led by the USACE through close coordination with the State and supported by the USGS and a panel of eight experts (known as the Evaluation Support Panel) with firsthand knowledge of Dauphin Island and its resources. The second (Task 6.1b) was to identify longer-term, more comprehensive restoration measures that were formulated and evaluated using technical expertise and the tools developed as part of this study.

A detailed description of the Interim Projects developed under Task 6.1a is documented in Appendix A of the 2017 Interim Report (USACE 2017). A copy of the interim report is available on the database developed for this study at <a href="https://gom.usgs.gov/DauphinIsland/Default.aspx">https://gom.usgs.gov/DauphinIsland/Default.aspx</a>. For ready reference, the locations, names, and a brief description of the 27 projects, including the project types, benefits, and costs (as estimated by project proponents) are shown in Figure 2 below.

Potential restoration measures, influenced by the interim project evaluations and model results, were developed to address the study objectives to identify viable options for the restoration of natural and nature base features and habitat of Dauphin Island to enhance the sustainability of the island and restore habitat for species affected by the 2010 Deepwater Horizon oil spill. Section 3.1.2 describes the restoration measures formulated and the cost estimates prepared for construction and operation and maintenance.

Potential Projects	Herbes	Island	for Ann
Mobile County, Alabama			St Starting
			ALABAMA A
Data Collection Saltmarsh Restoration	A CONTRACTOR OF A CONTRACTOR OFTA CONTRACTOR O		14 (21
Beach and Dune Restoration 💮 Stormwater Drainage Improvements			3 June }
Dune Restoration 🔶 Water Supply			18 91
Nearshore Placement Wastewater Treatment Plant Upgrades		Woolie Day	Y Your
Sand Bypassing Ocontrol Burns and Invasive Species Ma	anagement		FLORIDA
Restore Dredged Holes     I and Acquisition			Guilt of Mexico
0 0.5 1 2			LOCALITY MAP
Mies	· +		5000, JASSA, BY
Date: September 2016			
Mississippi Sound			
		Dauphin Island	
	and the second sec		
	107		
	10 - CA		
		Cull of Moving	
		Gulf of Mexico	
		Gulf of Mexico	
		Gulf of Mexico	
A Frject Name	Project Type	Gulf of Mexico Benefits	Cont
Eroject Name     Drughn Idan Public Reach and Dune Restoration	Project Type Backet and Dures Restoration Backet and Dures Restoration	Gulf of Mexico  Exercise  Exercise Exercise Exercise  Exercise  Exercise Exercis	Cott 510000000 541 550.000
Erect Name     Erect Name     Duphn Island Public Beach and Dune Restoration     West Ford Beach and Dune Restoration     West Ford Beach and Dune Restoration     West Ford Beach and Dune Restoration	Priject Type Beach and Dune Restoration Beach and Dune Restoration Beach and Dune Restoration	Culf of Mexico Energy Restantion to reduce breaching potential and increase protection of habitat for a variability of unique plant and animal assemblages. Restantion to reduce breaching potential and increase protection of habitat for a variability of unique plant and animal assemblages. Restantion to reduce breaching potential and increase protection of habitat for a variability of unique plant and animal assemblages. Restantion to reduce breaching potential and increase protection of habitat for a variability of unique plant and animal assemblages.	Cott 510.000,000 561.501.000 52.500.000
Froject Name     Froject Name     Supplin Island Public Beach and Dune Restoration     West End Beach and Dune Restoration     West End Beach and Dune Restoration     Mid-Hand Land Acquisition and Management - Phase II     Mid-Hand Land Acquisition and Management - Phase II	Project Type Beach and Dure Restoration Beach and Dure Restoration Land Acquisition Land Acquisition	Constrained on the basis of the variety of unique plant and animal assemblages.         Restoration to reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.         Restoration to reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.         Conservation of coastal barrier beach and dure habitst for variety of unique plant and animal assemblages.         Conservation of coastal barrier beach and dure habitst for variety of unique plant and animal assemblages.	Cost 510,000,000 551,501,000 51,500,000 51,500,000
Ergict Name     Ergict Name     Supplin Island Public Reach and Dune Restoration     West End Baech and Dune Restoration     West End Baech and Dune Restoration     West End Baech and Dune Restoration     Subicitation Land Acquisition and Management - Phase I     Mici-Island Land Acquisition and Management - Phase I     Subplin Island Adudubon Bild Sanchurary Shoreline Restoration & Management     Supplin Island Adudubon Bild Sanchurary Shoreline Restoration & Management	Project Type Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Dune Restoration	Could of Mexico  Entration to reduce breaching potential and increase protection of habitat for a variety of unique plant and animal assemblages.  Restoration to reduce breaching potential and increase protection of habitat for a variatety of unique plant and animal assemblages.  Conservation of coastal barrier beach and dune habitat for ravariety of unique plant and animal assemblages.  Restoration to reduce breaching potential and increase protection of habitat for a variatety of unique plant and animal assemblages.  Restoration to reduce breaching potential and increase protection of habitat for a variatety of unique plant and animal assemblages.  Restoration coastal barrier beach and dune habitat for ravariety of unique plant and animal assemblages including mecoropical birds and wintering migratory species.  Rubit access to natural resources.  Increase protection and habitat for a variety of unique plant and animal assemblages.	Cost 51.0000,000 52.500,000 51.000,000 51.000,000 54.5550
Ergicti Nane     Ergicti Nane     Douphin Island Acquisition and Management - Phase 1     Midisland Land Acquisition and Management - Phase 1     Douphin Island Adudoon Bild Sanctuary Shoreline Restoration & Management     Douphin Island Adudoon Bild Sanctuary Shoreline Restoration & Management     Douphin Island Adudoon Bild Sanctuary Shoreline Restoration & Management     Ouphin Island Adudoon Bild Sanctuary Shoreline Restoration & Management     Ouphin Island Adudoon Bild Sanctuary Shoreline Restoration & Management	Frict Type     Exch and Dure Restoration     Beach and Dure Restoration     Land Acquisition     Land Acquisition     Land Acquisition     Control Burs and Insvire Species Management     Control Burs and Insvire Species Management	Could of Mexico     Could a service of a variety of unique plant and animal asemblages.     Increase in healtral mediate and bank habitat for a variety of unique plant and animal asemblages.     Increase protection and habitat for a variety of unique plant and animal asemblages.     Increase protection and habitat for a variety of unique plant and animal asemblages.     Increase in the attriat mature increase.	Cost \$10,000,000 \$51,501,000 \$2,550,000 \$45,650 \$1,079,380
Froject Name     Froject Name     Froject Name     Supplin Island Public Beach and Dune Restoration     West End Beach Julic Beach and Dune Restoration     West End Beach Julic Beach and Dune Restoration     West End Acquisition and Management - Phase II     Michidand Land Acquisition and Management - Phase II     Dauphin Island Acquisition and Management - Phase II     Dauphin Island Audubon Bird Sanctuary Shoreline Restoration & Management     Dauphin Island Audubon Bird Sanctuary Shoreline Restoration & Management     Dauphin Island Audubon Bird Sanctuary Shoreline Restoration & Management     Dute Dauphin Island Nearshore Placement     Itile Dauphin Island Nearshore Placement	Project Type Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Dune Restoration Control Burns and Invasive Species Management Nearshore Pincement Send Burnskipe	Construction on the biolist of or a variety of unique plant and animal assemblages.     Increase protection and habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier bach and dure habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier bach and dure habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier bach and dure habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier bach and dure habitat for a variety of unique plant and animal assemblages.     Increase protection on thabitat for a variety of unique plant and animal assemblages.     Increase in the antival resources.     Increase in the antival for a variety of unique plant and animal assemblages.     Increase as definient supply to Utile Daughin bland comples.     Subaerial and subtiet bare.     Increase in the antival for avariety of unique plant and and subtiets therefing various visibilitifie induring aguatic and avian species.     Increase in the antival for avariety of Definer avariety.	Cost 50,000,000 561,501,000 51,000,000 5445,650 51,079,350 52,250,000 53,960,000
Project Name     Project Name     Dauphin Island Public Beach and Dune Restoration     West Furd Beach and Dune Restoration     West Furd Beach and Dune Restoration     West Furd Beach and Management - Phase I     Mid-island Land Acquisition and Management - Phase I     Mid-island Land Acquisition and Management - Phase I     Mid-island Land Audubon Bird Sanctuary Shoreline Restoration & Management     Dauphin Island Audubon Bird Sanctuary Shoreline Restoration & Management     Plate Baye Menical Land Reserved     Michigend Land Band Nershore Placement     Michigend Land Band Nershore Placement     Michigend Land Band Nershore Placement     Michigend Land Land Management     Place Baye Beneficial Lise Restoration	Project Type Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Dune Restoration Control Burns and Invasive Species Management Nearshore Placement Sand Rypassing Saltmanh Restoration	Conservation of costast hardre beaks and dure habitat for variety of unique plant and animal assemblages.     Increase protection and habitat for variety of unique plant and animal assemblages.     Increase in hearthy maritime forrest and beak and dure habitat to free.     Increase selferent stuppe to Little Durphin Island complex. Subserial and subtidal habitats benefiting various wildlife including aquatic and avian species.     Increase selferent stuppe to Sand/Pielian complex. Subserial and subtidal habitats benefiting various wildlife including aquatic and avian species.     Increase selferent stuppe to Sand/Pielian complex. Subserial and subtidal habitats benefiting various wildlife including aquatic and avian species.     Increase selferent stuppe to Sand/Pielian complex. Subserial and subtidal habitats benefiting various wildlife including aquatic and avian species.     Increase selferent stuppe to Sand/Pielian complex. Subserial and subtidal habitats benefiting various wildlife including aquatic and avian species.     Increase selferent suppe to Sand/Pielian complex. Subserial and subtidal habitats benefiting various wildlife including aquatic and avian species.	Cost 51.0.000,000 52.500,000 54.45,550 51.001,000 5445,550 53.469,000 53.3460,000 53.469,000 53.469,000
Eroject Name      Eroject Name      Doughin Island Public Beach and Dure Restoration      West End Beach and Dure Restoration      Michiadra Land Acquisition and Management - Phase I      Michiadra Land Acquisition and Management - Phase I      Michiadra Land Audubon Bild Sanctuary Shoreline Restoration & Management      Dauphin Island Audubon Bild Sanctuary Shoreline Restoration & Management      Zotaphin Island Audubon Bild Sanctuary Shoreline Restoration & Management      Tuttle Dauphin Island Nearshore Placement      Sub Starshore Beacement      Horited Starshore Beacement      Old Burg Starshore Beacement      Dill Borrow Risch Duried Lagrant Oil Spill Damage	Project Type Reach and Dune Restoration Beach and Dune Restoration Land Acquistion Land Acquistion Dune Restoration Control Burns and Invasive Species Management Nearshore Placement Sand Bypasing Saltmanh Restoration Restore Dreiged Holes	Control of the second sec	Cost \$10,000,000 \$61,501,000 \$2,500,000 \$445,650 \$1,079,350 \$2,250,000 \$3,960,000 \$5,460,000
Project Name     Project Name     Project Name     Support Strategy St	Project Type Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Dune Restoration Land Acquisition Dune Restoration Control Burns and Invasive Species Management Nearshore Pincement Sand Bypasing Saltmash Restoration Restore Dreiged Holes Stormwatter Draingel Emprovements	Constrained and a subject of a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habitat for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier beach and dure habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier beach and dure habitat for a variety of unique plant and animal assemblages.     Conservation of coastal barrier beach and dure habitat for a variety of unique plant and animal assemblages.     Increase protection and habitat for a variety of unique plant and animal assemblages.     Increase set direct and beach and dure habitat tores.     Increase set direct and beach and dure habitat tores.     Increase set direct and beach and dure habitat tores.     Restore nursery habitat for a variety of unique plant and animal assemblages.     Increase set direct and beach and dure habitat tores.     Restore nursery habitat for a variety of unique plant and animal assemblages.     Increase set direct and beach and dure habitat tores.     Restore nursery habitat for a variety of unique plant and subtidial habitats benefiting various wildlife including squatic and avian species.     Increase definent supply to Little Doughin talor subtidie to the Mississippi Sound. Restore Subaerial and subtidial habitats.     Improve the overal health of the subaries in and around Dauphin island including flakery and shellfor habitats.	Cost 510,000,000 551,500,000 51,000,000 5445,650 51,079,350 52,459,000 53,369,000 53,560,000 55,660,000 55,660,000
Erojett Nane     Erojett Nane     Erojett Nane     Supplin Island Public Beach and Dune Restoration     Supplin Island Acquisition and Management - Phase I     Mid-Island Land Acquisition Association - Phase I     Mid-Island Land Acquisition Association - Phase I     Mid-Island Land Land Land Land Land Land Land L	Foject Type     Project Type     Beach and Dune Restoration     Beach and Dune Restoration     Beach and Dune Restoration     Land Acquisition     Land Acquisition     Control Burns and Invasive Species Management     Nearshore Plecement     Sand Bypassing     Satimarah Restoration     Restore Dreleged Holes     Stormwater Draiting Improvements     Wastewater Treatment Plant Upgrades     Wastewater Treatment Plant Upgrades	Exercise of the exercis of the exercise of the exercise of the exercise of the exercise o	Cost \$10,000,000 \$4,500,000 \$4,560 \$1,000,000 \$445,650 \$1,479,350 \$2,255,000 \$2,445,000 \$3,346,000 \$2,445,000 \$3,346,000 \$3,460,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,050,000 \$10,000,000,000 \$10,000,000,000 \$10,000,000,000,000 \$10,000,000,000,000,000 \$10,000,000,000,000 \$10,000,000,000,000
Eroject Name     Eroject Name     Eroject Name     Dauphin Island Public Beach and Dune Restoration     West End Beach and Dune Restoration     Mid-island Land Acquisition and Management - Phase I     Mid-island Land Acquisition and Management - Phase I     Dauphin Island Acquisition and Management - Phase I     Mid-island Land Acquisition and Management - Phase I     Moready During I (2010 to Protect Against Oli Spill Damage     Stormwater Quality Rehabilitation Project - Phase I     Aloce Bay/Missispip Sound Water Quality Enhancement Project - Phase I     Aloce Bay/Missispip Sound Water Quality Enhancement Project - Phase I     Aloce Bay/Missispip Sound Water Quality Enhancement Project - Phase I	Project Type Beach and Dune Restoration Beach and Dune Restoration Beach and Dune Restoration Land Acquistion Land Acquistion Dune Restoration Control Burs and Invasive Species Management Nearshore Placement Sard Bypasing Saltmarsh Restoration Restore Dreiged Holes Stormwater Drainage Inprovements Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades	Control of the state of th	Cost 561,501,000 561,501,000 542,560,000 53,369,000 53,2650,000 55,560,000 53,3650,000 53,3650,000 53,3450,000
Project Name Project	Project Type Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Control Burns and Inwaive Species Management Nearshore Placement Sand Bypassing Saltmank Restoration Restore Dredged Holes Stormwater Draitegie Improvements Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades	Constrained and the state of the state	Cost \$10,000,000 \$2,500,000 \$445,650 \$1,000,000 \$445,650 \$2,445,650 \$2,445,650 \$2,445,650 \$2,445,000 \$2,445,000 \$2,445,000 \$3,145,000 \$3,
Erigist Name     E	Project Type     Project Type     Beach and Dune Restoration     Beach and Dune Restoration     Beach and Dune Restoration     Land Acquisition     Land Acquisition     Land Acquisition     Control Burns and Invasive Species Management     Nearshore Placement     Sand Bypassing     Saltmarsh Restoration     Restore Dreliged Holes     Storatet Drainage Improvements     Wastewater Treatment Plant Upgrades	Conservation of created breaching and increase protection of habitat for a variately of unique plant and animal assemblages.     The standard of the stan	Cost \$10,000,000 \$61,501,000 \$2,550,000 \$1,000,000 \$445,500 \$1,007,005 \$2,850,000 \$2,450,000 \$3,960,000 \$3,960,000 \$10,050,000 \$11,050,000 \$11,050,000 \$13,145,0
Evolet Name     Evolet Na	Project Type Beach and Dune Restoration Beach and Dune Restoration Beach and Dune Restoration Land Acquistion Dune Restoration Control Burs and Invasive Species Management Nearshore Placement Sand Psyasing Saltmarsh Restoration Restore Dredged Holes Stormwater Drainage Improvements Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades Water Supply Water Supply	Exercision of reduce breaching potential and increase protection of habits for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habits for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habits for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habits for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habits for a variety of unique plant and animal assemblages.     Restoration of coastal barrier back and dune habitat for variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     Totica coasts to atrual resources.     Increase selfment supply to Dittle Dauphin Island comples. Subaerial and subtidal habitats benefiting various vilidifie including aquatic and avian species.     Increase selfment supply to Dittle Dauphin Island comples. Subaerial and subtidal habitats benefiting various vilidifie including aquatic and avian species.     Increase selfment supply to Dittle Dauphin Island including fishey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Island Including fishey and shellfish habitats.     Indicates the impact on estuaries and a	Cost 510,000,000 561,501,000 52,2500,000 5445,650 52,2500,000 53,960,000 53,960,000 55,660,000 510,0650,000 513,450,000 513,450,000 513,450,000 514,500 53,1442,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1550,000 54,1500,0000 54,1500,000 54,1500,000 54,1500,000 54,1500,000 54,1500
Project Name     Project Name     Douphin Island Public Beach and Dune Restoration     West End Beach and Dune Restoration     West End Seadh Adquisition and Management - Phase I     Mid-island Land Acquisition and Management - Phase I     Mid-island Land Acquisition and Management - Phase I     Douphin Island Audubon Bird Sanctuary Shoreline Restoration & Management     Utile Douphin Island Manhore Super Aquines     Mid-island Land Acquisition and Management - Phase I     Douphin Island Audubon Bird Sanctuary Shoreline Restoration & Management     Utile Douphin Island Manhore Network Project     Ance Bay Mississipi Sound Water Quality Enhancement Project - Phase I     Aloce Bay Mississipi Sound Water Quality Enhancement Project - Phase II     Douphin Island Water Super Aquing Improvements     Douphin Island Water Super Varier Varier Varier Varier Varier V	Project Type Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Control Burns and Invasive Species Management Nearshore Placement Santimanh Restoration Control Burns and Invasive Species Management Nearshore Placement Santimanh Restoration Restore Dredged Holes Stormwater Draitage Improvements Wastewater Treatment Plant Upgrades Wastewater Treatment Plant Upgrades Water Supply Water Supply Land Acquisition	Conservation of and breaching and potential associated impacts in the Missispip Sound. Restore Suberial and sublidal habitats     more the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the stuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the stuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the stuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the stuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the stuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shellfish habitats.     Improve the overall health of the estuaries in and around Dauphin Hiahan Including Tahey and shelfish habitats.     Improve the overall health of the estuaries in a	Cost 510,000,000 54,150,000 54,150,000 54,150,000 54,4550 51,079,350 52,850,000 55,460,000 55,460,000 55,460,000 53,145,000 53,145,000 53,145,000 53,142,000 53,142,000 53,428,0000 53,428,0000 53,428,00000000000000000000000000000000000
Project Name     P	Project Type     Project Type     Beach and Dune Restoration     Beach and Dune Restoration     Beach and Dune Restoration     Lind Acquisition     Lind Acquisition     Dune Restoration     Santi Bypassing     Santiash Restoration     Restore Direction the Statement     Santiash Restoration     Restore Direction the Statement     Santiash Restoration     Restore Direction the Statement     Santiash Restoration     Santiash Restoration     Santiash Restoration     Restore Direction     Santiash Restoration     Land Acquisition     Land Acquisition     Land Acquisition	Exercise	Cost \$10,000,000 \$41,501,000 \$44,500,000 \$44,550 \$4,000,000 \$44,550 \$5,950,000 \$5,950,000 \$5,950,000 \$5,950,000 \$5,1050,000 \$11,050,000 \$1,145,0000 \$1,145,0000
Evolution	Project Type Beach and Dune Restoration Beach and Dune Restoration Beach and Dune Restoration Land Acquistion Dune Restoration Land Acquistion Dune Restoration Control Burs and Invasive Species Management Nearshore Plocement Sand Bypasing Saltmarsh Restoration Restore Dredged Holes Storriwater Drainage Improvements Wastewater Treatment Flant Upgrades Wastewater Treatment Flant Upgrades Wastewater Treatment Flant Upgrades Wastewater Treatment Flant Upgrades Wastewater Treatment Flant Upgrades Water Supply Land Acquisition Land Acquisition Land Acquisition Land Acquisition	Exercision of reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.     Restoration to reduce breaching potential and increase protection of habitst for a variety of unique plant and animal assemblages.     Increase protection and habitat for a variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     Public access to natural resources.     Increase sediment supply to Dittle Dauphin Island comples. Subaerial and subtidal habitats benefiting various vilidilie including aquatic and avian species.     Increase sediment supply to Dittle Dauphin Island comples. Subaerial and subtidal habitats benefiting various vilidilie including aquatic and avian species.     Increase sediment supply to Dittle Dauphin Island including fishery and shelffish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishery and shelffish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishery and shelffish habitats.     Improve the overall health of the estuaries in and around Dauphin Island including fishery and shelffish habitats.     Indices the impact on estiting water aquifers.     Conservation of nigratory bird habitat that includes provides poor habitat for nigratory species.     Conservation of nigratory bird habitat that includes provides poor thabitat for any and the forest.     Conservation of nigratory bird habitat that includes provides poor this and fitas during low tide, rich interior wetlands and maritime forest.	Cost 510,000,000 541,501,000 52,2500,000 5445,550 52,250,000 53,960,000 53,960,000 53,960,000 53,145,000 54,0000 54,000 54,000 54,0000 54,0000 54,0000 54,
Project Nanc     Project Nanc     Project Nanc     Dauphin Island Public Beach and Dune Restoration     Augustantian Stream	Project Type     Project Type     Beach and Dune Restoration     Beach and Dune Restoration     Beach and Dune Restoration     Land Acquisition     Land Acquisition     Control Burns and Invasive Species Management     Nearsbore Placement     Sand Bypassing     Saltmarsh Restoration     Control Burns and Invasive Species Management     Nearsbore Placement     Sand Bypassing     Saltmarsh Restoration     Sand Restoration     Land Acquisition	Exerce nerver head breaching and potential and ancuda bagibin bladia to benefiting various wildlife including aquatic and avian species.     Increase referent and warrent and annual assemblages.     Increase referent and threa threat and subsidial habitats benefiting various wildlife including aquatic and avian species.     Increase referent shappi to threat and bagabin haland including fibery and shellfish habitats.     Increase referent haland breaching and potential and annual assemblages.     Increase referent shappi to threat and bagabin haland including fibery and shellfish habitats.     Increase referent shappi to threat and bagabin haland including fibery and shellfish habitats.     Increase referent shappi to threat and bagabin haland including fibery and shellfish habitats.     Increase referent heating to the stuaries in and around bagabin haland including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery and shellfish habitats.     Increase reference to costast hariter bestuaries in and around bagabin haland including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery and shellfish habitats.     Increase reference the stuaries in and around bagabin halan including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin halan including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery and shellfish habitats.     Improve the overal heating three stuaries in and around bagabin haland including fibery	Cost 510,000,000 561,500,000 52,500,000 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,4550 53,42500 53,42500 53,42500 53,4250000 53,425000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,420000 54,4200000 54,4200000 54,4200000 54,4200000 54,42000000 54,42000000 54,42000000 54,400000000000000000000000000000000000
Evolution	Price Type     Beach and Dune Restoration     Lind Acquisition     Dune Restoration     Control Gurss and Invasive Species Management     Nearshore Flocement     Sand Oppasing     Saltmarsh Restoration     Restore Dredged Holes     Stormwater Treatment Plant Upgrades     Wastewater Treatment Plant Upgrades     Waster Supply     Land Acquisition     Land Acquisition     Land Acquisition     Land Acquisition     Land Acquisition     Land Acquisition	Exercision to reduce breaching potential and increase protection of habitat for a variety of unique plant and animal assemblage.     Exercision to reduce breaching potential and increase protection of habitat for a variety of unique plant and animal assemblage.     Conservation of coastal barrier back and dune habitat tor variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     The servation of coastal barrier back and dune habitat tor variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     The servation of coastal barrier back and dune habitat tor variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     The servation of coastal barrier back and dune habitat tor variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     Therease variety of unique plant and animal assemblages including neotropical birds and wintering migratory species.     Therease variety of the stand resources.     Subaerial and subaerial and subtal babitats barefiling various wildlife including aquatic and avian species.     Increases variety of unique plant and animal assemblages including request and avian species.     Increase variety of the origit and toxeholds habitats barefiling various wildlife including aquatic and avian species.     Increase land including tishey and shelffish habitats.     Improve the overall health of the estuaries in and around bapphin Island including tishey and shelffish habitats.     Improve the overall health of the estuaries in and around bapphin Island including tishey and shelffish habitats.     Improve the overall health of the estuaries in and around bapphin Island including tishey and shelffish habitats.     Improve the overall health of the estuaries in and around bapphin Island including tishey and shelffish habitats.     Improve the overall health of the estuaries in and around bap	Cost \$10,000,000 \$51,500,000 \$2,500,000 \$2,550,000 \$2,455,557 \$2,455,000 \$2,455,000 \$2,445,000 \$3,360,000 \$3,360,000 \$3,145,000 \$3,145,000 \$3,145,000 \$3,145,000 \$3,145,000 \$3,1442,000 \$3,1442,000 \$3,142,000 \$3,0000 \$3,0000 \$3,0000 \$3,00000 \$3,00000 \$3,00000000000000
Project Name     Project Name     Dauphin Island Public Beach and Dune Restoration     Zivest End Beach and Dune Restoration     Zivest End Beach and Dune Restoration     Zivest End Seach Adoubtion and Management - Phase I     Mid-Sialnal Cand Acquisition and Management - Phase I     Mid-Sialnal Cand Mater Canditor Acquisition     Tole Bayben Biolise Size Canditor     Pill Borrow Pils Dag in 2010 to Protect Against OII Spill Damage     Siornwater Quality Rehabilitation Project     Aloce Bay/Mississpi Sound Water Quality Enhancement Project - Phase I     Dauphin Island Water Suppl Aquically Enhancement Project - Phase I     Dauphin Island Water Suppl Aquically Enhancement Project - Phase I     Dauphin Island Water Suppl Aquically Enhancement Project - Phase I     Dauphin Island Water Suppl Aquically Enhancement Project - Phase I     Dauphin Island Water Suppl Aquically Enhancement Project - Phase I     Dauphin Island Water Suppl Aquisition     Sistiner Property Acquisition     Sistiner Property Acquisition     Dauphin Island Spared Property Acquisition	Project Type Beach and Dune Restoration Beach and Dune Restoration Beach and Dune Restoration Land Acquisition Land Acquisition Control Burns and Invasive Species Management Nearshore Plecement Santimank Restoration Control Burns and Invasive Species Management Nearshore Plecement Santimank Restoration Restore Dreiged Holes Stormwater Dreattenet Plant Upgrades Wastewater Treattment Plant Upgrades Wastewater Treattment Plant Upgrades Wastewater Treattment Plant Upgrades Wastewater Treattment Plant Upgrades Waster Supply Water Supply Water Supply Land Acquisition Land Acquisition Land Acquisition Land Acquisition Land Acquisition Land Acquisition	Conservation of oxistal barrier back and surved Bayehin Island including fishery and shellfish habitats.     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats.     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats.     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats.     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Increase self-and breaching and potential associated impacts in the Mississippi Sound. Restore Suberial and subid habitats     Improve the overall habit th the estuaries in and around Dauphin Island including fishery and shellfish habitats.     Improve the overall habit th the estuaries in and around Dauphin Island including fishery and shellfish habitats.     Improve the overall habit th the estuaries in and around Dauphin Island including fishery and shellfish habitats.     Improve the overall habit th the estuaries in and around Dauphin Island including fishery and shellfish habitats.     Increase self-and on estuaries in and around Dauphin Island Including fishery and shellfish habitats.     Increase Island th the estuaries in and around Dauphin Island Including fishery a	Cost 510,000,000 52,150,000 54,150,000 54,150,000 54,4550 51,079,350 52,250,000 53,455,000 53,455,000 53,145,000 510,050,000 51,147,000 51,42,000 51,40
Project Nane      Project Nane      Audition     Project Nane      Audition     Project Nane      Audition     Audition     Project Nane      Audition     A	Project Type     Project Type     Beach and Dune Restoration     Beach and Dune Restoration     Beach and Dune Restoration     Land Acquisition     Land Acquisition     Control Burns and Invasive Species Management     Nearbore Placement     Sarnd Bypassing     Satimarah Restoration     Restore Dredged Holes     Sorrowet Practment Plant Upgrades     Wastewater Tratement Plant Upgrades     Wastewater Tratementex Plant Upgrades     Wastewater Tratement Plant Upgrades     Was	Events	Cost 510,000,000 561,501,000 52,500,000 544,550 51,007,9350 52,850,000 53,960,000 53,960,000 53,1650,000 53,145,000 53,0000 53,0000 54,0000 53,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,0000 54,00000 54,00000 54,0000

Figure 2: Potential Interim Projects Considered by the USACE, State of Alabama, and Evaluation Support Panel

#### 3.1.2. Formulation and Cost Estimation of Restoration Measures

The project team evaluated the hydrodynamic, morphological change, water quality, life-cycle structure response, and habitat model results of the no-action future conditions, and considered the Interim Report project recommendations, to develop potential restoration measures. Descriptions of the measures developed to meet the study objectives are provided below along with descriptions of the key assumptions made for estimating the costs of each measure. These consisted of restoration measures on the ebb tidal shoal south of Dauphin Island, Gulf beach restoration measures, back barrier and marsh restoration measures, and land acquisitions for conservation.

The following sections detail how the restoration measures, which vary in scale, location, and design, may be constructed.

#### **3.1.2.1. Ebb Tidal Shoal Measures 3.1.2.1.1. Measure 3 Pelican Island Southeast Nourishment**

**Description:** The Pelican Island Southeast Nourishment measure would serve to supply sand to the nearshore littoral system while enhancing vital critical habitat that is found naturally along the ephemeral, subaerial sand deposit. This measure, as shown in Figure 3, would place an estimated 4.5 million cubic yards at a target elevation of 4.5 feet NAVD88 southeast of the existing Pelican Island along the general 1985 island shoreline position. Estimates of fill quantities are based on 2015/2016 USACE and USGS topographic and bathymetric surveys and account for historic volumetric change rates observed for the area based on 2010 to 2016 surveys.

Potential sources of sand for initial construction include borrow areas located within the Mobile ebb tidal shoal system, relic sand deposits located just offshore of Petit Bois Pass (PBP), and upland sources located within dredge material sites along the Alabama-Tombigbee river system as shown in Figure 4 and Figure 5. Borrow sources for future nourishments include sand dredged from Mobile Harbor Bar Channel during routine maintenance activities. These sources are assumed to be compatible with the native beach materials on the island; therefore, volume estimates for initial construction and future nourishment efforts do not include an overfill factor.



Figure 3. Pelican Island Southeast Nourishment Measure



Figure 4. Petit Bois Pass Relic Sand Deposits and Mobile Ebb Tidal Shoal Borrow(SIBUA-South) Sources



Figure 5. Alabama-Tombigbee River Sand Borrow Sources example

**Cost:** The estimates for initial construction costs range from \$72.9 to \$119.0 million, depending on the borrow source used. Material sources included the Sand Island Beneficial Use Area-South(SIBUA-South), PBP East relic sand deposits, or upland sources along the Alabama-Tombigbee River. Option 1 consists of using only PBP, approximately 12 miles from the project site, as the borrow source. Option 2 considers using all available material from SIBUA-South about 5 miles from the project site and the remainder from the PBP area. Option 3 accounts for using material barged down from an upland disposal area (DA). Estimated duration of construction for options 1 and 2 is 13 months; option 3 has a duration of 14 months. To maintain maximum benefits, nourishments would be needed on an estimated 10-year average cycles. Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e.,

future O&M costs) are estimated at \$3.0 million for a 20-year life and assume the use of sand dredged from Mobile Harbor Bar Channel during routine maintenance activities. For the O&M estimate, the only cost included is the additional cost of disposing of the dredged material on the project site for beneficial use. The summary of costs for this restoration measure to included monitoring and adaptive management are provided in Table 2 below.

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 – Petit Bois Pass Relic Sand Deposits	\$79.4		
Option 2 – Mobile Ebb Tidal Shoal and Petit Bois Pass Relic Sand	\$72.9		
Deposits			
Option 3 – Alabama-Tombigbee River Sand	\$119.0		
Option 1 – Mobile Harbor Bar Channel		\$3.0	\$8.5
Monitoring and Adaptive Management (3% of initial project costs)	\$2.7	-	

Table 2. Present Value Costs for the Pelican Island Southeast Nourishment Measure

#### 3.1.2.1.2. Measure 7 Sand Island Platform Nourishment and Sand Bypassing

**Description:** The Sand Island Platform Nourishment and Sand Bypassing measure would serve to build up the shoal system around the Sand Island Lighthouse and supply sediment to the nearshore littoral system along regions of the submerged ephemeral sand deposits of Pelican and Sand Islands. This measure, as shown in Figure 6, would place an estimated 4.3 million cubic yards at target elevations of -8 to -6 feet NAVD88 within regions located along the general 1874-50 Sand Island shoreline position. Estimates of initial fill quantities are based on 2015/2016 USACE and USGS topographic and bathymetric surveys and account for historic volumetric change rates observed for the area based on 2010 to 2016 surveys.

Potential sources of sand for initial construction include a combination of the Mobile Harbor bar channel, borrow areas located within the SIBUA-South, and upland sources located within dredge material sites along the Alabama-Tombigbee river system, estimated as Option 1 or PBP estimated as Option 2. Borrow sources are shown in Figure 4 and Figure 5. Borrow sources for future nourishments include sand dredged from Mobile Harbor Bar Channel estimated at approximately every 2 years during routine maintenance activities. These sources are assumed to be compatible with the native beach materials on the islands and shoals; therefore, volume estimates for initial construction and future nourishment efforts do not include an overfill factor.



Figure 6. Sand Island Platform Nourishment

**Cost:** The estimates for initial construction costs range from \$82.0 to \$103.1 million, depending on the borrow source used. To maintain maximum benefits, nourishments would be needed on an estimated 2-year average cycles. Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e., future O&M costs) are estimated at \$10.4 million and assume the use of sand dredged from Mobile Harbor Bar Channel during routine maintenance activities. The summary of costs for this restoration measure to included monitoring and adaptive management are provided in Table 3 below. For the O&M estimate, the only cost included is the additional cost of disposing of the dredged material on the project site for beneficial use.

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 – Mobile Ebb Tidal Shoal, Mobile Harbor Bar Channel, and	\$103.1		
Alabama-Tombigbee River Sand			
Option 2 – Petit Bois Pass Relic Sand Deposits	\$82.0		
Option 1 – Mobile Harbor Bar Channel		\$10.4	\$29.7
Monitoring and Adaptive Management (3% of initial project costs)	\$2.8		

#### 3.1.2.2. Gulf Beach Measures

3.1.2.2.1. Measure 8 East End Beach and Dune Restoration

**Description:** The proposed East End beach and dune measure would restore vital habitat that has been lost along the east end of Dauphin Island, Alabama and provide additional storm damage reduction to existing herbaceous and wooded dunes located landward of the proposed footprint, primarily along the Dauphin Island Audubon Bird Sanctuary.

The East End measure, as shown in Figure 7, would place an estimated 1.2 million cubic yards of sand along the shoreline at a natural berm elevation of approximately 5.5 feet NAVD88. The measure includes construction of a frontal dune at an elevation of 12 feet NAVD88 and width of 25 feet along a 4,800 foot stretch of the coast, to slightly overlap with and extend eastward of where the natural extensive high dune system currently ends. The dunes would be vegetated with approximately 50,400 native dune plants (Bitter Panicum, Sea Oats, and Gulf Bluestem) that are robust in helping stabilize dunes and incorporate roughly 3,200 feet of sand fencing.



Figure 7. East End Beach and Dune Restoration Measure

Potential sources of sand for initial construction material include borrow areas located within the SIBUA-South, PBP, and upland sources located within dredge material sites along the Alabama-Tombigbee river system (as shown in Figure 4 and Figure 5). Borrow sources for future nourishments include the sources just referenced as well as potential sand dredged from Mobile Harbor Bar Channel during routine maintenance activities. These sources are assumed to be compatible with the native beach materials on the island; therefore, volume estimates for initial construction and future nourishment efforts do not include an overfill factor.

**Cost:** The estimates for initial construction costs range from \$29.8 to \$35.2 million, depending on the borrow source used. Option 1 is estimated using a cutterhead dredge to pipe material approximately 6 miles from SIBUA-South to the project site, Option 2 is estimated using a single large hopper dredge moving material from PBP, and the cost for Option 3 is based on material being barged to the site from an upland DA on the Alabama-Tombigbee system. To maintain maximum benefits, nourishments would be needed on an estimated 7-year average cycles. Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e., future O&M costs) range between \$5.8 and \$7.9 million, depending on the borrow source used. The summary of costs for this restoration measure to included monitoring and adaptive management are provided in Table 4 below.

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50- Year O&M Costs (\$ million)
Option 1 – Mobile Ebb Tidal Shoal	\$28.2		
Option 2 – Petit Bois Pass Relic Sand Deposits	\$29.8		
Option 3 – Alabama-Tombigbee River Sand	\$35.2		
Option 1 – Mobile Harbor Channel		\$5.8	\$23.8
Option 2 – SIBUA-South		\$5.8	\$23.8
Option 3 - PBP		\$7.9	\$32.5
Monitoring and Adaptive Management (3% of initial project costs)	\$0.9	-	

Table 4. Present Value Costs for the East End Beach and Dune Restoration Measure

# 3.1.2.2.2. Measure 5 West End Beach and Dune Nourishment (No Buyouts)

**Description:** This West End measure, as shown in Figure 8, generally follows the recommended design laid out in the 2011 Town of Dauphin Island Beach and Barrier Island Restoration Project, placing an estimated 4.6 million cubic yards of sand along the shoreline to widen the natural beach approximately 4 miles along the developed stretch of coast at a natural berm elevation of approximately 5.5 feet NAVD88. Additionally, the measure includes construction of a frontal dune at an elevation 12 feet NAVD88 and width of 25 feet seaward of existing structures. The dunes would be vegetated with approximately 221,000 native dune plants (Bitter Panicum, Sea Oats, and Gulf Bluestem) that are robust in helping stabilize dunes. Roughly 14,000 feet of sand fencing would also be incorporated to further capture windblown sand and promote additional dune growth.



Figure 8. West End Beach and Dune Nourishment (No Buyouts) Measure

Potential sources of sand for initial construction and nourishments include borrow areas located within the Mobile ebb tidal shoal system (SIBUA-South) and relic sand deposits located just offshore of Petit Bois Pass, as shown in Figure 4. These sources are assumed to be compatible with the native beach materials on the island; therefore, volume estimates for initial construction and future nourishment efforts do not include an overfill factor.

**Cost:** The estimates for initial construction costs range from \$73.0 to \$78.7 million, depending on the borrow source used. To maintain maximum benefits, nourishments amounting to approximately 1.1 million cubic yards of material would be needed on an estimated 10-year average cycle. Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e., future O&M costs) is estimated at \$52.0 million. The summary of costs for this restoration measure are provided in Table 5 below.

Wiedsuite			
Borrow Source Options	Initial Construction Cost	20-Year O&M Costs	50-Year O&M Costs
	(\$ million)	(\$ million)	(\$ million)
Option 1 – SIBUA-South and PBP	\$78.7		
Option 2 – PBP	\$73.0		
Option 1 – PBP		\$52.0	\$148.7
Monitoring and Adaptive Management (3% of initial project costs)	\$2.3	-	

Table 5. Present Value Costs for the West End Beach and Dune Restoration (No Buyouts) Measure

## 3.1.2.2.3. Measure 6 West End Beach and Dune Nourishment (with Voluntary Buyouts)

**Description:** The West End Beach and Dune Nourishment (with Voluntary Buyouts) measure is a modification of the West End Beach and Dune (No Buyouts) measure described previously in section 3.1.2.2.2. It would also provide additional storm damage reduction benefits including the removal of approximately 225 residential structures along some of the most vulnerable segments of the island. Other benefits include reduction in the breaching in regions immediately down drift and to the west of the West End Public Beach.

The measure, as shown in Figure 9, would place an estimated 3.1 million cubic yards of sand along the shoreline at a natural berm elevation of approximately +5.5 feet NAVD88 to widen the natural beach approximately 4 miles along the developed stretch of coast. Additionally, the measure would include construction of a frontal dune at an elevation +10 feet NAVD88 and width of 30 feet just seaward of Bienville Boulevard. The dunes would be vegetated with approximately 231,000 native dune plants (Bitter Panicum, Sea Oats, and Gulf Bluestem) that are robust in helping stabilize dunes. Roughly 14,000 feet of sand fencing would also be incorporated to further capture windblown sand and promote additional dune growth.



Figure 9. West End Beach and Dune Nourishment (with Voluntary Buyouts) Measure

Potential sources of sand for initial construction and nourishments include borrow areas located within the Mobile ebb tidal shoal system and relic sand deposits located just offshore of Petit Bois Pass, as shown in Figure 4. These sources are assumed to be compatible with the native beach materials on the island; therefore, volume estimates for initial construction and future

nourishment efforts do not include an overfill factor.

**Cost:** The estimates for initial construction cost are \$147.7 million when using a combination of SIBUA-South and PBP as the borrow areas. Using PBP exclusively results in an estimate of \$142.9 million. Both the options include estimated costs for purchasing all 225 of the residential structures. To maintain maximum benefits, nourishments would be needed on an estimated 10-year average cycle. The initial construction is estimated to take 8 months using a single large hopper dredge.

 Table 6. Present Value Costs for the West End Beach and Dune Nourishment (with Voluntary Buyouts) Measure

	Initial Construction Cost (\$ million)	Real Estate Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 – Mobile Ebb Tidal Shoal and Petit Bois Pass Relic Sand Deposits	\$57.5	\$90.2		
Option 2 – Petit Bois Pass Relic Sand Deposits	\$52.7	\$90.2		
Option 1 - Petit Bois Pass Relic Sand Deposits			\$52.0	\$148.5
Monitoring and Adaptive Management (3% of <i>initial project costs</i> )	\$1.7		-	

Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e., future O&M costs) is estimated at \$52.0 million using PBP. This estimate is based on dredging 945,000 CY from PBP every 10 years. The summary of costs for this restoration measure are provided in Table 6 above.

#### 3.1.2.2.4. Measure 4 West End and Katrina Cut Beach and Dune Restoration (with Voluntary Buyouts)

**Description:** The West End and Katrina Cut Beach and Dune Restoration (with Voluntary Buyouts) measure is a modification of West End Beach and Dune Nourishment (with Voluntary Buyouts) measure described previously in Section 3.6.2.2.3. This measure extends from the current pier near monument D1-18 to just west of the Katrina cut structure where it would tie into the natural herbaceous dune systems to the west. It would restore vital beach and dune habitat. It would also provide additional storm damage reduction benefits, including the removal of approximately 225 residential structures along some of the most vulnerable segments of the island.

The measure, as shown in Figure 10, would place an estimated 7.9 million cubic yards of sand along the shoreline at a natural berm elevation of approximately +5.5 feet NAVD88 to widen the natural beach approximately 6 miles along west end. Additionally, the measure would include construction of a frontal dune at an elevation of +10 feet NAVD88 and a width of 30 feet. The dune would be located just seaward of Bienville Boulevard and the Katrina Cut structure where it would ultimately tie into the natural near continuous herbaceous dune system to the west. The

dunes would be vegetated with approximately 358,600 native dune plants (Bitter Panicum, Sea Oats, and Gulf Bluestem) and roughly 14,000 feet of sand fencing would be incorporated to further capture windblown sand and promote additional dune growth.



Figure 10. West End and Katrina Cut Beach and Dune Restoration (with Voluntary Buyouts) Measure

Potential sources of sand for initial construction and nourishments include borrow areas located within the Mobile ebb tidal shoal system and relic sand deposits located just offshore of Petit Bois Pass, as shown in Figure 4. These sources are assumed to be compatible with the native beach materials on the island; therefore, volume estimates for initial construction and future nourishment efforts do not include an overfill factor.

**Cost:** The estimates for initial construction costs range from \$211.0 million using SIBUA-South and PBP to \$206.4 million using only PBP. Each material source would result in a construction project lasting 16 months using a single large hopper dredge. The initial construction costs include the estimated amount to purchase all 225 of the residential structures. To maintain maximum benefits, nourishments placing approximately 2.0 million cubic yards of sand would be needed on an estimated 10-year average cycle. Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e., future O&M costs) is estimated to range from \$84.4 to \$158.4 million. The first option for O&M borrow area would involve using the PBP site, the second option involves the use of material from an upland DA on the Alabama-Tombigbee system. The summary of costs for this restoration measure are provided in Table 7 below.

Table 7. Present Value Costs for the West End and Katrina Cut Beach and Dune Restoration (with Voluntary Buyouts) Measure

<b>Borrow Source Options</b>	Initial Construction Cost (\$ million)	Real Estate Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 – SIBUA-South and PBP	\$120.8	\$90.2		
Option 2 – PBP	\$116.2	\$90.2		
Option 1 – Petit Bois Pass Relic Sand Deposits			\$84.4	\$241.2
Option 2– Alabama-Tombigbee Waterway			\$158.4	\$453.0
Monitoring and Adaptive Management (3% of initial project costs)	\$6.4			-

#### 3.1.2.2.5. Measure 17 Katrina Cut Structure Removal

**Description:** The proposed measure to remove the Katrina Cut structure, as shown in Figure 11, would involve the excavation of an estimated 230,000 tons of ALDOT Class 5 Riprap and Grade A stone along approximately 7,300 feet of the island's north shoreline. This rock could be sold or leveraged in use with other restoration efforts that require reef structures in the area.



Figure 11. Katrina Cut Structure Removal Measure

**Cost:** The initial construction cost estimate for this measure is \$7.7 million and is estimated to require no maintenance under low sea level and average storm conditions (e.g., ST2SL1). Under higher storm intensity and frequency with rising seas (e.g., ST3SL3), the area is susceptible to breaching, which will drive future decisions as to whether to allow the area to naturally heal or enact measures that would artificially close the breach in an effort to balance impacts and benefits to aquatic habitats such as oyster reefs and seagrasses. The summary of costs for this restoration measure are provided in Table 8 below.

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Structure Removal	7.7		
Monitoring and Adaptive Management (3% of initial project costs) 7	0.2		

Table 8. Present Value Costs for the Katrina Cut Structure Measure

This estimate assumes no O&M costs are needed, but that monitoring would be used to assess performance. The estimate also makes the assumption that the materials removed from the Katrina Cut are to be reused, not disposed. No allowance is included, however, for any new real estate if the material is stockpiled. All work is considered to be land based and turbidity curtains are included for the entire project length.

#### 3.1.2.3. Back Barrier and Marsh Restoration Measures 3.1.2.3.1. Measure 9 2010 Borrow Pits Restoration

**Description:** The measure consists of filling borrow pits located on backside of Dauphin Island that were excavated during the 2010 Deep Water Horizon oil spill along the developed segment of the west end. The sand was used to construct two sand dunes, referred to as berms, along the island. One dune ran shore-parallel at the water's edge and the other ran parallel to Bienville Boulevard. This measure, as shown in Figure 12, would restore approximately 31 acres of back barrier flats by filling existing holes excavated from various private properties along the north side of the island with an estimated 285,000 cubic yards of material. No permit records or surveys existed that could be used to estimate the exact quantity or depth that the material was excavated. Quantities were therefore estimated based on USACE 2016 topographic and bathymetric LiDAR surveys with an assumed maximum excavation depth in holes 10 feet in areas with no survey coverage.



Figure 12. 2010 Borrow Pit Restoration Measure

Potential sources of sand for initial construction and nourishments include beneficial use of dredge material from the Dauphin Island Village Channel, as shown in Figure 13, or excavated from approved upland areas and truck hauled to the site. These sources are assumed to be compatible with the native beach materials on the island; therefore, volume estimates for initial construction and future nourishment efforts do not include an overfill factor.



Figure 13. Dauphin Island Village Channel and GIWW Borrow Sources

**Cost:** The estimates for construction costs range from \$5.1 to \$6.4 million, depending on the borrow source used. The estimate assumed that Dauphin Island Village Channel would be used as the fill source, the pumping distance would be 3 miles and that a small 16"-20" dredge would be used. The option 2 methodology was estimated using an upland disposal area as the borrow site and the fill material being trucked and dumped. This estimate assumes no O&M costs are needed, but that monitoring would be used to assess performance. The summary of costs for this restoration measure are provided in Table 9 below.

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 Dauphin Island Village Channel	5.2		
Option 2 Upland Source	6.4		
Monitoring and Adaptive Management (3% of initial project costs)	0.2		

Table 9. Present Value Costs for the 2010 Borrow Pits Restoration Measure

#### 3.1.2.3.2. Measure 10 Marsh Habitat Restoration Behind Katrina Cut

**Description:** The Marsh Habitat Restoration behind Katrina Cut measure would restore back bay habitat behind the structure with intertidal marsh, which has been lost along the leeside of

Dauphin Island. The Katrina Cut marsh measure, as shown in Figure 14, would restore approximately 75 acres of intertidal marsh and tidal flats along the lee side of the Katrina cut structure. The area would be filled with an estimated 1.1 million cubic yards of sand and planted with approximately 1.6 million marsh plant species (Juncus Roemarianus and Spartina alterniflora) that are native to the back bay marsh systems.

Potential sources of sand for initial construction include relic sand deposits located just offshore of Petit Bois Pass and upland sources located within dredge material sites along the Alabama-Tombigbee river system (as shown in Figure 4 and Figure 5). These sources are assumed to be compatible for marsh restoration.



Figure 14. Marsh Habitat Restoration behind Katrina Cut

**Cost:** The initial construction cost estimate for this measure range between \$28.5 and \$41.2 million depending on the source of fill material. No long term maintenance cost outside of 3 percent total project costs for monitoring and adaptive management are included. The summary of costs for this restoration measure are provided in Table 10 below.

Table 10. Present Value Costs for the Marsh Habitat Restoration Behind Katrina Cu
---

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 Petit Bois Pass	28.5		
Option 2 Upland sources – Truck Haul	41.2		

Option 3 Upland sources – Barge Haul	35.9	
Adaptive Management and Monitoring (3% of initial project costs)	1.1	

Option 1 estimates the cost using a 20" pipeline dredge with a pumping distance of about 3 miles with an estimated construction duration of 8 months. Truck hauling from an upland DA would occur over a period of about 15 months. The estimate includes a \$250K allowance for repairing roads damaged by the truck traffic. The third option, barging upland DA borrow material, is estimated to require 12 months of work. O&M is not expected to be needed for this measure. Maintenance and replacement of the plants during the warranty period is included in the construction cost estimate.

#### 3.1.2.3.3. Measure 12 Aloe Bay Beneficial Use Marsh Restoration

**Description:** The Aloe Bay Beneficial Use Restoration measure would restore intertidal marsh that has been lost along the leeside of Dauphin, Island within Aloe Bay. This measure, as shown in Figure 15, would restore approximately 6 acres of intertidal marsh. The area would be filled with an estimated 34,000 cubic yards of sediment and planted with approximately 105,000 Juncus Roemarianus and Spartina alterniflora plant species that are native to the back bay marsh systems. In addition, the measure would incorporate approximately 1,900 linear feet of low crested rubble mound or a bioengineered breakwater system as well as a terminal groin at the east end to retain sediment within the template. The shore parallel breakwater structures would function to reduce shoreline erosion and wave energy in its lee.

The potential source of sand for initial construction include beneficial use of dredge material from the Dauphin Island Village Chanel, as shown in Figure 15. These sources are assumed to have suitable sediments for marsh restoration.



Figure 15. Aloe Bay Beneficial Use Marsh Restoration

**Cost:** The initial construction cost estimates for this measure range between 4.4 and 5.0 million depending on the material used in the construction of the offshore breakwater. No long term maintenance cost outside of 3 percent total project costs for monitoring and adaptive Management are included. The summary of costs for this restoration measure are provided in Table 11 below.

Table 11. Present Value Costs for the Aloe Bay Beneficial Use Marsh Restoration Measure

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O&M Costs (\$ million)	50-Year O&M Costs (\$ million)
Option 1 Low Crested Rubble Mound	4.4		
Option 2 Bioengineered Breakwater System	5.0		
Adaptive Management and Monitoring (3% of initial project costs)	0.15		

Both options are expected to take 4 months of work. Use of a small 16"-20" dredge is assumed for the minimal amount of sand placement included in this measure. O&M is not expected to be needed for this measure. Maintenance and replacement of the plants during the warranty period is included in the construction cost estimate.

#### 3.1.2.3.4. Measure 11 Graveline Bay Marsh Restoration

Description: The Graveline Bay March Restoration measure would restore intertidal marsh that

has been lost along the leeside of Dauphin Island within Graveline Bay. This measure, as shown in Figure 16, would restore approximately 25 acres of intertidal marsh. The area would be filled with an estimated 162,000 cubic yards of material and planted with approximately 623,000 marsh plant species (Spartina alterniflora) that are native to the back bay marsh systems.

The potential sources of sand for initial construction include beneficial use of dredge material from the Dauphin Island Village Chanel or the Gulf Intracoastal Waterway (GIWW) as shown in Figure 13. The small boat channel in the lee of the Graveline marsh is the assumed source for spray application of sediment over the marshes for future maintenance. This source is assumed to have suitable sediments for marsh restoration.



Figure 16. Graveline Bay Marsh Restoration

**Cost:** The initial construction cost estimate for this measure is \$5.3 million. O&M of the marsh with a hydraulic spray application of dredged sediments of approximately 70,000 cubic yards of sediment was assumed every 10 years. In addition, monitoring and adaptive management is included to monitor sea level change and marsh accretion rates. Estimates of total present value cost for nourishments over a 20-year project life-cycle (i.e., future O&M costs) is estimated at \$17.6 million. The summary of costs for this restoration measure are provided in Table 12.

Borrow Source Options	Initial Construction Cost	20-Year O&M Costs	50-Year O&M Costs
	(\$ million)	(\$ million)	(\$ million)
Graveline Bay Marsh Restoration	\$5.3		
Maintenance – Spray Application		\$17.6	\$30.9
Adaptive Management and Monitoring (3% of initial project costs)	\$0.2		

Table 12. Present Value Costs for the Graveline Bay Marsh Restoration

The initial construction duration is estimated at 4 months. The maintenance costs included in this estimate have higher uncertainty than the other estimates. Although spray application has been used in other regions, no reliable local cost information was available for comparison.

#### 3.1.2.3.5. Measure 18 West End Back Barrier Herbaceous Dune Plant Restoration

**Description:** This measure, as shown in Figure 17, would vegetate approximately 21 acres with roughly 120,000 native dune plants (Bitter Panicum, Sea Oats, and Gulf Bluestem) that are robust in helping stabilize dunes. In addition, roughly 19,000 feet of sand fencing would be incorporated to further capture windblown sand and promote additional dune growth.



Figure 17. West End Back Barrier Herbaceous Dune Plant Restoration Measure

**Costs:** The estimates for initial construction costs are \$1.5 million. No long term maintenance cost outside of 3 percent total project costs for monitoring and adaptive management are included. The summary of costs for this restoration measure are provided in Table 13 below.

Borrow Source Options	Initial Construction Cost (\$ million)	20-Year O & M Costs (\$ million)	50-Year O & M Costs (\$ million)
West End Backbarrier Herbaceous Dune Plant Restoration	\$1.5		
Monitoring and Adaptive Management (5% of initial project costs)	0.1		

Table 13. Present Value Costs for the West End Backbarrier Herbaceous Dune Plant Restoration

This estimate assumes no O&M costs are needed, but that monitoring would be used to assess performance. Replacement of dead plants during the warranty period is included in the construction

#### 3.1.2.4. Land Acquisition Measures

The Interim Report identified numerous land acquisitions intended to serve as important habitat conservation and protection actions. The project team determined that 11 of the land acquisitions identified in the Interim Report should be further evaluated as potential restoration measures to be considered individually or in combination with other measures. The Interim Report grouped each of the interim projects into one of three groups based on the results of evaluations conducted by a multi-agency support panel. "Group 1" projects were those projects that most strongly satisfied the evaluation criteria. Land acquisitions identified as "Group 2" projects were less clear in the benefits they would provide. This was generally because these land acquisitions were considered too fragmented to substantially provide a benefit to the ecosystem, or because they were thought to already provide their highest ecological capacity and that was unlikely to change. None of the 11 land acquisitions evaluated in this final report were identified as "Group 3" projects.

A method for further assessing the performance of the individual land acquisitions was developed as part of the structured decision making alternative assessment tool developed for this study, as described in Task 6.2 of the main report. Refinements or updates to the land acquisition costs were not made since the interim report. Descriptions of the land acquisition costs are provided in the sections below.

**3.1.2.4.1.** West End Land Acquisition (Interim Project ID #17) Description: The proposed project consists of the acquisition and conservation of approximately 720 acres west of Katrina Cut as shown in Figure 18.



Figure 18. West End Land Acquisition

**Cost:** The estimated land acquisition cost as submitted by Mobile Baykeeper in the Alabama Coastal Restoration Portal, and vetted by USACE real estate staff, is \$10 million with an O&M cost of \$5,000 per year over a 10 year period.

#### 3.1.2.4.2. Mid-Island Land Acquisition and Management Phase I (Interim Project ID #3)

**Description:** The proposed project consists of the acquisition and conservation of approximately 10 acres of undeveloped beach and dune habitat located west of the public fishing pier (as shown in Figure 19) and includes the provision of enhanced controlled public access.



Figure 19. Mid-Island Land Acquisition and Management Phase 1

**Cost:** The estimated land acquisition cost, as determined by USACE real estate staff, is approximately \$2.5 million and there are no estimated O&M costs.

## 3.1.2.4.3. U.S. Coast Guard Property Acquisition (Interim Project ID #21)

**Description:** The U.S. Coast Guard (USGS) operated a recreational facility on the southeastern side of Dauphin Island until the housing facilities were destroyed by hurricanes in 2005-2007. The property is no longer needed by the USCG and is in the process of being disposed by the General Services Administration (GSA) Public Building Service. The approximately 7.5-acre parcel (as shown in Figure 20) which fronts the Gulf of Mexico is bounded on the east by the Dauphin Island Sea Lab (DISL), on the west by the Dauphin Island Bird Sanctuary, and on the north by the Dauphin Island Park and Beach Board Campground.



Figure 20. U.S. Coast Guard Property Acquisition Location

**Cost:** The estimated land acquisition cost, as determined by USACE real estate staff, is \$2.5 million and there are no estimated O&M costs.

#### 3.1.2.4.4. Dauphin Island 39 Parcel Property Acquisition: Parcel A – West End (Interim Project ID #22a)

**Description:** This project consists of the acquisition of approximately 518 acres on the west end of Dauphin Island along the Mississippi Sound as shown in Figure 21. The majority of this acreage is open water within the Mississippi Sound which is devoid of vegetative habitats. The remainder encompasses approximately 87 acres of the north side of the island beginning at St. Stephen Street and extending west to the end of Bienville Boulevard. These areas are characterized as overwash sand abutting residential properties. Some of the areas are vegetated with low dune vegetation, others are ponds created to obtain sand during the Deepwater Horizon Oil Spill.



Figure 21. Dauphin Island 39 Parcel Property Acquisition: Parcel A – West End Location

**Cost:** The estimated land acquisition cost, as developed by USACE real estate staff, is approximately \$900,000 and there are no estimated O&M costs.

#### 3.1.2.4.5. Dauphin Island 39 Parcel Property Acquisition: Parcel B – Graveline Bay (Interim Project ID #22b)

**Description:** The Graveline Bay acquisition area includes 6 parcels comprising 340 acres of wetland and open water habitat south and west of the southern edge of the Dauphin Island Airport runway to the vicinity of Pineda Street (see Figure 22 for location). No residential or commercial properties are included in this area.



Figure 22. Dauphin Island 39 Parcel Property Acquisition: Parcel B – Graveline Bay Location

**Cost:** The estimated land acquisition cost, as developed by USACE real estate staff, is approximately \$400,000 and there are no estimated O&M costs.

# 3.1.2.4.6. Dauphin Island 39 Parcel Property Acquisition: Parcel C – Aloe Bay (Interim Project ID #22c)

**Description:** This project consists of the acquisition of approximately 76 acres of shallow open water habitat in the Aloe Bay area of Mississippi Sound adjacent and north east of the Dauphin Island Airport runway (as shown in Figure 23). This acquisition was considered a Group 2 project in the Interim Report because of the uncertainty associated with the benefits that would accrue, above what is currently provided, due to conservation.



Figure 23. Dauphin Island 39 Parcel Property Acquisition: Parcel C – Aloe Bay Location

**Cost:** The estimated land acquisition cost, as developed by USACE real estate staff, is approximately \$100,000 and there are no estimated O&M costs.

#### 3.1.2.4.7. Dauphin Island 39 Parcel Property Acquisition: Parcel D – Little Dauphin Island Bay (Interim Project ID #22d)

**Description:** This project consists of the acquisition of approximately 150 acres of shallow open water habitat in the in Little Dauphin Bay and Mississippi Sound including a portion of the disposal area for maintenance of the federally authorized Government Cut Channel (see Figure 24). This portion of the property is maintained against erosion through the routine placement of this material.



Figure 24. Dauphin Island 39 Parcel Property Acquisition: Parcel D – Little Dauphin Island Bay Location

**Cost:** The estimated land acquisition cost, as developed by USACE real estate staff, is approximately \$200,000 and there are no estimated O&M costs.

#### 3.1.2.4.8. Dauphin Island 39 Acquisition: Parcel E – East End (Interim Project ID #22e)

**Description:** This project consist of the acquisition of five separate parcels of undeveloped land on the east end of the island, comprising approximately 4 acres total (see Figure 25). Four of the properties are located in the commercial area of the island north of Bienville Blvd. The fifth property is located on the north side of the main dune system in the vicinity of the golf course.



Figure 25. Dauphin Island 39 Parcel Property Acquisition: Parcel E - East End Location

**Costs:** The estimated land acquisition cost, as developed by USACE real estate staff, is approximately \$620,000 and there are no estimated O&M costs.

# 3.1.2.4.9. Tupelo Gum Swamp Land Acquisition (Interim Project ID #18)

**Description:** The proposed project consists of the acquisition and conservation of up to 10 acres of gum swamp located within the center of the widest part of Dauphin Island. This "Tupelo Gum Swamp" is located between several dead-end roads branching off Iberville Drive and Hernando Street on the widest part of the island south of Bienville Boulevard (see Figure 26). Twenty platted lots total approximately 10 acres containing substantial wetlands populated by tupelo gum trees, saw palmetto, and pines interspersed with ponded freshwater wetlands.



Figure 26. Tupelo Gum Swamp Land Acquisition Location

**Cost:** The estimated land acquisition cost, as determined by USACE real estate staff, is approximately \$700,000 and there are no estimated O&M costs.

#### 3.1.2.4.10. Gorgas Swamp Land Acquisition (Interim Project ID #19)

**Description:** The proposed project consists of the acquisition and conservation of approximately 10 acres identified as the "Gorgas Swamp" (see Figure 27). This swath of wetlands east of the Tupelo Gum Swamp (Project ID #18) is centered on Gen. Gorgas Street between the main dunes and Gen. Gaines Place. Twenty platted lots totaling approximately 10 acres contain substantial wetlands populated predominately by tupelo gum trees. To date, three of the 20 lots have been purchased for conservation by the Dauphin Island Bird Sanctuary. Currently, this area is being destroyed by excessive all-terrain vehicle traffic, which compacts the soil, generating ruts and gullies that serve to drain the water off the surface thus interrupting the hydrologic cycle that is critical to maintenance of this unique habitat.



Figure 27. Gorgas Swamp Land Acquisition Location

**Cost:** The estimated land acquisition cost, as determined by USACE real estate staff, is approximately \$700,000. Minimal costs, estimated to be less than \$5,000, for gates and/or signage would be required to curtail continued all-terrain vehicle use and associated damage.

#### 3.1.2.4.11. Steiner Property Acquisition (Interim Project ID #20)

**Description:** The Steiner Property is a parcel left largely untouched during the initial development of the island in the 1950s. The property consists of a swath of wetlands on the north side of Bienville Boulevard between Grant and Fort Conde Streets and runs northward with the northern boundary being the main portion of Dauphin Island Bay (see Figure 28). Only two lots on the entire property have been developed and five parcels have been purchased for conservation by the Dauphin Island Bird Sanctuary.



Figure 28. Steiner Property Acquisition Location

**Cost:** The estimated land acquisition cost, as determined by USACE real estate staff, is approximately \$600,000 and there are no estimated O&M costs.