Edisto Beach, South Carolina Coastal Storm Risk Management Project Validation Report

US Army Corps of Engineers ®
Charleston District

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1. Purpose

1.1 Study Purpose

The purpose of this report is to validate the modified project (authorized project without the inlet reaches) is economically justified, environmentally acceptable and feasible from an engineering perspective (also referred to as the three E's). For the purposes of this validation report, the modified project consists of the 2014 recommended plan as described in the Chief's Report dated 5 September 2014 minus the construction of the two inlet reaches. The two inlet reaches begin at the southern end of the project, with a dune that would transition from an elevation of 15-ft to 14-feet NAVD 88 and a top width of 15-feet that extends around the end of the island for 5,290 feet. This validation report will be used to document the analysis to determine if the modified project (authorized project minus the inlet reaches) meets the three E's and if it is within the Chief's discretionary authority for approval by the MSC Commander.

1.2 Project Purpose

The authorized purpose is for hurricane and storm damage reduction. The authorized plan will reduce coastal storm damages to buildings and other infrastructure in the Town of Edisto Beach, South Carolina; protect the only evacuation route; protect important sea turtle and shorebird habitat; and preserve existing recreational opportunities along Edisto Beach. It has the full support of the local sponsor and stakeholder agencies (US Army Corps of Engineers, 2014).

2. Authority

2.1 Study Authority

The Edisto Beach CSDR Feasibility Study was conducted in response to a resolution adopted on April 22, 1988, by the Committee on Environment and Public Works of the United States Senate:

> "*Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army in accordance with the provisions of Section 110 of the River and Harbor Act of 1962, is hereby authorized to study, in cooperation with the State of South Carolina, its political subdivisions and agencies and instrumentalities thereof, the entire Coast of South Carolina in the interests of beach erosion control, hurricane protection and related purposes. Included in this study will be the development of a comprehensive body of knowledge, information, and data on coastal area changes and processes for such entire coast.*"

2.2 Construction Authority

The Project was authorized for Construction in Public Law (P.L.) 114-322 on 16 December 2016. Construction funds were appropriated in the Bipartisan Budget Act of 2018 (P.L. 115-123, Title IV). The Bipartisan Budget Act of 2018 (BBA18) appropriated supplemental funding for disaster recovery projects that have been previously authorized.

3. Project Location

Edisto Island is a barrier island located at the mouth of the South Edisto River in Colleton County, South Carolina, approximately 20 miles southwest of Charleston, South Carolina and approximately 50 miles northeast of Savannah, Georgia (Figure 1). The incorporated Town of Edisto Beach is located on the southern end of the island and Edisto Beach State Park is located on the northern end of the island. Edisto Beach encompasses approximately 6 miles of shoreline, all of which were studied in the 2014 Feasibility Report.

Figure 1. Edisto Beach, South Carolina

3.1 Description of Authorized Project

The authorized plan is the National Economic Development (NED) Plan to reduce hurricane and storm damages by constructing a beach fill and limited groin extensions along the shoreline of Edisto Beach, SC. The recommended plan for hurricane and storm damage reduction includes construction of a dune to an elevation of 15-feet North American Vertical Datum 1988 (NAVD 88) and top width of 15-feet beginning at the northern end of the project and extending southward along the beach for 16,530 feet. This dune would be fronted by a berm at an elevation of 7-feet NAVD 88. The first 7,740 feet of berm length would have a width of 75 feet. The width would taper to 50-feet over the remaining length of the berm. The width of each end of the berm would taper to match the existing beach profile. Beginning at the

southern end, the dune would transition to an elevation of 14-feet NAVD 88 and a top width of 15-feet that extends around the end of the island for 5,290 feet. No berm was authorized in front of this dune because the existing beach profile provides an adequate berm (see Figure 2). There would also be constructed approximately 1,130 ft of total groin lengthening across 23 of the existing groins, with an average lengthening of approximately 50-feet within a range of 20-feet to 100- feet per groin.

Figure 2. Reaches in the Edisto Beach CSDR Authorized Project.

4. Changed Conditions since Authorization (Existing Conditions)

4.1 Town of Edisto Beach Restoration Project (2017)

4.1.1 Overview

Protracted beach erosion has occurred at Edisto Beach since project authorization (2014) along with impacts from 3 named tropical storms and two federally declared coastal storm disasters (Robert T. Stafford Disaster Relief and Emergency Assistance Act Pub. L. § 100, 707 U.S.C. 102, FEMA, 2016 and FEMA 2017). As a result, non-Corps emergency funding was made available to the Town of Edisto Beach to restore the beach profile back to pre-2016 hurricane season levels and to lengthen the groins. The design described in the Authorized

Project was used, when possible, for both the beach and lengthening of the groins. However, some of the groins were extended longer than authorized. The contractor's final report for the 2017 Town of Edisto Beach Project is included as Appendix C for reference.

4.1.2 Beach Restoration

In 2017 the Town of Edisto Beach completed a beach restoration project using non-Corps emergency funding. The beach restoration consisted of 1,006,000 CY of material from the authorized borrow area (Figure 6) and placed on the shoreline for a total length of 19,300 linear feet. Of the total quantity, 850,000 CY of sand was placed on the ocean facing side of the authorized project and not on the inlet reaches. The 2017 Town of Edisto Beach Project featured a 7ft berm, ranging from 55 to 165ft wide, with a 1:10 slope (Figure 7) and did not consist of any dunes. This sand placement restored the beach to the 2016 pre-storm conditions which were very similar to the existing condition profile used in the Beach-fx model for the 2014 Feasibility Study.

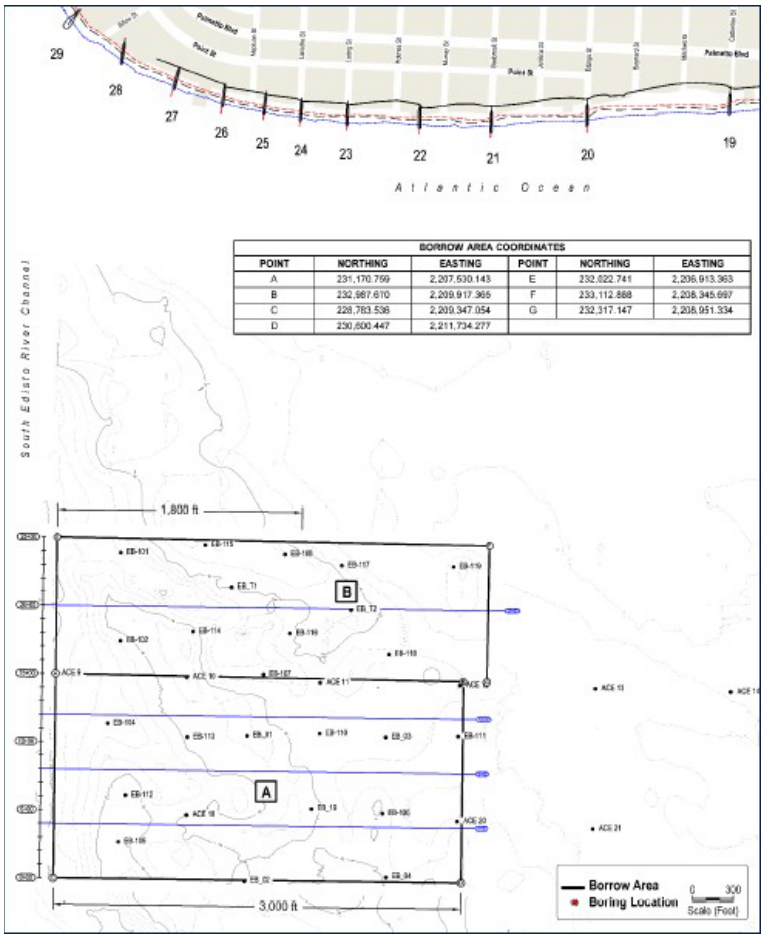


Figure 3: Borrow Area for the 2017 Town of Edisto Beach project

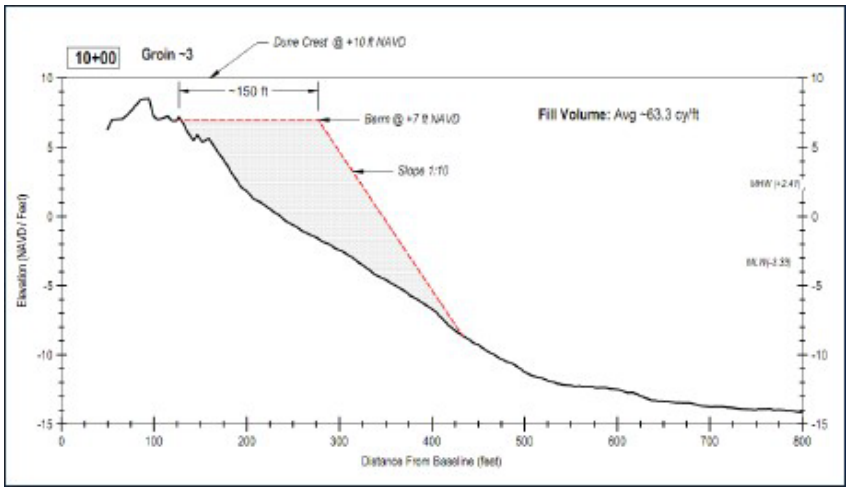


Figure 4: Representation of the Beach Profile Constructed in the 2017 Town of Edisto Beach Project

4.1.3 Lengthening of Groins

The groin designs in the 2017 Town of Edisto Beach Project were extended based on the length of Groin 16, which was determined to have the ideal length for trapping sand on Edisto Beach. Groins were extended using sheet pile or armor stone, and lengthening ranged between 20ft and 100ft. Groins were constructed using fiberglass-reinforced vinyl composite sheet pile, marine mattresses, armor stone, and concrete. Figure 4 is a representation of the groins lengthened in the 2017 Town of Edisto Beach project and their locations are represented in Figure 5. A comparison between groin length in the 2014 authorized project and the 2017 project is made in Table 1. The lengthening of the existing groins completed by the sponsor met or exceeded specification in the Authorized Project. The Charleston District conducted an initial analysis of the 2017 lengthening of the existing groins completed by the non-Federal sponsor and indicated the lengthened groins will function as authorized and that construction met or exceeded specifications described in the 2014 Edisto Beach CSDR Feasibility Study.

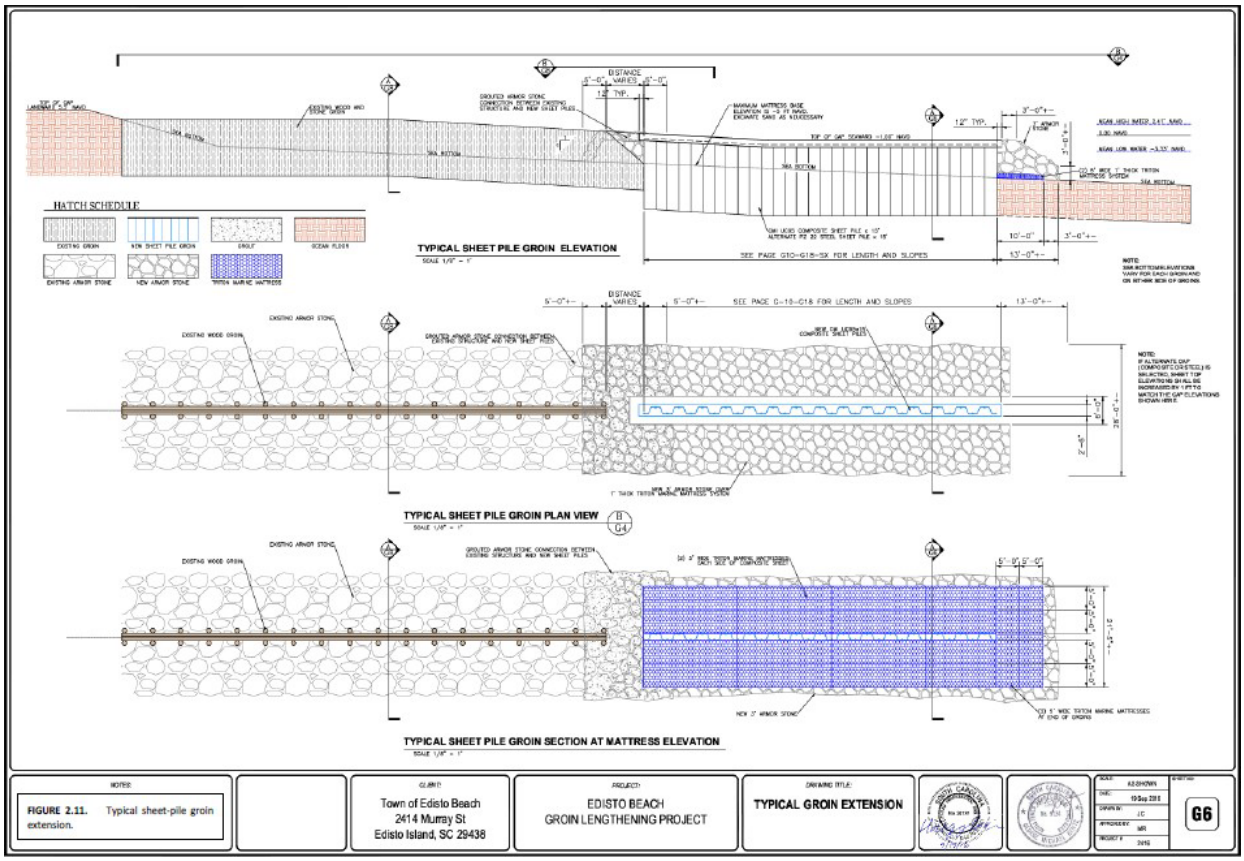


Figure 5: Representation of the Groins Lengthened in the 2017 Town of Edisto Beach Project

Table 1. Comparison of Groin Lengthening in the 2017 Town of Edisto Beach Project and the Authorized Project

Groin #	USACE Authorized Project Extension length (ft)	2017 Extension length
1	80	90
2	80	85
3	90	90
4	90	90
5	100	100
6	100	100
7	80	90
8	60	90
9	50	95
10	50	95
11	40	95
12	40	45
13	40	90
14	30	65
15	20	40
16	20	20
17	20	20
18	20	40
19	0	0
20	20	40
21	30	30
22	30	30
23	20	30
24	20	30
25	0	40
26	0	50
27	0	50
Total	**1,130**	**1,640**

4.2 Town of Edisto Beach Request for Removal of Inlet Reaches

After the Charleston District received BBA 2018 funds to construct the authorized Edisto Beach CSRM Project, the non-Federal sponsor requested the authorized dune in inlet reaches not be constructed and removed from the project. The Charleston District completed a previous analysis in 2016 which concluded that the costs and benefits estimated for the authorized dunes located in the inlet reaches did not provide a positive return on National investment and the inlet reaches could be considered a separable element. The discussion in a letter from OMB to the ASA(CW) codifies that Army has concluded that the Inlet segment could be considered a separable element of the Edisto Beach project (see Appendix C). By removing the authorized improvements along the inlet reaches, the project will be modified, and this validation report focuses on what will be referred to as the "modified project, as represented in Figure 6.

No significant design changes are needed to construct the Modified Project and to receive the authorized level of performance. The benefit-cost-ratio for the modified project was validated using the 2014 authorized benefits for the remaining reaches along with the updated certified costs.

Figure 6: Modified Project Showing Removal of Inlet Reaches

5. Modified Project Description

The 2022 Modified Project is the 2014 Authorized Project minus the construction of the dunes for the two inlet reaches. See Table 2 below for a comparison of the 2014 Authorized Project and the 2022 Modified Project.

The 2017 Town of Edisto Beach Restoration Project completed by the non-Federal sponsor is considered the existing conditions for the analysis in this validation report. The following sections describe proposed modifications, updated cost, revised economics, and validation of the 2014 environmental analysis of the modified project. No other aspects of the project were assessed, as they are not impacted by the modifications.

Initial construction of the modified project, anticipated in late 2025 calls for 929,000 CY of sand to be used to build a protective dune and berm. Over the 50-year period of analysis, it is estimated that 476,000 CY of sand is needed for renourishment of the dune and berm in 3 separate events in 16-year intervals. The borrow area is described in the Authorized Project and it is believed to contain enough beach quality sand to provide the necessary quantities for the 50-year period of analysis that was evaluated in the 2014 Feasibility Report.

Lengthening of the groins are an essential feature for the performance of the Federally Authorized project. Since they were completed as part of the 2017 Town of Edisto Beach Restoration project by the non-Federal sponsor they are considered an existing condition. The lengthening of the groins is vital for successful project performance and an essential factor in

determining the nourishment cycles (derived by Beach-fx) for the project. The Charleston District's assessment confirmed that the lengthening of the groins were constructed to USACE standards and guidelines. In order for the groin extensions to become a Federal feature (accepted into the project and be eligible for P.L. 84-99) a separate action outside of this validation study and report needs to be taken to verify this assumption.

Table 2 summarizes these changes between the modified project and the Authorized Project.

Table 2. Summary of Construction Modifications to Authorized Project

Project Components	**2014 Authorized Project**	**Town of Edisto Beach 2017 Restoration Project**	**2022 Validation Report (Modified Project)**
Sand Placed, Initial Construction	924,000 CY	850,000 CY	929,000 CY
Sand Placed/ Renourishment	476,000 CY	-	476,000 CY
Dune, Inlet Reaches	• 4 inlet reaches • EL = 14ft NAVD 88 • Top width = 15ft • Length = 5,290ft	-	• 2 inlet reaches • EL = 14ft NAVD 88 • Top width = 15ft • Length = 1,046ft
Dune, Shoreline Facing	• EL = 15ft NAVD 88 • Top Width = 15ft • Length = 16,530ft • Taper to existing profile at each end	-	• EL = 15ft NAVD 88 • Top Width = 15ft • Length = 16,530ft • Taper to existing profile at each end
Berm, All Other Reaches	7,740' L x 75'W x 7' H narrowing to 8,790' L x 50' W x 7' H	To match pre-2016 storm conditions	7,740' L x 75'W x 7' H narrowing to 8,790' L x 50' W x 7' H
Berm Tapers, All Other Reaches	Ends of tapers will match beach profile	-	Ends of tapers will match beach profile
Groin Lengthening	1,130' across 24 groins	1,640' across 27 groins	1,130' across 24 groins (construction complete; pending acceptance into federal project)

6. Changes in Scope, Purpose, Location, Real Estate, and Design

The Chief of Engineers' discretionary authority to approve changes to authorized projects is delegated to the Division Commander provided the change(s) meet all of the criteria set forth in ER 1105-2-100, Appendix G, Paragraph G- 13.a. All of the criteria are met with regard to the change deleting the inlet reaches. Project scope, whether measured in terms of average annual benefits, project cost, or the quantity of sand needed for initial construction, will have changed by less than 20% (see further discussion below). Accordingly, the scope of this project modification is within the delegated discretionary authority of the Division Commander.

6.1 Change in Scope

The scope of the project has changed since the Chief's Report was signed on 5 September 2014. The Town of Edisto Beach has requested removing the inlet reaches 1 and 2. The

project delivery team assessed the impacts of removing the inlet reach from the Authorized Project.

6.2 Change in Purpose

The authorized project purpose is coastal storm risk management, and the modified project does not change the authorized project purpose.

6.3 Change in Location

The project footprint is the same on the ocean facing reaches and the modified project removes the inlet reaches. Therefore, the location of the inlet reaches is removed from the project.

6.4 Change in Real Estate

The requirements for lands, easements, rights-of-way, relocations, and disposal/borrow areas (LERRDs) to construct a dune and berm system along the shoreline of Edisto Beach within the project limits is consistent between the Authorized Project and the Modified Project. The NFS must secure and certify to USACE Perpetual Storm Damage Reduction Easements and Temporary Work Area Easements for lands required for project purposes. Land above the mean high-water line where the landward toe of the beach fill material will be placed requires a Perpetual Storm Damage Reduction easement. The location of proposed work area is owned by the NFS and requires certification of a Temporary Work Area easement. Should any State of SC documents be issued for submerged lands such as a borrow area, this is considered a non-standard estate and will require approval from USACE HQ prior to acceptance and use for project purposes. An examination of project maps indicates that there are 159 parcels in the modified project that intersect with the construction line. A small subset of landowners is concerned about perpetual easements. The Town is supportive, and willing to educate landowners, and gather necessary easements. No utilities or facility relocations will be required. Temporary work easements are not required, as the staging area is owned by the sponsor.

Current public access and parking was compared with that in the Authorized Project. A survey was conducted by the Town of Edisto Beach in February 2020 that confirmed public parking spaces and access points have remained consistent with the Authorized Project validating that benefits have not been limited by changes in public parking. Cost estimates for validation purposes also include estimated land costs for staging areas and federal and non-federal administrative costs. The Modified Project costs includes a 25% contingency for real estate. The real estate costs for the Authorized Project were estimated at $989,000 using FY13 pricing. Based on project maps, the real estate costs for the Modified Project using FY21 pricing is estimated to be $922,000.

6.5 Change in Design

Coastal conditions as described in the last approved report were verified by Engineering Division to be substantially unchanged. The 2017 sand placement conducted by the sponsor restored the beach to the existing condition as described and modeled in the 2014 Feasibility Report. A minimum groin length is necessary to support the nourishment interval. In cases where groins were lengthened beyond specifications provided in the Authorized Project, the USACE Regulatory Division found no impacts to the intent of the authorized project. Engineering did not find changes in the site conditions that warranted re-running of Beach-fx or altering the design template. Any design changes henceforth would be conducted as part of the PED process and are expected to be minimal.

6.6 Change in Sand Quantity Required

The total quantity of sand in the Authorized Project was approximately 924,000 CY for the initial construction, as derived from Beach-fx during the 2014 feasibility study. The volume currently required for the modified project is approximately 929,000 CY and was derived using the typical construction profile designed in the 2014 feasibility study overlaying it with survey data obtained in 2018 and 2020. These changes in sand amounts accounts for changes in beach profile since the Feasibility Study. The change in quantity of sand for initial construction is 0.5%. The sand quantities required per periodic renourishment were derived from the Beach-fx Coastal Engineering Modeling Software and will remain 476,000 CY as described in the Authorized Project.

7. Changes in Project Cost

7.1 Authorized Project Cost

Based on the 2014 price level, the estimated total cost of the authorized plan is $53,871,000, which includes the project first cost of initial construction of $21,129,000 and a total of three periodic nourishments at a total cost of $32,742,000. Table 3 presents Authorized Project cost. The total initial construction costs of the Modified Project are based on the cost of beach replenishment; lands and damages; planning, engineering & design; and construction management.

Table 3. Authorized Project Annual Costs at FY 2014 Price Level

Initial Construction	$21,129,000
1st Periodic nourishment	$10,914,000
2nd Periodic nourishment	$10,914,000
3rd Periodic nourishment	$10,914,400
Total First Cost	$53,871,000
Average Annual First Cost	$1,418,000
O&M	$83,000
Total Average Annual Cost	$1,501,000

7.2 Modified Project Cost

Based on October 13, 2013 pricing, the total cost of Initial Construction of the Authorized Project was $21,129,000. Excluding the repair and extension of the groins, the cost is $18,268,740. The cost of building the dune in the Inlet Reaches is approximately $1,633,744. Removing these reaches would decrease the total cost (based on October 2013 pricing) by 8.94 %. This percentage is compared to the price minus the groin lengthening.

To generate costs for the dredging and placement of the material, it was assumed that a 30” hydraulic pipeline dredge would be utilized. This type of dredge was used due to the proximity of the borrow area to the beach where the material is to be placed. The beach vegetation was

assumed to require 30 acres of planting for initial construction and 15 acres of planting for each periodic nourishment cycle. The unknowns for this project include the ability of the sponsor to obtain easements, the quantity of material required when the project is constructed and the availability of adequate competition for an acceptable bidding climate. Due to the types of equipment required, the acquisition strategy was assumed to be full and open for large contractors.

Due to the relatively short durations for the initial construction (3 months) and periodic nourishment cycles (a little over 1 month), a detailed construction schedule was not prepared. However, utilizing input from the PDT, a preliminary schedule was assumed with initial construction to begin late 2025. A 16-year period was calculated between nourishment cycles by Coastal Engineering resulting in 3 cycles through the 50-year life of this project. Since a hydraulic pipeline dredge was assumed to be used for construction, the only environmental restriction is the requirement for sea turtle nest observers during the period from April through October. Costs were included for these observers in the cost estimate and therefore construction can take place anytime during the year. The preliminary project schedule was used for the generation of the Total Project Cost Summary (TPCS), as well as the schedule portion of the Cost and Schedule Risk Analysis (CSRA). The construction schedule will change as the project moves through the various project lifecycle phases

Total project cost estimates for FY22 were used for the following calculations, based on instructions found in Section B-4-4 of EC 11-2-222 (31-March 2020). Tables 5 and 6 display the cost of periodic nourishments normalized to 2014 price level of the last approved report at the OMB 7% discount rate, FY22 discount rate (of 2.25%), project rate 3.5%, and the applicable rate 4%. These costs were normalized to 2014 price level using the Civil Works Construction Cost Index System (CWCCIS) quarterly cost indexes from the March31, 2022 report (US Army Corps of Engineers, 2022). Table 6 summarizes the remaining project costs (50 years remaining Federal participation through 2073)

A cost-schedule risk analysis was performed and resulted in a 22% contingency for the initial construction, and a 29% contingency for the periodic renourishments. High risk factors included the dredge equipment used, sand quantities needed, market conditions, and contract modifications or claims.

Table 4. Total Project Cost Summary

Event	Year	Project Year	Base Cost	Oct 2013 Price Level PV @2.25%	Oct 2013 Price Level PV @3.5%	Oct 2013 Price Level PV @4%	Oct 2013 Price Level PV @7.0%
Initial Construction	2025	0	$ 28,367,000	$23,571,934	$23,571,934	$23,571,934	$23,571,934
1st Renourishment	2041	16	$ 15,660,000	$9,115,080	$7,504,607	$6,947,685	$4,407,914
2nd Renourishment	2057	32	$ 15,660,000	$6,384,802	$ 4,327,951	$3,709,426	$1,493,113
3rd Renourishment	2073	48	$ 15,660,000	$4,472,335	$2,495,955	$1,980,493	$505,769
Total Project Cost			$ 75,347,000	$43,544,151	$37,900,448	$36,209,538	$29,978,730
IDC				$79,882	$124,347	$142,150	$249,178
Av. Annual Cost				$1,462,206	$1,621,138	$1,692,178	$2,190,310

Notes: Average Annual Cost includes interest during construction (IDC)

Table 5. Remaining Project Cost Summary

Event	Year	Project Year	Base Cost	Oct 2013 Price Level PV @2.25%	Oct 2013 Price Level PV @3.5%	Oct 2013 Price Level PV @4%	Oct 2013 Price Level PV @7.0%
Initial Construction	2025	0	$ 28,145,000	$23,387,460	$23,387,460	$23,387,460	$23,387,460
1st Renourishment	2041	16	$ 15,660,000	$9,115,080	$7,504,607	$6,947,685	$4,407,914
2nd Renourishment	2057	32	$ 15,660,000	$6,384,802	$4,327,951	$3,709,426	$1,493,113
3rd Renourishment	2073	48	$ 15,660,000	$4,472,335	$2,495,955	$1,980,493	$505,769
Total Project Cost			$ 75,125,000	$43,359,678	$37,715,974	$36,025,064	$29,794,256
IDC				$79,257	$123,374	$141,038	$247,228
Av. Annual Cost				$1,456,002	$1,613,232	$1,683,539	$2,176,801

Notes: Average Annual Cost includes interest during construction (IDC)

8. Changes in Project Benefits

8.1 Previously Approved Benefits

Storm damage reduction benefits and recreation benefits from the 2014 Chief's Report were calculated at the discount rate of 3.5% based on FY14 price level. Costs and BCR from the 2014 Chief's Report are shown in Table 4.

Table 6. Summary of Average Annual Benefits from 2014 Chief's Report

Storm Damage Reduction Benefits	**$ 2,894,000**
Recreation Benefits	**$ 573,200**
Average Annual Benefits	**$ 3,467,200**
Average Annual Costs	**$ 1,501,000**
Benefit to Cost Ratio	**2.3**
Net Average Annual Benefits	**$ 1,966,200**

8.2 Modified Project Benefits

A level 1 economic analysis was performed to assess the benefits of the modified project if the inlet reaches were removed. After consulting with SAD Senior Economist and Regional Economists, it was concluded that subtracting the benefits attributable to Reaches 1 and 2 from the total average annual coastal storm damage reduction (CSDR) benefits was a more accurate measure of project benefits for the Modified Project.

The total average annual CSDR benefits calculated for the Authorized Project is $2,894,000 at the 2014 price level. The CSDR benefits attributable to the Inlet Reaches is $425,418 or 14.7% of the total. Removing these reaches decreases the average annual benefit by 14.7%. For the BCR computation, benefits were prorated according to the remaining benefits excluding the Inlet Reaches. The average annual CSDR benefits applicable to this Validation Report are $2,468,582.

8.3 Economic Benefit Assumptions

A key assumption for validation of CSRM projects is that the original project average annual benefits will be held constant over the project life. The benefits are held constant assuming all other economic conditions are met. If economic conditions change significantly, that will trigger an update higher than a Level 1 update. Market values were used in validation to verify the current economic conditions. Depreciated replacement values are not required to verify economic conditions for a Level 1 update.

8.4 Inventory of Structures

The primary National Economic Development (NED) benefits come in the form of storm damage reduction benefits, which are based on the number and value of property and contents within the project area located close to the shoreline. The current structural inventory was compared to that included in the 2014 Chief's Report (US Army Corps of Engineers, 2014).

To update the approximated total market value of the City's front beach structures, the Town of Edisto Beach Tax Assessor's records on the current inventory and value of structures in 2014 and 2018 were examined. Data obtained from the non-Federal Sponsor in April 2022 revealed that currently there are 760 oceanfront properties on Edisto Beach. The total estimated value of structures in 2014 was about $77,851,500, and $104,195,885 in 2022, a 30 percent increase in value in four years. A letter obtained from the Town of Edisto Beach confirms that since 2014 all property within the project area is in good repair. Since 2014, three new structures have been built; eight structures have been demolished and rebuilt at higher value; two structures have been demolished and under construction; and four structures have been demolished and are currently vacant. None of the developments that have occurred will

materially alter the assumptions that framed and supported the 2014 Chief's Report. Current vacant land may be developed in the near future, which would likely increase benefits.

8.5 Recreation

Hurricane and storm damage reduction benefits are the only allowable benefits to be reported in this Economic Update. Recreation benefits are included here for historical reference only. The last approved report (2014 Chief's Report) lists average annual recreation benefits as $573,200.

8.6 Updated BCR and RBRCR

The benefit cost ratio (BCR) and the remaining benefit and remaining cost ratio (RBRCR) were updated following instructions in Section B-4-4 of recently issued guidance memorandum EC 11-2-222 dated March 31, 2020. The prescribed discount rates in the guidance are the OMB rate of 7%, the current FY22 discount rate of 2.250 which is defined as the rate in effect when construction funds were first appropriated for Edisto Beach. In addition, computations were done based on the last approved report's discount rate of 3.5% since the benefits are derived from the last approved report. A benefit to cost ratio for the total project was computed for this economic update using total project cost estimates for FY22 and sunk cost. The costs used to calculate the total average annual cost used in the benefit to cost ratio were normalized to Oct 2013 price level to be consistent with the benefit stream of the last approved report.

The Modified Project BCR for with and without recreation is presented in Tables 7 and 8, respectively. For the Modified Project computations, benefits were prorated by subtracting CSDR benefits attributable to the Inlet Reaches from the total project CSDR benefits. Tables 9 and 10 provide the RBRCR for without and with recreation, respectively. The summary format of BCR and RBRCR updates in the guidance are shown in Tables 11 and 12, respectively, for the OMB 7% discount rate and 4% applicable rate for the fiscal year of the appropriation of construction funds.

Table 7. Total Project Benefit to Cost Ratio (with recreation benefits)

	FY20 Discount Rate at Price Level of Chief's Report	OMB Discount Rate at Price Level of Chief's Report	Last Approved Report Discount Rate
Price Levels	Oct. 2013	Oct. 2013	Oct. 2013
Discount Rate	2.25%	7.00%	3.50%
Year of Discount Rate	FY2022	OMB	FY2014
Annual Cost* (Oct 2013 price level)	$ 1,558,432.01	$ 2,286,535.66	$1,717,364
Total Annual Benefits (Oct 2013 price level)	$3,041,782	$3,041,782	$3,041,782
Net Benefits	$1,483,350	$755,246	$1,324,418
BCR	1.95	1.33	1.77

*Annual Cost includes O&M cost of $96,226.

Table 8. Total Project Benefit to Cost Ratio (without recreation benefits)

	FY20 Discount Rate at Price Level of Chief's Report	OMB Discount Rate at Price Level of Chief's Report	Last Approved Report Discount Rate
Price Levels	Oct. 2013	Oct. 2013	Oct. 2013
Discount Rate	2.25%	7.00%	3.50%
Year of Discount Rate	FY2022	OMB	FY2014
Annual Cost* (Oct 2013 price level)	$1,558,432.01	$2,286,535.66	$1,717,364
Total Annual Benefits (Oct 2013 price level)	$2,468,582	$2,468,582	$2,468,582
Net Benefits	$910,150	$182,046	$751,218
BCR	1.58	1.08	1.44

*Annual Cost includes O&M cost of $96,226

Table 9. Remaining Benefits/Remaining Costs Ration (without recreation benefit)

	FY20 Discount Rate at Price Level of Chief's Report	OMB Discount Rate at Price Level of Chief's Report	Last Approved Report Discount Rate
Price Levels	Oct. 2013	Oct. 2013	Oct. 2013
Discount Rate	2.25%	7.00%	3.50%
Year of Discount Rate	FY2022	OMB	FY2014
Annual Cost (Oct 2013 price level)	$ 1,552,227.79	$ 2,273,027.41	$1,709,458
Total Annual Benefits (Oct 2013 price level)	$ 2,468,582	$ 2,468,582	$ 2,468,582
Net Benefits	$916,354	$195,555	$759,124
BCR	1.59	1.09	1.44

Table 20. Remaining Benefits/Remaining Costs Ratio (with recreation benefits)

	FY20 Discount Rate at Price Level of Chief's Report	OMB Discount Rate at Price Level of Chief's Report	Last Approved Report Discount Rate
Price Levels	Oct. 2013	Oct. 2013	Oct. 2013
Discount Rate	2.25%	7.00%	3.50%
Year of Discount Rate	FY2022	OMB	FY2014
Annual Cost (Oct 2013 price level)	$1,552,227.79	$2,273,027.41	$1,709,458
Total Annual Benefits (Oct 2013 price level)	$3,041,782	$3,041,782	$3,041,782
Net Benefits	$1,489,554	$768,755	$1,332,324
BCR	1.96	1.34	1.78

Table 3. Total Project Benefit Cost Ratio Update Summary (without recreation)

Project Name	Edisto Beach CSDR, General Investigation Study
Business Line	Coastal Storm Risk Management
District	South Atlantic Charleston (SAC)
BCR when initially authorized	2.3
Date when originally authorized	2014
Title of last approved report	Edisto Beach Colleton County, South Carolina, Coastal Storm Damage Reduction General Investigations Study.
Date of last approved report	September 2014
Type of Report	Validation Report
Approval Authority	HQ
Discount Rate from last approved report	3.5%
Annual Benefits from last approved report (Chief's Report)	$2,894,000
Annual Cost from last approved report	$1,501,000
Annual Cost from last approved report at 7%	Not Available
Discounted Annual cost from current estimate at 7%	$,2,286,536
Discounted Annual cost from current estimate at 4% (the applicable rate)	$1,788,404
BCR from last approved report	2.3
BCR from last approved report at 7%	Not Available
Modified Project BCR at 7%	1.08
Modified Project BCR at current discount rate of 2.25%	1.38

Price levels were adjusted to reflect price levels of benefits from the last approved report (FY14) using CWCCIS, dated 31 March 2022

Table 4. Remaining Benefit Remaining Cost Ratio Update Summary (without recreation)

Project Name	Edisto Beach CSDR, General Investigation Study
Business Line	Coastal Storm Risk Management
District	South Atlantic Charleston (SAC)
BCR when initially authorized	2.3
Date when originally authorized	2014
Title of last approved report	Edisto Beach Colleton County, South Carolina, Coastal Storm Damage Reduction General Investigations Study.
Date of last approved report	September 2014
Type of Report	Feasibility Report
Approval Authority	HQ
Discount Rate from last approved report	3.5%
Annual Benefits from last approved report (Chief's Report)	$2,894,000
Annual Cost from last approved report	$1,501,000
Annual Cost from last approved report at 7%	Not Available
Discounted Annual cost from current estimate at 7%	$2,273,027
Discounted Annual cost from current estimate at 4% (the applicable rate)	$1,779,765
BCR from last approved report	2.3
BCR from last approved report at 7%	Not Available
Modified Project BCR at 7%	1.09
Modified Project BCR at current discount rate of 2.25%	1.59
Price levels were adjusted to reflect price levels of benefits from the last approved report (FY14) using CWCCIS, dated 31 March 2022	

9. Environmental Compliance and Validation

USACE previously described the affected environment and evaluated environmental effects associated with the Edisto Island Coastal Storm Risk Management Project in the 2014 Final Feasibility Report and Environmental Assessment (FFR/EA) and determined the project would not result in impacts significant enough to warrant an EIS. USACE also evaluated environmental effects largely equivalent to Federal project in an Environmental Assessment and Finding of No Significant Impact (EA/FONSI) for the 2016 Section 10/404 permit issued to the Town of Edisto which authorized groin extension and beach nourishment activities along 3.6 miles of shoreline, including within the footprint of the Federal project. The modifications to the Federal project have been reviewed by USACE for environmental compliance and are not expected to result in any significant adverse environmental impacts as described by the National Environmental Policy Act of 1969 (NEPA), as amended. The conditions, project description, and environmental effects described in the 2014 FFR/EA are still valid, and

supplementation of the FFR/EA is not required per 40 CFR 1502.9(d) because substantial changes to the proposed action have not occurred, nor do the changes have significant bearing on the findings of the FFR/EA. This section is designed to provide supplemental information to document compliance with NEPA and the Council on Environmental Quality regulations (US Army Corps of Engineers, 2021).

9.1 Borrow Area

The 2014 EA identified one borrow area for the nourishment of Edisto Island. The sand borrow area for the project is an approximately 1 square mile portion of the ebb tide delta located about 2 miles offshore of the west side of the island (Figure 9). It contains approximately 7.2 million cubic yards of beach quality material. The curves in the northern and eastern corners of the borrow area are due to cultural resource avoidance areas associated with two potential sites of prehistoric interest. Both areas will be avoided using a buffer with a radius of 1,500 feet placed around the center points. No hardbottom habitat was found in the borrow area or within a quarter mile buffer surrounding the area. The proposed borrow area was narrowed down from a larger area containing about 30 million cubic yards of material. In 2008, the larger area was evaluated and characterized based on 77 cores taken at approximately 1,000 foot spacing throughout the site (CSE, 2008). No other potential borrow areas were considered because the selected borrow area contains an adequate quantity of beach quality material to nourish Edisto Beach over a 50-year period.

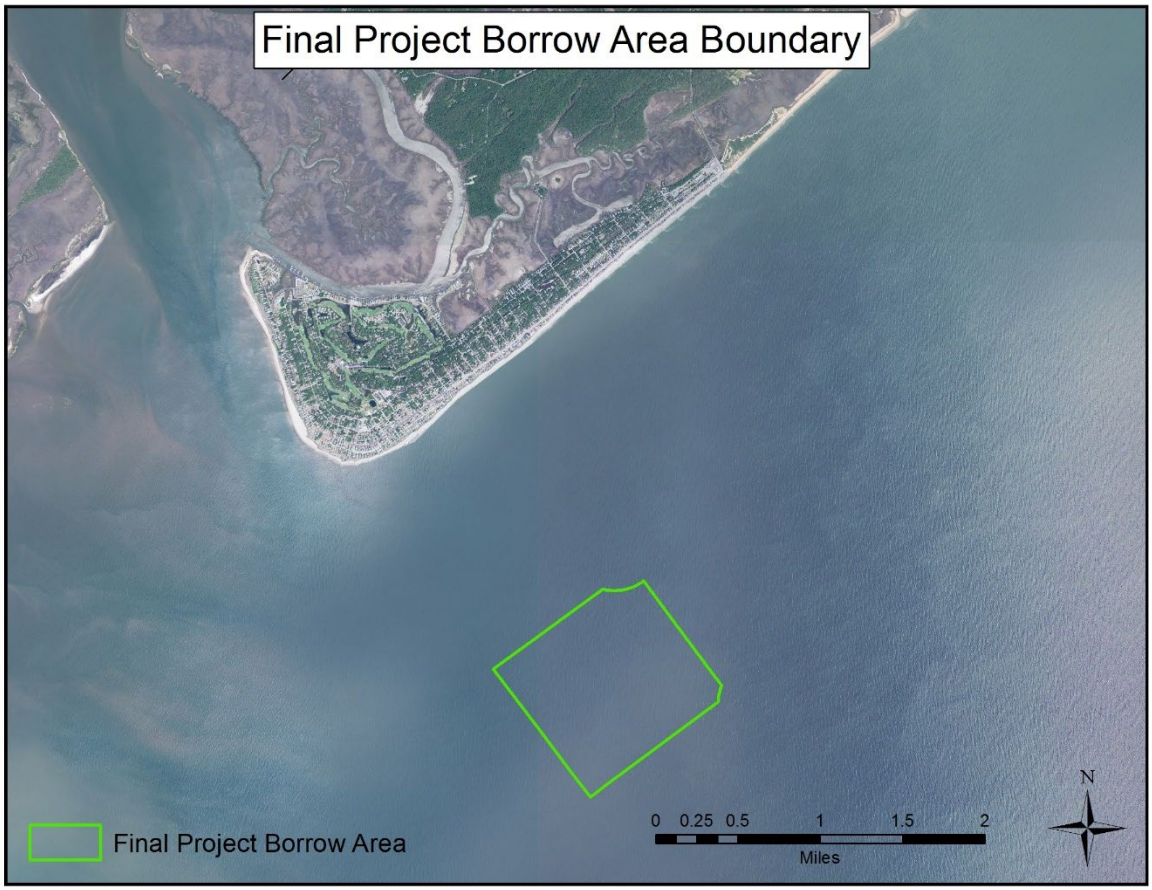


Figure 7: Location of proposed borrow area for the Edisto Beach project.

9.2 National Environmental Policy Act of 1969, as amended (42 U.S.C. §4321 et seq.)

USACE has previously described the affected environment and evaluated environmental effects of the Edisto Island Coastal Storm Risk Management Project in the 2014 FFR/EA. The EA determined that the impacts from the proposed project would not result in impacts significant enough to warrant an EIS and led to a FONSI finalized in 2014. NEPA for impacts that would be associated with the Federal project was also addressed under the Town's 10/404 permit. The findings of the 2014 FFR/EA and the EA/FONSI associated with the 10/404 permit are still valid as applied to the current Federal project.

9.3 Endangered Species Act of 1973 (16 U.S.C. §1531 et seq.)

Consultation with the U.S. Fish and Wildlife Service (USFWS) consistent with the Endangered Species Act (ESA) was completed for the FFR/EA. The January 9, 2014 Biological Assessment (BA) considered the effects of the proposed project on threatened and endangered species either known to be present or suspected to be present in the vicinity of the project. Based on conservation measures proposed in the BA, the USFWS concurred with the USACE determination that the proposed project was likely to adversely affect (LAA) the loggerhead sea turtle and not likely to adversely affect (NLAA) the leatherback sea turtle, piping plover, rufa red knot, and West Indian manatee. USFWS issued a 2014 Biological Opinion (BO) for the loggerhead sea turtle, the leatherback sea turtle, piping plover, and West Indian manatee, and a 2014 Conference Opinion (CO) for the rufa red knot (candidate species).

Since the rufa red knot became a Federally listed species in 2015, USACE requested to re-initiate ESA consultation in March 2020. By letter dated April 7, 2020, USFWS advised that the current Federal project could be covered under a January 21, 2016, USFWS Biological Opinion (2016 BO) issued for the Town of Edisto Island Beach Nourishment Project since the Federal project footprint falls within the confines of that project. The 2016 BO addresses effects on the green sea turtle, leatherback sea turtle, Northwest Atlantic population of the loggerhead sea turtle and its critical habitat, piping plover and its critical habitat, rufa red knot, and the West Indian manatee. USFWS determined that the Town's project was not likely to adversely affect the green sea turtle, leatherback sea turtle, piping plover, rufa red knot, and West Indian manatee. The project may affect but is not likely to adversely affect the loggerhead turtle, or adversely modify or destroy designated critical habitat, provided work is performed in accordance with the terms and conditions (including reasonable and prudent measures, and conservation recommendations) contained in the 2016 BO. Incidental take of listed species that is in compliance with the terms and conditions of the 2016 BO is exempt from the prohibitions against take under the ESA. These terms and conditions will be incorporated into this and all future federal nourishment efforts.

Consultation with the National Marine Fisheries Service with regard to marine species protected under the ESA is not required due to the applicability of a Regional Biological Opinion (RBO) for the South Atlantic Region and the District's past and present commitment to adhere to the Terms and Conditions of the RBO.

9.4 Fish and Wildlife Coordination Act of 1958 (16 U.S.C. §661 et seq.)

Coordination with USFWS under this law was conducted through ongoing coordination and submission of Planning Aid letters as the project progressed. By letter dated January 25, 2012, the USFWS concurred that continued coordination and submission of necessary documentation or assessments would satisfy Section 2a of the FWCA and ensure that potential resource concerns would be adequately addressed. Since the project scope provided in the FFR/EA has been reduced, the storm damage reduction activities associated with the

Federal project should not result in long-term adverse effects to the subtidal benthic infaunal community. Therefore, the findings are still valid.

9.5 National Historic Preservation Act of 1966 (16 U.S.C. §1531 et seq.)

Federal undertakings must comply with the Archaeological and Historical Preservation Act of 1974 (16 USC 469-469c), the Abandoned Shipwreck Act of 1987 (PL 100-298; 43 USC 2101-2106), The National Historic Preservation Act (NHPA) of 1966, as amended (54 USC 306108) and the Advisory Council on Historic Preservation's implementing regulations at 36 CFR Part 800 (protection of Historic Properties). Section 106 of NHPA requires Federal agencies to provide the Advisory Council on Historic Preservation with a reasonable opportunity to comment on any Federal undertaking. The placement of sand on beaches and the use of sand from underwater borrow sites are typically subjected to cultural resources investigations to locate potentially significant resources, including historic properties, for purposes of NHPA Section 106 review. There are no historical or archaeological resources within the beach nourishment zone which would be affected by the placement and movement of sand. A comprehensive cultural resources review was conducted in February 2013 for the proposed offshore borrow area, including a quarter mile buffer around the area. Two potential sites of prehistoric interest were identified within the survey area. The survey report was reviewed by the South Carolina Institute of Archaeology and Anthropology (SCIAA), and the South Carolina State Historic Preservation Office (SHPO). By letter dated April 12, 2013, SCIAA concurred with the recommendation to place a 1,500 ft. buffer zone around arbitrary points for the two sites as potential paleolandscape features and advised that no additional surveys would be required. By e-mail dated April 29, 2020, SHPO concurred that no additional surveys would be required and USACE had met their responsibilities pursuant to 36 CFR 800.4.

9.6 Clean Water Act of 1972 (33 U.S.C. §1341 et. seq. and 33 U.S.C. §1344(b) et seq.)

The proposed project would occur within the open ocean and on an adjacent beach. These waters are classified as Class SA waters by the SC Department of Health and Environmental Control (SCDHEC). Class SA waters are tidal saltwater suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption.

They are also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora. A 401 Water Quality Certification is not required for this project. SCDHEC has determined that beach nourishment activities have very few water quality impacts and has waived certifications for beach nourishment activities.

Section 404 of the Clean Water Act governs the discharge of dredged or fill material into waters of the U.S. Although USACE does not process and issue permits for its own activities, USACE authorizes its own discharges of dredged or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, NEPA, and application of the Section 404(b)(1) guidelines. A Section 404(b)(1) evaluation was completed for the 2014 FFR/EA and more recently for the 10/404 permit issued to the Town. The findings of these evaluations are still valid as applied to the current Federal project.

9.7 Coastal Zone Management Act of 1972 (16 U.S.C. §1451 et seq.)

USACE determined that the project was consistent to the maximum extent practicable with the enforceable policies of the South Carolina Coastal Zone Management (CZM) Program and the Office of Coastal Resource Management (OCRM) concurred with the USACE determination by letter dated December 23, 2013. By e-mail dated January 14, 2020, OCRM confirmed that the 2013 Coastal Zone Consistency determination would remain valid and nothing further would be required.

9.8 Coastal Barrier Resources Act of 1982 (16 U.S.C. §3501 et seq.) and Coastal Barrier Improvement Act of 1990 (16 U.S.C. §3501 et seq.)

Coastal barriers along the Atlantic and Gulf coasts provide quality habitat for migratory birds and other wildlife. This habitat is essential for spawning, nursery, nesting, and feeding for a variety of commercially and recreationally important species of finfish and shellfish. Recognizing this and the fact that barrier islands contain recreational and cultural resources and serve as natural protective buffers from storms, Congress passed the Coastal Barrier Resources Act in 1982. In this Act, Congress declared that the purpose of the act is to minimize the loss of human life, wasteful expenditure of Federal revenues, and damage to fish, wildlife, and other natural resources by restricting future Federal expenditures and financial assistance that could potentially encourage development of barrier islands (16 U.S.C. 3501 et seq.).

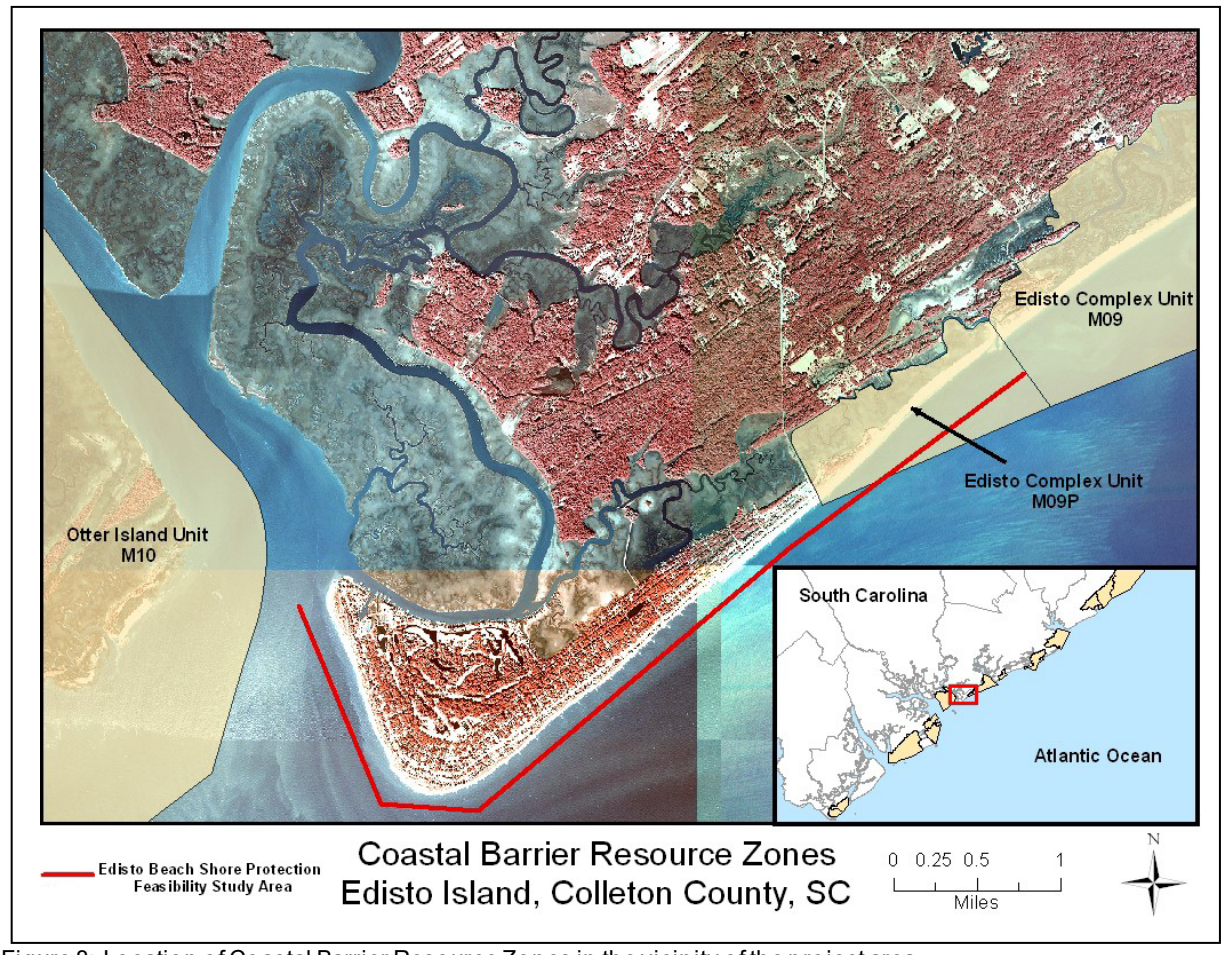


Figure 8: Location of Coastal Barrier Resource Zones in the vicinity of the project area

The Town of Edisto Beach lies between two Coastal Barrier Resources Systems (CBRS) units, the Edisto Complex Unit (M09 and M09P) and the Otter Island Unit (M10) (Figure 4). Unit M09P is an "Otherwise Protected Area" (OPA) and is not a part of the CBRS. The Edisto Unit is composed of three small marsh islands, Botany Bay Island, Edingsville Beach, part of Jeremy Inlet, and Deveaux Bank. The Otter Island Unit includes the southwestern half of the

South Edisto River, Pine Island, Otter Island, and the southeastern tips of Fenwick Island and Hutchinson Island. By letter dated January 27, 2010, the USFWS confirmed that the proposed borrow area is not located in the CBRS.

9.9 Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.)

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Fishery Conservation and Management Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)." The definition for EFH may include habitat for an individual species or an assemblage of species, whichever is appropriate within each Fisheries Management Plan (FMP).

Estuarine and inshore EFH within the vicinity of the project consists of estuarine emergent wetlands, oyster reefs/shell banks, intertidal flats, aquatic beds, the estuarine water column, and the marine water column. An EFH Assessment was prepared for the 2014 FFR/EA and National Marine Fisheries Service (NMFS) concurred with the USACE determination that the proposed action would not have substantial individual or cumulative adverse impacts on EFH. In addition, an EFH assessment and consultation was conducted for the 10/404 permit for the Town's project in 2016, and that project has a larger geographic scope and similar ecological setting. Reinitiating EFH consultation is not required at this time since the 2014 EFH consultation anticipated construction well into the future and the project modification would not result in adverse effects to EFH resources.

10. Risk and Uncertainty

A cost-schedule risk analysis (CSRA) was performed as part of the validation. Risks that were moderate or high likelihood are discussed in this section. Material quantity represents a risk because sand quantity can be impacted by wave action, subsidence, coastal storms, and sea level rise. Sea level rise is discussed in more detail in the following subsection. Quantities for the project were defined by Beach-FX through a 300-iteration calibration. Depending on conditions during PED, more or less sand may be required. Real estate acquisition is a concern due to the fact that a subset of the landowners is not in favor of the project. However, the sponsor is highly motivated and willing to work through this challenge. A risk of all construction projects is modification to the contract, which typically center around material quantity. Competing work, loss of dredger, quantity assumption can cause modifications such as remobilizations and delays. Other modification potentials could include borrow source remobilization resulting from environmental impacts. Other factors that could impact the cost during contracting and construction include equipment used, fuel costs, productivity of the dredge and market conditions.

10.1 Sea level rise

During the feasibility study, per EC 1165-2-212, a sensitivity analysis on the economics of the Recommended Plan using low (Modified NRC Curve 1) and high (Modified NRC Curve 3) accelerated sea level rise rates was conducted. A full discussion of the accelerated sea level rise rates and how they were calculated for the project area is contained in Appendix A of the feasibility study.

The Recommended Plan was run through Beach-*fx* using historical, Curve 1, and Curve 3 sea level rise rates. Figure 9 displays how the average annual project costs, benefits, and net benefits change under each of these three scenarios. As shown in the figure, as sea level rise accelerates, the project costs increase. However, the project *benefits* increase even more

(because with higher sea level rise structures would be subject to even greater potential damages in the future without project condition). The project net benefits would be the highest under the Curve 3 sea level rise scenario. Based on this conclusion, no further analysis of the impacts of sea level rise was conducted for this validation study.

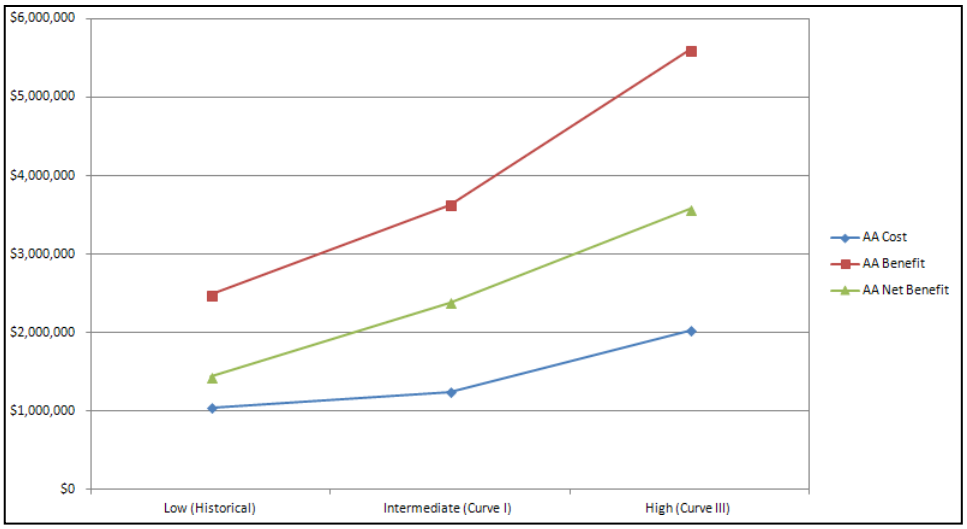


Figure 9. Changes in Average Annual Costs, Benefits, and Net Benefits (3.75% interest rate) under 3 different Sea-level Rise Scenarios

11. Conclusions and Recommendation

This Validation Report provides updated economic, environmental, and engineering information for Edisto Beach Coastal Storm Damage Reduction project and validates the modified project (without the two inlet reaches) is economically justified, environmentally acceptable, and technically feasible from and engineering perspective. The lengthened groins and removal of two inlet reaches do not alter the authorized fill template. The total project first cost for the modified project is estimated to be $75,347,000 at FY22 price levels and has a BCR of 1.95 with recreation and 1.58 without recreation both at 2.25% discount rate. The district concludes that none of the changes under the modified project result in an increase or decrease change greater than twenty percent; therefore, the validation report is within the Chief of Engineer's discretionary authority to approve. Once approved, the Edisto Beach Coastal Storm Damage Reduction project can be constructed without the inlet reaches as long as funding is available.

References

US Army Corps of Engineers. (2014). *2014 Chief's Report, Edisto Beach, Colleton County, South Carolina, Coastal Storm Damage Reduction General Investigation.* Washington D.C: US Army Corps of Engineers.

US Army Corps of Engineers. (2014). *Final Integrated Feasibility Report and Environmental Assessment, Coastal Storm Damage Reduction General Investigation Study, Edisto Beach, Colleton County, South Carolina.* Charleston, SC: Unpublished.

US Army Corps of Engineers. (2021, January 25). *Civl Works Construction Cost Index System*. Retrieved from Cost Engineering: https://www.usace.army.mil/Cost-Engineering/cwccis/

US Army Corps of Engineers. (2021, January 25). *Procedures for Implementing NEPA*. Retrieved from USACE Publication, Engineer Regulations: https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_200 2-2.pdf?ver=2013-09-08-233208-440-

Appendix A

Environmental Compliance Documentation

Validation Report

Edisto Beach, South Carolina

US Army Corps of Engineers ®
Charleston District

May 2022

TABLE OF CONTENTS

DEPARTMENT OF THE ARMY
CHARLESTON DISTRICT, CORPS OF ENGINEERS
69-A Hagood Avenue
CHARLESTON, SOUTH CAROLINA 29403-5107

REPLY TO
ATTENTION OF

September 28, 2016

Regulatory Division

Town of Edisto Beach
Coastal Science & Engineering
Mr. Steven Traynum
PO Box 8056
Columbia, South Carolina 29202

Dear Mr. Traynum:

This is in response to your application requesting a Department of the Army permit.

Enclosed is your Department of the Army Permit #2015-0528. It authorizes you to perform the work specified on the attached drawings. This permit is issued under the provisions of the Federal laws for the protection and preservation of the navigable waters of the United States.

Please notify this office promptly, in writing, when you start and complete the work. The enclosed cards may be used for that purpose. You should also be aware that a special condition has been included in this permit which requires that a copy of the permit and drawings must be available at the work site during the entire time of construction.

Respectfully,

for Travis G. Hughes
Chief, Regulatory Division

Enclosures

DEPARTMENT OF THE ARMY PERMIT

Permittee: TOWN OF EDISTO BEACH
c/o MS. IRIS HILL

2414 MURRAY STREET
EDISTO BEACH, SC 29438

Permit No: 2015-0528-1C

Issuing Office: CHARLESTON DISTRICT

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:
The proposed work consists of beach nourishment and groin lengthening along Edisto Beach, South Carolina in accordance with the attached drawings entitled: Edisto Beach Nourishment; Sheets 1 thru 9 of 9 dated April 23, 2015.

Project Location:
The proposed project is located adjacent to the Atlantic Ocean from the north end of the Edisto Beach State Park campground to Edisto Street near the south Edisto River Inlet in Edisto Beach, Colleton County, South Carolina.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on **30 September 2026.** If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

SEE PAGE 4

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

☒ Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

☒ Section 404 of the Clean Water Act (33 U.S.C. 1344).

☐ Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Iris Hill — 8/29/16

(PERMITTEE) — **(DATE)**

TOWN OF EDISTO BEACH
MS. IRIS HILL

IRIS HILL — 8/29/2016

(PRINT NAME) — **(DATE)**

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

for — SEP 28 2016

(DISTRICT ENGINEER) — **(DATE)**

MATTHEW W. LUZZATTO, P.E., PMP
or his Designee
Travis G. Hughes
Chief, Regulatory Division

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) — **(DATE)**

CONDITIONS FOR PERMIT #2015-0528-1C

Special Conditions:

a. That the permittee agrees to provide all contractors associated with construction of the authorized activity a copy of the permit and drawings. A copy of the permit will be available at the construction site at all times.

b. That the permittee shall submit a signed compliance certification to the Corps within 60 days following completion of the authorized work and any required mitigation. The certification will include:

    1. A copy of this permit;
    2. A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions;
    3. A statement that any required mitigation was completed in accordance with the permit conditions;
    4. The signature of the permittee certifying the completion of the work and mitigation.

c. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

d. Use of the permitted activity must not interfere with the public's right to free navigation on all navigable waters of the U.S.

e. That the permittee performs all nourishment activities in accordance with the twenty two (22) reasonable and prudent measures and nineteen (19) terms and conditions and two (2) conservation recommendations for the loggerhead sea turtle (*Caretta caretta)* included in the attached Biological Opinion dated January 21, 2016, by the U.S. Fish and Wildlife Service.

f. That all construction work must be conducted outside of the turtle nesting season which runs from May 15 through October 31.

g. The contractor must dredge mounds of suitable material rather than creating depressions whenever possible. Maximum authorized dredge depth is -16 ft MLLW.

h. The permittee agrees that the pump station and pipeline shall not impact hard bottom habitat.

i. That the permittee must advise the District Engineer, in writing, thirty (30) days prior to commencement of the dredging activity authorized by this document.

j. That the permittee must contact the United States Coast Guard to ascertain and assist in the issuance of a Notice to Mariners advising the boating public of the place and time that the dredging activity will be occurring.

k. That the permittee is responsible for properly installing and providing appropriate warning and

marking devices to alert the boating public of any dangers (such as cables, anchors, buoys and other appurtenances) associated with the proposed dredging activity. All warning and marking devices must be marked and installed in accordance with United States Coast Guard standards.

l. That the permittee agrees to contact the Boating Division of the South Carolina Department of Natural Resources to advise them of the place and time that the dredging activity will be occurring. The permittee will solicit any information that the Department may have on local boating traffic patterns and activities in the project area. Such information will be used to facilitate dredging plant and appurtenances setup and operation to insure safe navigation through the area of work.

m. All sand placed on the beach must be clean sand that is free from sources of contamination.

n. In order to insure protection and reduce potential construction-related impacts to West Indian manatees that may enter the project area during dredging activities performed outside the winter months (November 1 thru February 15), to discountable and insignificant levels, the permittee will comply with the following:

1. The permittee shall instruct all personnel associated with the project of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel must monitor water-related activities for the presence of manatee(s) during May 15 - October 15.

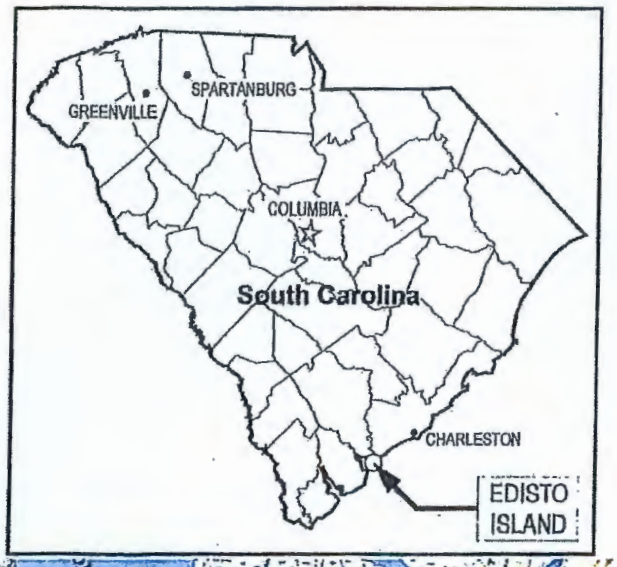
2. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

3. Any siltation barriers used during the project shall be made of material in which manatees cannot become entangled and must be properly secured, and regularly monitored to avoid manatee entrapment.

4. All vessels associated with the project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

5. If manatee(s) are seen within 100 yards of the active construction area all appropriate precautions shall be implemented to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet to a manatee. Operation of any equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment. Activities will not resume until the manatee(s) has departed the project area of its own volition.

6. Any collision with and/or injury to a manatee shall be reported immediately to Mr. Jim Valade of the U.S. Fish and Wildlife Service, North Florida Field Office at (904) 731-3116, and the SCDNR Hotline at 1-800-922-5431.



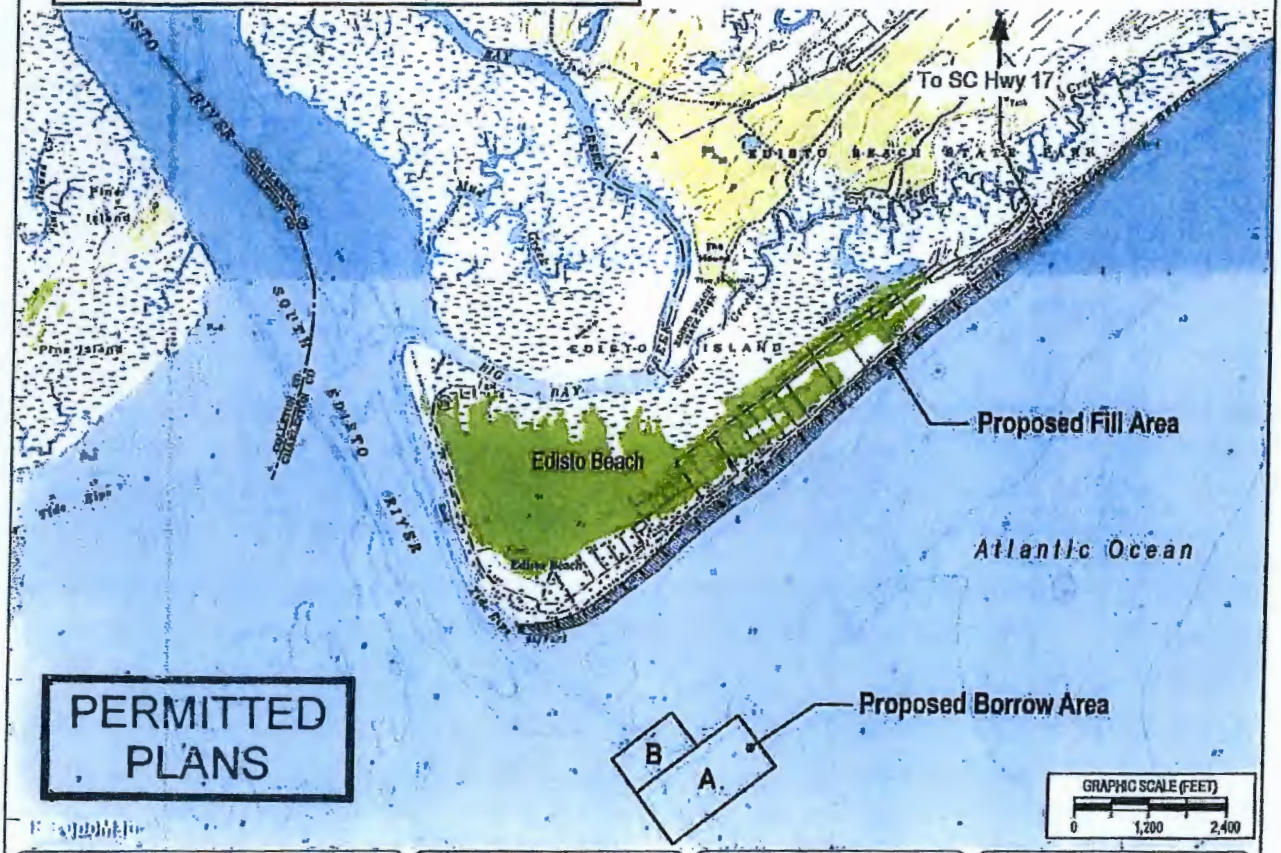
DIRECTIONS FROM SC HWY 17:

TAKE SC HWY 174 TOWARD EDISTO BEACH. FOLLOW HWY 174 TO PALMETTO BLVD. PROJECT EXTENDS NORTH ~3,300 FEET INTO EDISTO BEACH STATE PARK AND SOUTH ~16,000 FEET, JUST SOUTH OF BILLOW STREET AT POINT ST.

PROJECT LOCATION:

Latitude: *32° 29' 20" N*

Longitude: *80° 19' 020" W*



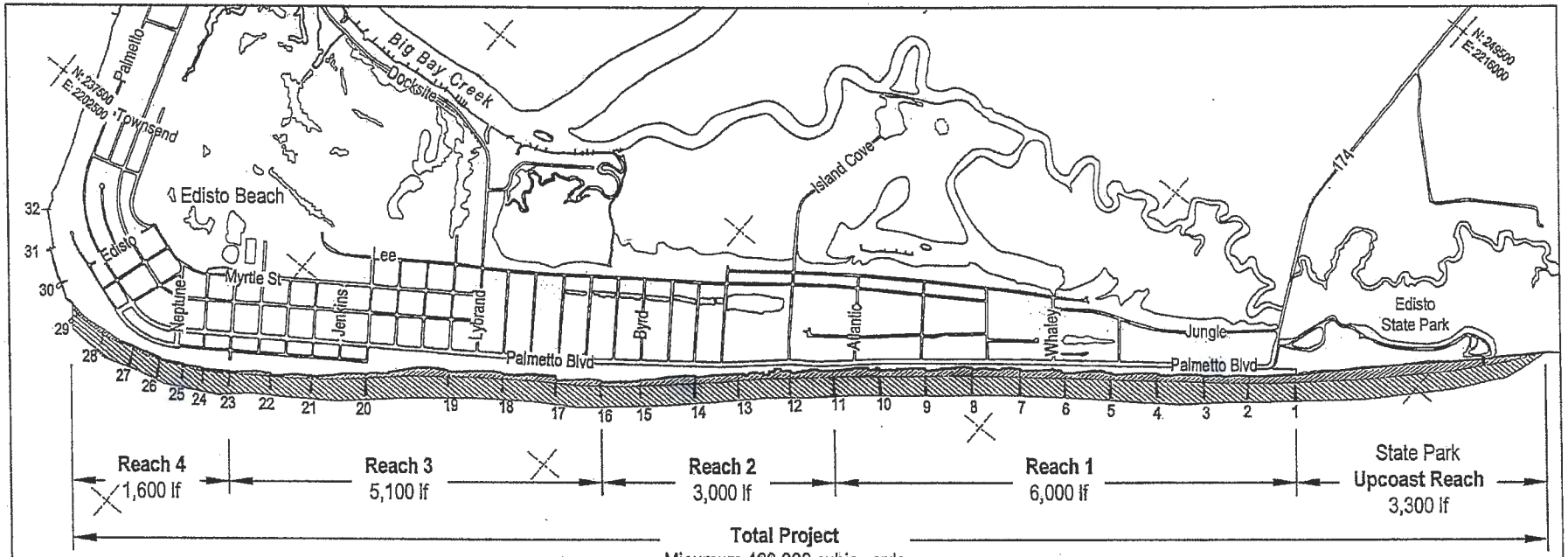
PERMITTED PLANS

APPLICANT: Town of Edisto Beach 2414 Murray St Edisto Island, SC 29438	*DRAWING TITLE:* VICINITY MAP *PROJECT:* *Beach Nourishment & Groin Extension*
AGENT: Coastal Science & Engineering PO Box 8056 Columbia, SC 29202	SCALE: AS SHOWN DATE: 23 April 2015 TMS# PROJECT #: 2416 SHEET #: 01

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION — COASTAL SCIENCE & ENGINEERING No. C01950

SOUTH CAROLINA PROFESSIONAL ENGINEER — No. 24737 — 4/23/15 — HENRY LIU KACZKOWSKI

PERMITTED PLANS



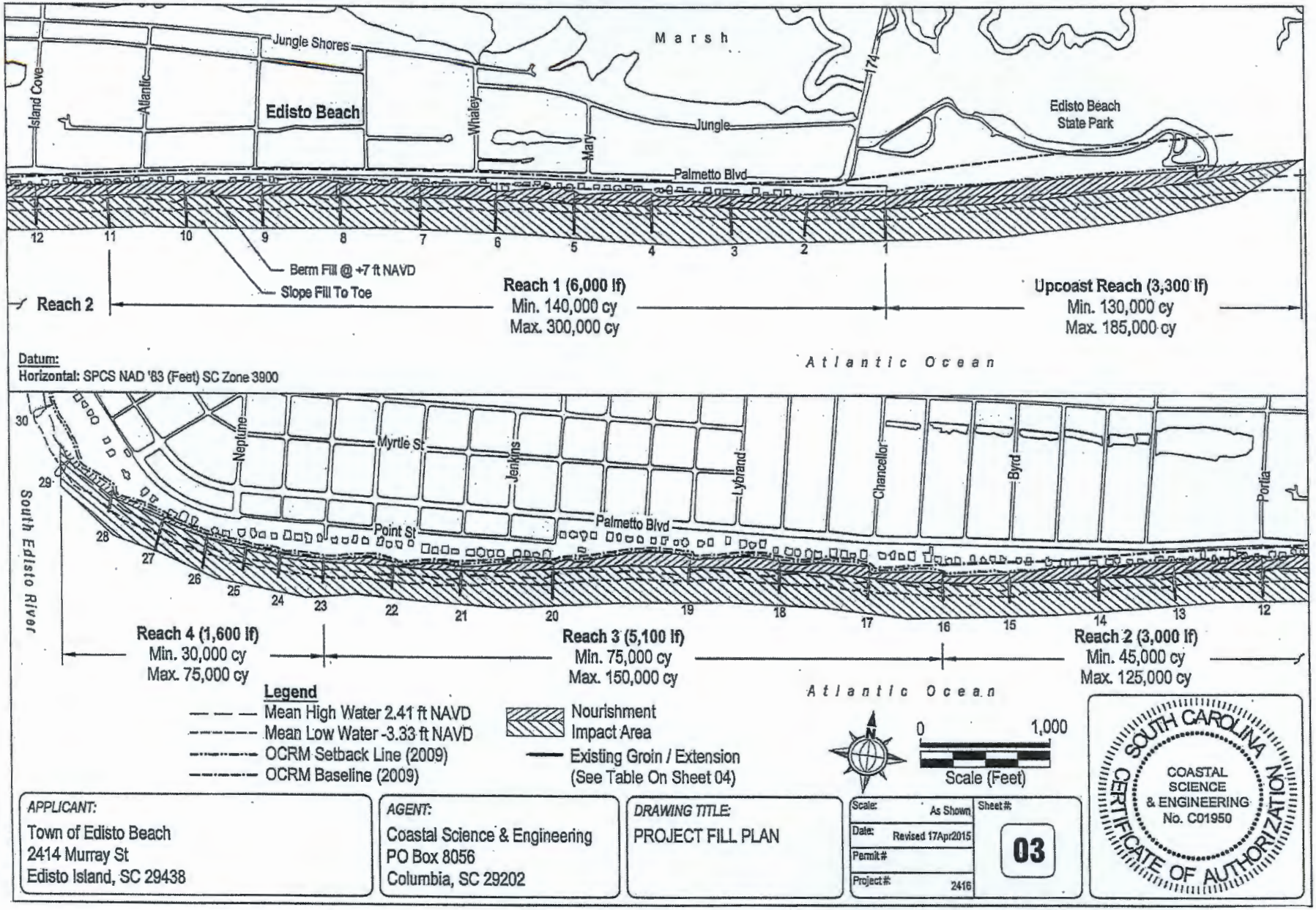
Datum:
Horizontal: SPCS NAD '83 (Feet) SC Zone 3900

APPLICANT:	AGENT:	DRAWING TITLE:		
Town of Edisto Beach 2414 Murray St Edisto Island, SC 29438	Coastal Science & Engineering PO Box 8056 Columbia, SC 29202	OVERALL PROJECT PLAN	Scale: As Shown Date: Revised 17Apr2015 Permit # Project #: 2416	Sheet #: 02

SOUTH CAROLINA
COASTAL SCIENCE & ENGINEERING
No. C01950
CERTIFICATE OF AUTHORIZATION

SAC-2015-0528-1C Edisto Beach Nourishment
April 23, 2015 Sheet 2 of 9

PERMITTED PLANS

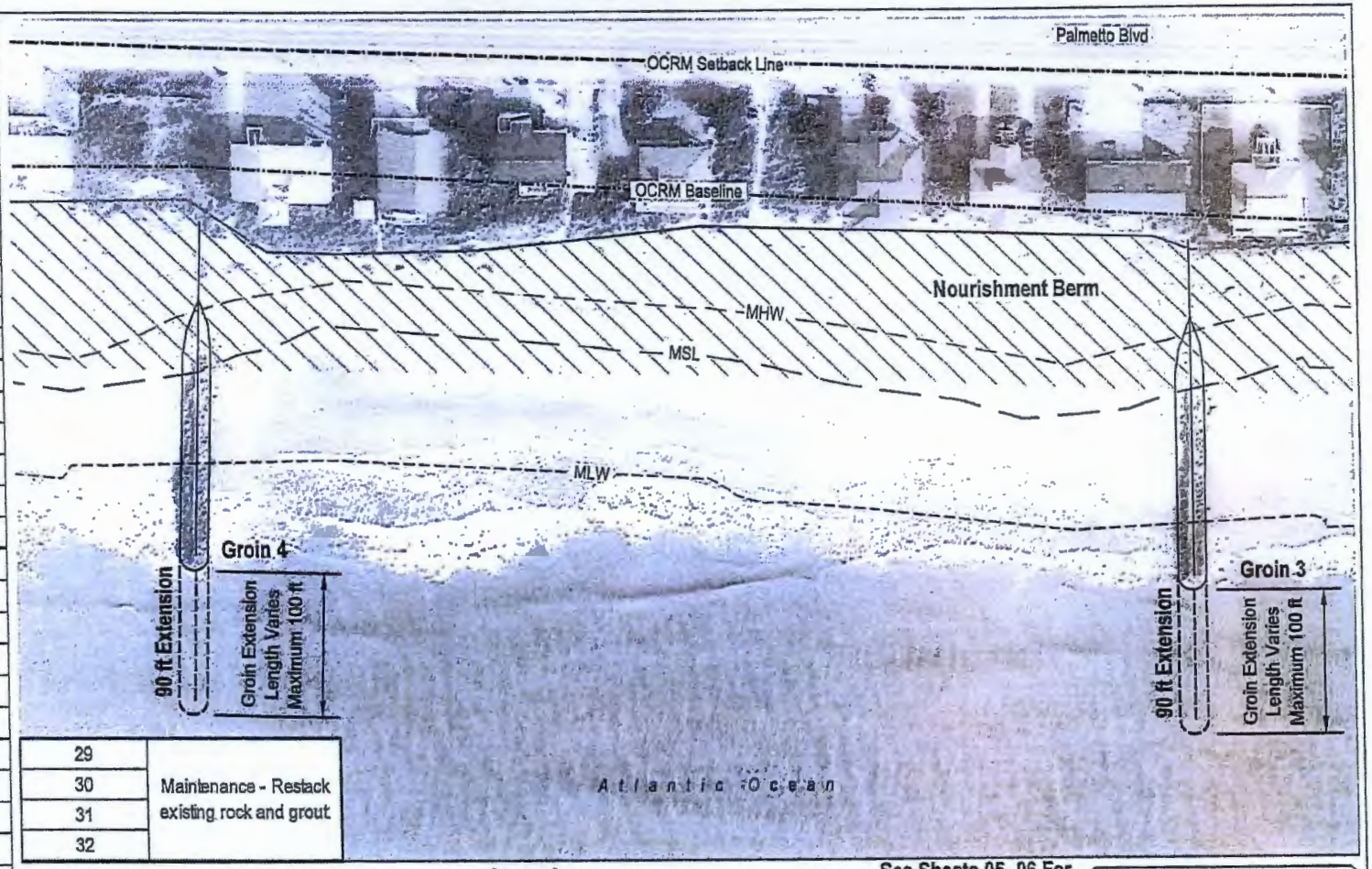


APPLICANT:	AGENT:	DRAWING TITLE:	Scale: As Shown	Sheet #:
Town of Edisto Beach 2414 Murray St Edisto Island, SC 29438	Coastal Science & Engineering PO Box 8056 Columbia, SC 29202	PROJECT FILL PLAN	Date: Revised 17Apr2015 Permit # Project #: 2416	03

SAC-2015-0528-1C Edisto Beach Nourishment
April 23, 2015 Sheet 3 of 9

PERMITTED PLANS

Groin No.	Estimated Maximum Extension (ft)
1	90
2	85
3	90
4	90
5	100
6	100
7	90
8	90
9	95
10	95
11	95
12	45
13	80
14	65
15	40
16	20
17	20
18	40
19	0
20	80
21	30
22	30
23	30
24	30
25	40
26	95
27	100
28	0



29	Maintenance - Restack existing rock and grout
30	
31	
32	

Datum Notes:
Horizontal: SPCS NAD '83 (Feet) SC Zone 3900
Vertical: NAVD 88 (Feet)
Image: IMC 25 May 2011
Contour positions based on measurements collected in July 2014.

Legend
- Mean High Water 2.41 ft NAVD
- Mean Low Water -3.33 ft NAVD
- OCRM Setback Line (2009)
- OCRM Baseline (2009)

See Sheets 05- 06 For Typical Fill Profiles

0 100
Scale (Feet)

SOUTH CAROLINA COASTAL SCIENCE & ENGINEERING No. C01950 CERTIFICATE OF AUTHORIZATION

APPLICANT:
Town of Edisto Beach
2414 Murray St
Edisto Island, SC 29438

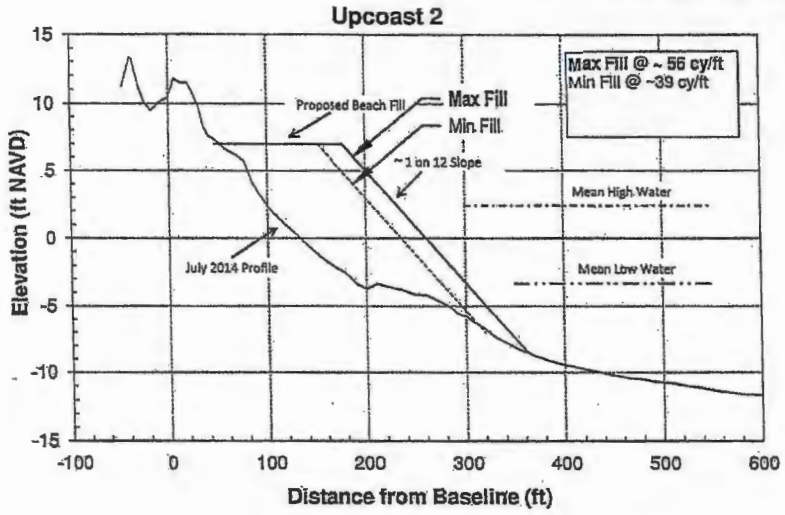
AGENT:
Coastal Science & Engineering
PO Box 8056
Columbia, SC 29202

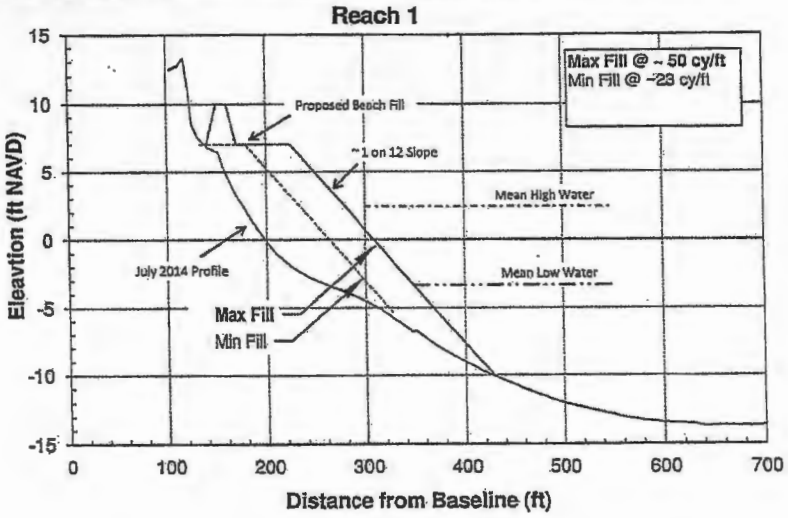
DRAWING TITLE:
GROIN EXTENSION PLAN
GROINS 1-28

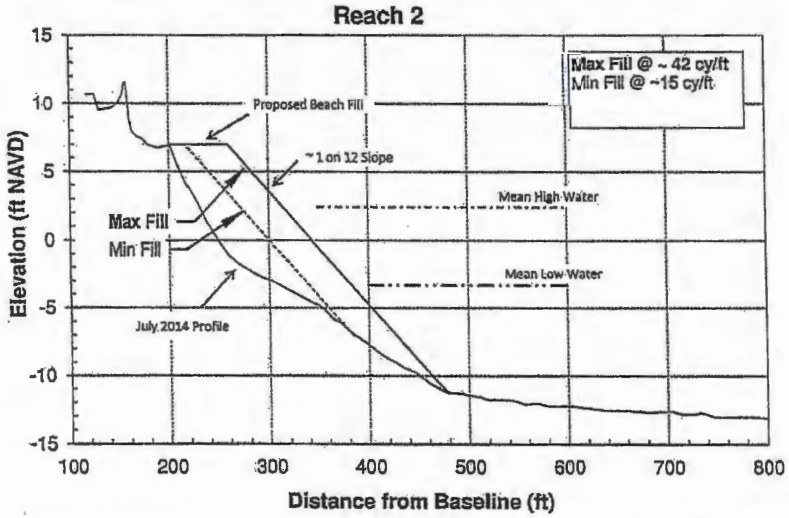
Scale: As Shown
Date: Revised 17Apr2015
Permit#:
Project#: 2416
Sheet#: 04

SAC-2015-0528-1C Edisto Beach Nourishment
April 23, 2015 Sheet 4 of 9

PERMITTED PLANS



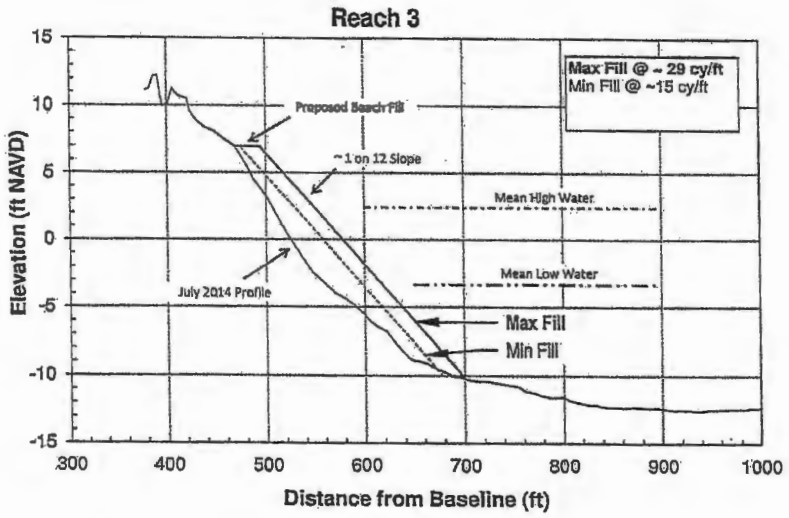


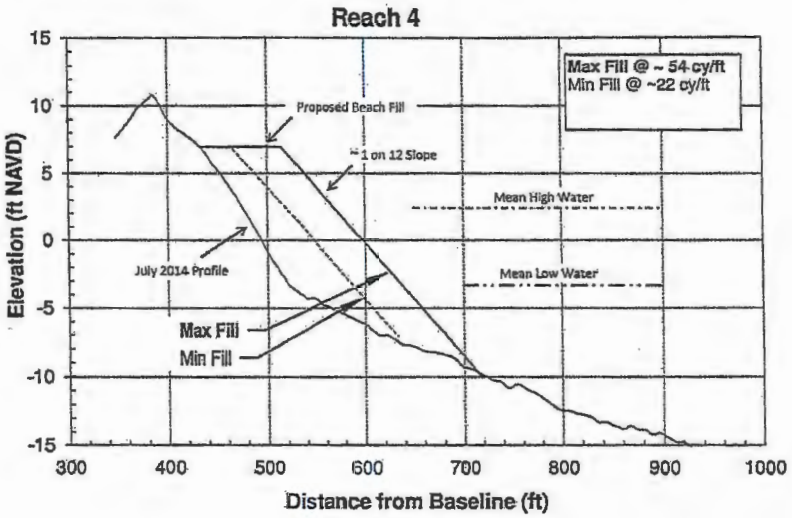


APPLICANT: Town of Edisto Beach 2414 Murray St Edisto Island, SC 29438	*AGENT:* Coastal Science & Engineering PO Box 8056 Columbia, SC 29202	*DRAWING TITLE:* **TYPICAL FILL PROFILES** UPCOAST & REACH 1 - 2	Scale: As Shown Date: 23 April 2015 Permit# Project#: 2416 Sheet #: **05**

SOUTH CAROLINA COASTAL SCIENCE & ENGINEERING No. C01950 CERTIFICATE OF AUTHORIZATION

PERMITTED PLANS





APPLICANT:
Town of Edisto Beach
2414 Murray St
Edisto Island, SC 29438

AGENT:
Coastal Science & Engineering
PO Box 8056
Columbia, SC 29202

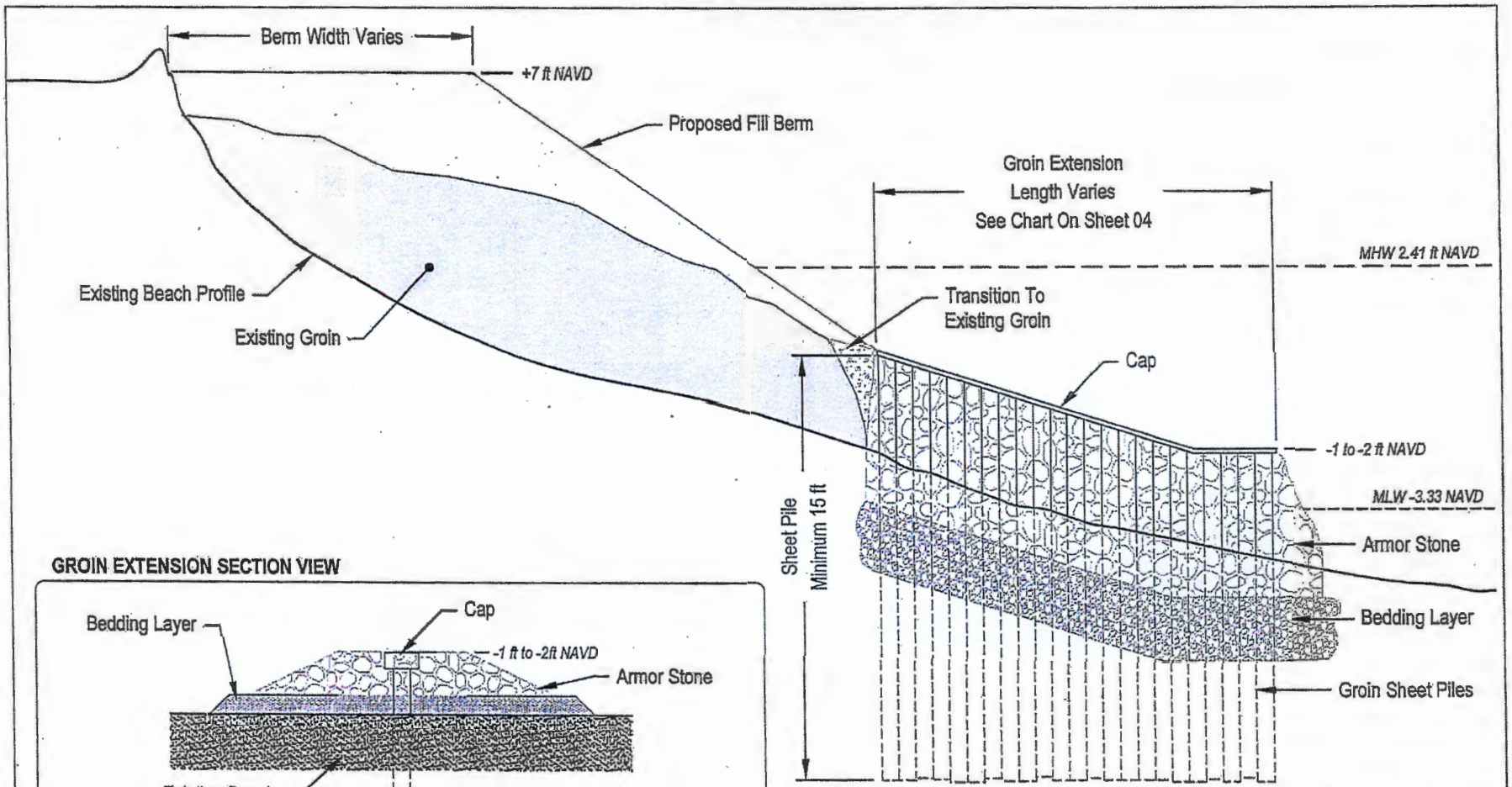
DRAWING TITLE:
TYPICAL FILL PROFILES
REACH 3 - 4

Scale:	As Shown
Date:	23 April 2015
Permit #:	
Project #:	2416

Sheet #: **06**

SOUTH CAROLINA COASTAL SCIENCE & ENGINEERING No. C01950 CERTIFICATE OF AUTHORIZATION

PERMITTED PLANS



SOUTH CAROLINA COASTAL SCIENCE & ENGINEERING No. C01950 CERTIFICATE OF AUTHORIZATION

APPLICANT: Town of Edisto Beach 2414 Murray St Edisto Island, SC 29438	*AGENT:* Coastal Science & Engineering PO Box 8056 Columbia, SC 29202	*DRAWING TITLE:* **GROIN EXTENSION** PROFILE & SECTION VIEW	Scale: As Shown Date: 23 April 2015 Permit #: Project #: 2416 Sheet #: **07**

PERMITTED PLANS

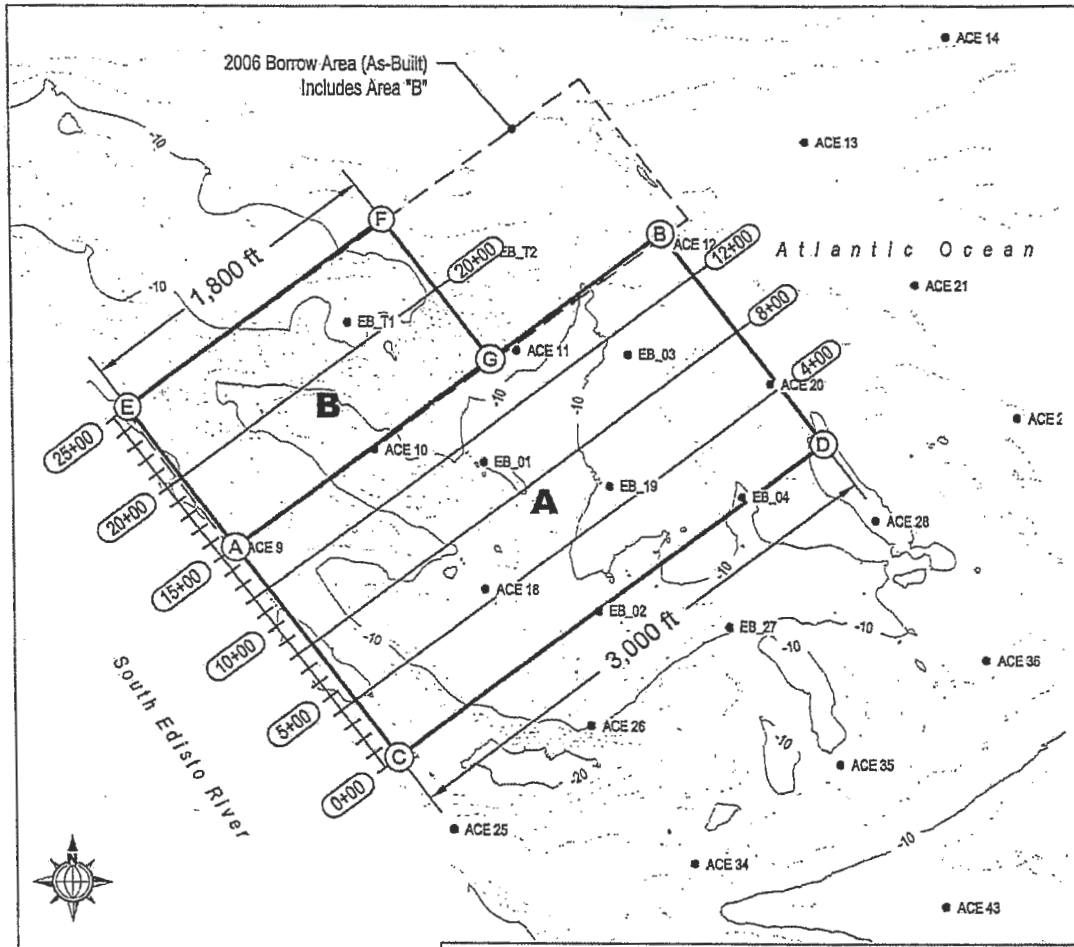
Example Condition Photo

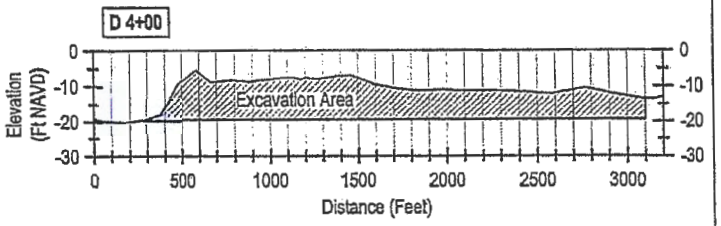
Typical Condition - Not To Scale

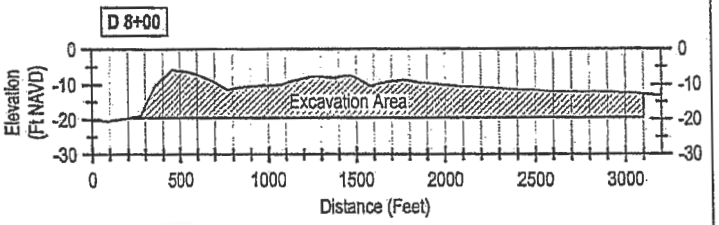
APPLICANT: Town of Edisto Beach 2414 Murray St Edisto Island, SC 29438	*AGENT:* Coastal Science & Engineering PO Box 8056 Columbia, SC 29202	*DRAWING TITLE:* **GROIN MAINTENANCE** Groins 29-32	Scale: As Shown Date: Revised 17Apr2015 Permit# Project#: 2416 Sheet#: **7a**

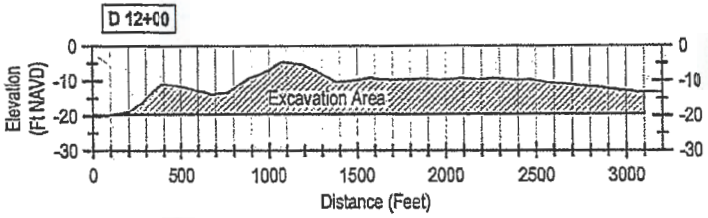
SOUTH CAROLINA COASTAL SCIENCE & ENGINEERING No. C01950 CERTIFICATE OF AUTHORIZATION

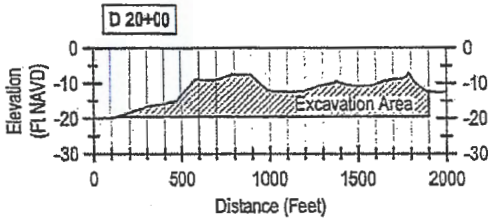
PERMITTED PLANS











Note:
Excavations to -19.5 ft NAVD

Datum Notes:
Horizontal: SPCS NAD '83 (Feet) SC Zone 3900
Vertical: NAVD 88 (Feet)
Bathymetry Shown Collected July 2014

BORROW AREA COORDINATES					
POINT	NORTHING	EASTING	POINT	NORTHING	EASTING
A	231,170.759	2,207,530.143	E	232,022.741	2,206,913.363
B	232,987.670	2,209,917.365	F	233,112.688	2,208,345.697
C	228,783.536	2,209,347.054	G	232,317.147	2,208,951.334
D	230,600.447	2,211,734.277			

0 1,000
Scale (Feet)

SOUTH CAROLINA COASTAL SCIENCE & ENGINEERING No. C01950 CERTIFICATE OF AUTHORIZATION

APPLICANT:
Town of Edisto Beach
2414 Murray St
Edisto Island, SC 29438

AGENT:
Coastal Science & Engineering
PO Box 8056
Columbia, SC 29202

DRAWING TITLE:
BORROW AREA DETAILS & SECTIONS

Scale:	As Shown
Date:	23 April 2015
Permit #:	
Project #:	2416

Sheet #: 08

SAC-2015-0528-1C Edisto Beach Nourishment
April 23, 2015 Sheet 9 of 9

United States Department of the Interior

FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

April 7, 2020

Lt. Colonel Rachel A. Honderd, District Engineer
U.S. Army Corps of Engineers
69A Hagood Avenue
Charleston, South Carolina 29403-5107

Attn: Ms. Bethney Ward

Re: Edisto Beach Coastal Storm Damage Reduction Project
Charleston County, South Carolina
FWS Log No. 04ES1000-2015-F-0697-R001

Dear Colonel Honderd:

The U.S. Fish and Wildlife Service (Service) has reviewed your March 12, 2020, letter received as an attachment to your March 25, 2020, email requesting to reinitiate formal consultation and adopt the Service's January 21, 2016, Biological Opinion (BO) (FWS Log No. 04ES1000-2015-F-0697) for the Town of Edisto Beach (Town). These comments are submitted in accordance with provisions of section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531-1543) (ESA).

The U.S. Army Corps of Engineers' (Corps) originally proposed to place 924,000 cubic yards (cy) of sand along 24,270 linear feet (lf) of shoreline and lengthen 23 of the existing groins. The Service provided a BO (FWS Log No. 04ES1000-2013-F-0451) for the Federal project on January 31, 2014, followed by a revised BO on March 14, 2014. Prior to the authorization of the Federal project, the Town applied for a Department of the Army permit under section 404 of the Clean Water Act to place 835,000 cy of sand along 19,000 lf of shoreline and lengthen 26 of the existing groins. The Service provided an updated BO (FWS Log No. 04ES1000-2015-F-0697) for the regulatory project on January 21, 2016, because the rufa red knot (*Calidris canutus rufa*) listing was finalized and critical habitat was designated for the Northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*).

The proposed Federal project would place 830,000 cy of sand along 16,530 lf of shoreline. No groin work is proposed because it was completed under permit number SAC-2015-00528-1C. The proposed Federal project falls within the confines of the action area described in the Service's January 21, 2016, BO. Since there have been no listing or critical habitat designation changes for species within the action area, the Service will allow the Corps to adopt the BO for

the Federal project as long as all of the Conservation Measures, Reasonable and Prudent Measures (RPMs), and Terms and Conditions are incorporated as project requirements.

The BO includes an Incidental Take Statement that requires the Corps to implement RPMs that the Service considers necessary or appropriate to minimize the impacts of anticipated taking on the listed wildlife species. Incidental taking of federally listed species that complies with the terms and conditions of this statement is exempted from the prohibitions against "taking" under the ESA.

Reinitiating consultation is required if the Corps retains discretionary involvement or control over the Action (or is authorized by law) when:

a. The amount or extent of incidental take is exceeded;
b. New information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. The Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. A new species is listed or critical habitat designated that the Action may affect.

A complete administrative record of this consultation is on file in our office. If you have any questions about the BO, please contact Ms. Melissa Chaplin at melissa_chaplin@fws.gov or (843) 727-4707 extension 217.

Sincerely,

Thomas D. McCoy
Field Supervisor

TDM/MKC

DEPARTMENT OF THE ARMY
CHARLESTON DISTRICT CORPS OF ENGINEERS
69A HAGOOD AVENUE
CHARLESTON, SOUTH CAROLINA 29403

March 12, 2020

Mr. Tom McCoy
U.S. Department of the Interior
Fish and Wildlife Service
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

Dear Mr. McCoy:

The United States Army Corps of Engineers, Charleston District (USACE) is in the process of updating environmental documents for the Edisto Beach Coastal Storm Risk Management (CSRM) federal project. The Finding of No Significant Impact and the Final Integrated Feasibility Report and Environmental Assessment (FIFR/EA) were signed in 2014. Originally called Coastal Storm Damage Reduction at Edisto Beach, the project was previously authorized under the Water Infrastructure Improvements for the Nation Act of 2016 (WIIN Act, 2016). Project construction was appropriated for funding under the Bipartisan Budget Act of 2018 (Public Law 115-123, Title IV). USACE is now moving forward with the federal project, for which the Town of Edisto is the non-federal sponsor. With this letter, USACE requests to reinitiate consultation with the U.S. Fish and Wildlife Service (USFWS) under provisions of Section 7 of the Endangered Species Act of 1973, as amended, related to the CSRM federal project.

As background, on January 31, 2014, the USFWS issued a Biological Opinion (BO) and Conference Opinion (FWS Log No. 2013-F-0451) for the federal project that concurred with the USACE determination of likely to adversely affect (LAA) for the loggerhead sea turtle and not likely to adversely affect (NLAA) for the leatherback sea turtle, piping plover, red knot, and the West Indian manatee. USFWS made a determination of NLAA for the green sea turtle. Prior to authorization of the federal project, the Town of Edisto applied for a Section 404 permit to perform groin lengthening and beach nourishment activities along 3.6 miles of open facing shoreline, an area that includes the footprint of the current federal project. On January 21, 2016, the USFWS issued a Biological Opinion (BO) for beach re-nourishment and groin repair on Edisto Beach associated with Department of the Army (DA) permit number SAC-2015-00528-1C (FWS Log No 2015-CPA-0102/04ES1000-2015-F-0697). The DA permit authorizes the placement of up to 1.1 million cubic yards of beach quality sand along approximately 19,100 linear feet of shoreline beginning at the north end of the Edisto Beach State Park Campground and extending to Edisto Street near the South Edisto River Inlet. Since the federal project falls within the confines of the existing 2016 BO and the federal project footprint has been decreased, we are requesting to utilize the existing 2016 BO for the federal project.

As additional information for the federal project, the beach nourishment includes the initial placement of 830,000 CY of sand along 3.1 miles of shoreline. The sand quantity has been reduced by 94,000 CY from the 2014 project due to removal of 5,290 lf of shoreline nourishment along Edisto Inlet based on a request from the non-federal sponsor. The federal project consists of a 15-foot high, 15-foot wide dune beginning at the southern end of the State Park and extending southward along the beach for 16,530 feet. The dune would be fronted by a 7-foot high (elevation) berm. The first 7,740 feet of berm length would have a width of 75 feet. The width would taper to a 50-foot width over the remaining length of the berm. The width of each end of the berm would taper to match the existing beach profile. No berm would be constructed beyond groin 29 because the existing beach profile provides an adequate berm. There will be no groin work since the Town of Edisto completed groin lengthening activities under their 2016 permit. The borrow area location and boundaries will remain the same as the 2014 project.

USACE is requesting USFWS written concurrence that the 2016 BO may be utilized for the federal project. We appreciate your consideration of our request.

Please contact Andrea Hughes, Biologist, Planning and Environmental Branch, Charleston District, by mail at U.S. Army Corps of Engineers, 69A Hagood Avenue, Charleston, South Carolina 29403; by telephone at (843) 329-8145; or by email at andrea.w.hughes@usace.army.mil, with comments, questions, or the need for additional information.

Sincerely,

Nancy Parrish

Nancy Parrish
Chief, Planning and Environmental Branch

Enclosure

Figure 1. Edisto Beach Federal Project

United States Department of the Interior

FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

January 25, 2012

Mt. Patrick O'Donnell
Chief, Planning and Environmental Branch
U.S. Army Corps of Engineers
69A Hagood Avenue
Charleston, SC 29403-5107

Attn: Mark Messersmith

Re: Town of Edisto Feasibility Study, Colleton County, SC
FWS Log No. 2012-CPA-0060

Dear Mr. O'Donnell:

The U.S. Fish and Wildlife Service (Service) submits this letter in response to the U.S. Army Corps of Engineers (USACE) request regarding future coordination for the Town of Edisto storm damage reduction feasibility study. You have requested that future coordination under the Fish and Wildlife Coordination Act (FWCA) be fulfilled through ongoing coordination and submission of Planning Aid Letters as the project progresses. In consideration of the project's characteristics and scope, the USACE believes this will suffice and substitute for a Coordination Act Report and satisfy section 2(a) of the FWCA. The Service concurs that our continued coordination and submission of necessary documentation or assessments will ensure that potential resource concerns will be adequately addressed.

Please note our concurrence does not negate the Service's or the USACE responsibilities or requirements mandated by other resource laws such as the Endangered Species Act, National Environmental Policy Act, or the Coastal Zone Management Act. We look forward to continued coordination with the USACE toward the development of this project. If you have any questions or need clarification of Service comments, please contact Mr. Mark Caldwell at (843) 727-4707 ext. 215 and reference FWS Log No. 2012-CPA-0060.

Sincerely,

Jay B. Herrington
Field Supervisor

JBH/MAC

From: Schroer, Keely
To: Hughes, Andrea W CIV USARMY CESAC (USA)
Cc: Johnson, Elizabeth; SPIREK, JIM; BRADLEY, RYAN
Subject: [Non-DoD Source] Re: Edisto Beach Coastal Storm Risk Management Project, Colleton County
Date: Wednesday, April 29, 2020 4:48:15 PM

Dear Andrea:

Thank you for your email regarding the subject-referenced project. We also received the plans and previous correspondence as supporting documentation for this undertaking. The State Historic Preservation Office (SHPO) is providing comments to the Corps of Engineers (Corps) pursuant to Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR 800. Consultation with the SHPO is not a substitution for consultation with Tribal Historic Preservation Offices, other Native American tribes, local governments, or the public.

Our office defers to the expertise of the Maritime Research Division (MRD), under the direction of the State Underwater Archaeologist, for undertakings that may include submerged resources. The following are the comments and recommendations of the MRD:

"After review of the Corps ongoing Edisto beach re-nourishment project and their proposed use of the original borrow area with the 1500-foot buffer to protect potential paleolandscape features, we concur that no additional surveys are required at this time."

Please contact Ryan Bradley at 803-576-6565 or rbradley@sc.edu or Jim Spirek at 803-576-6566 or spirek@sc.edu if you have any questions or require additional information about this recommendation.

Our office concurs that no additional surveys are needed and the responsibilities pursuant to 36 CFR 800.4 have been met.

Please refer to SHPO Project Number 10-CW0381 in any future correspondence regarding this project If you have any questions, please contact me at (803) 896-6181 or KSchroer@scdah.sc.gov.

Sincerely,

Keely

Keely Lewis-Schroer
Archaeologist
State Historic Preservation Office
SC Department of Archives & History
8301 Parklane Road
Columbia, SC 29223
Ph: 803.896.6181 Fax: 803.896.6167 Blockedhttps://scdah.sc.gov/historic-preservation
kschroer@scdah.sc.gov

From: Hughes, Andrea W CIV USARMY CESAC (USA) <Andrea.W.Hughes@usace.army.mil>
Sent: Monday, April 27, 2020 12:09 PM
To: Schroer, Keely
Subject: Edisto Beach Coastal Storm Risk Management Project, Colleton County

Hi Keely,

I'm currently working on the Edisto beach re-nourishment project. A feasibility study with an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) was completed in 2014. In response to the federal project, SHPO provided a letter in 2010 advising a cultural resource survey would be required. The survey report

was completed and reviewed by SCIAA in 2013. In their letter dated April 2013, SCIAA concurred with the contractors recommendations to place a 1500 ft. buffer zone around two areas of potential paleolandscape settings and advised that no additional inspections of the magnetic, acoustic, or sub-bottom reflectors is warranted in the designated borrow site.

The 2014 federal project consisted of a 15-foot high, 15-foot wide dune beginning at the northern end of the project and extending southward along the beach for 16,530 feet and fronted by a 7-foot high berm. At this point, the dune would transition to a 14-foot high, 15-foot wide dune extending around the end of the island for an additional 5,290 feet. No berm was proposed for this reach. In addition, approximately 1,130 feet of total groin lengthening was proposed across 23 of the existing groins.

In 2016, the Town of Edisto applied for and received a Section 404 permit to perform groin lengthening and beach nourishment activities along 3.6 miles of open facing shoreline. The current federal project includes the initial placement of 830,000 CY of sand along 3.1 miles of shoreline. The sand quantity has been reduced by 94,000 CY from the 2014 project due to removal of 5,290 lf of shoreline nourishment along Edisto Inlet based on a request from the non-federal sponsor. The current federal project consists of a 15-foot high, 15-foot wide dune beginning at the southern end of the State Park and extending southward along the beach for 16,530 feet. The dune would be fronted by a 7-foot high (elevation) berm. No berm would be constructed beyond groin 29 because the existing beach profile provides an adequate berm. There will be no groin work since the Town of Edisto completed groin lengthening activities under their 2016 permit. The borrow area location and boundaries will remain the same as the 2014 project.

We have recently been authorized to proceed with the federal project and are currently documenting environmental compliance for the reduced project. We intend to use the original borrow area with the 1500 foot buffer to protect the potential paleolandscape settings. We are requesting SHPO concurrence that no additional surveys are required and we have met our responsibilities under Section 106 of the National Historic Preservation Act, as amended.

Please let me know if you need additional information or if you would like to discuss. Thanks so much for your assistance!

Andrea

Andrea W. Hughes
Biologist, Planning and Environmental Branch
U.S. Army Corps of Engineers, Charleston District
69-A Hagood Avenue
Charleston, South Carolina 29403
843.329.8145

UNIVERSITY OF SOUTH CAROLINA
SOUTH CAROLINA INSTITUTE OF ARCHAEOLOGY AND ANTHROPOLOGY

12 April 2013

Alisha N. Means
Biologist
Planning & Environmental Branch
US Army Corps of Engineers-Charleston District
69A Hagood Avenue
Charleston SC 29403-5107

Re: Review of Edisto Beach Renourishment Project report.

Dear Ms. Means,

Our office has reviewed the draft report of the *Hardbottom and Cultural Resource Surveys, Edisto Beach Offshore Borrow Site, Edisto Beach, South Carolina*, prepared by Dial Cordy and Associates, Inc. for the Edisto Beach hurricane and storm damage protection project. Our review is focused on the submerged cultural resources aspects of the project. The report is a solid discussion of the scope, methods, research, and findings, especially in its awareness of inundated paleolandscapes bearing the potential of prehistoric cultural materials along the South Carolina coast.

We concur with the contractor's recommendations to place a 1,500 ft. buffer zone around the two arbitrary center points: Site 1—E2213373, N232446; and Site 2--E2218203, N227338 (NAD83 South Carolina State Plane East U.S. Survey Feet) as potential paleolandscape features. We also agree that no additional inspections of the magnetic, acoustic, or sub-bottom reflectors is warranted in the designated borrow site. We do, however, request that any inadvertent discovery of potential archaeological materials, i.e., wood structure, prehistoric lithics, ceramics, etc. during dredging operations cease from that area until inspections may reveal the source of this material. Please contact my office or the SHPO for further guidance in this instance. Our office has no objections from a submerged cultural resources viewpoint for dredging operations to occur in this borrow site. If plans change, please consult with our office for additional guidance.

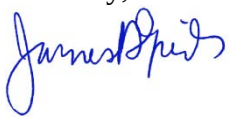
We do though offer several editorial comments to improve the graphics for the final report:

1. Fig. 34, p. 47—please choose a color scheme to more fully reveal the trackline points, as well as to bring out the contours.
2. The above recommendation would also go for the Appendix B contour maps.
3. Please ensure the PDF images are of good quality in 100% zoom.

1321 Pendleton Street • Columbia, SC 29208-0071 • (803) 576-6566 • FAX (803) 254-1338

Thank you for this opportunity to review the report and your support of preserving the submerged archeological legacy in South Carolina waters. If you have any questions, comments, etc. about this matter please contact me.

Sincerely,



James D. Spirek
State Underwater Archaeologist
Maritime Research Division

Cc: Rebekah Dobrasko, SC SHPO

From: Stout, Christopher
To: Hughes, Andrea W CIV USARMY CESAC (USA)
Subject: [Non-DoD Source] RE: Edisto Beach CZC - will a new submission be required?
Date: Tuesday, January 14, 2020 9:37:39 AM

Hey Andrea

With the reduced project footprint, the original Coastal Zone Consistency determination would remain valid and nothing further would be required at this time.

In regards to the potential impacts to dune vegetation, replanting of any disturbed areas would be acceptable and no further coordination on those efforts would be necessary.

Let me know if you have any other questions.

Regards
Chris

Christopher M. Stout
Manager, Coastal Zone Consistency Section
S.C. Dept. of Health & Environmental Control
Office: (843) 953-0691
Mobile: (843) 340-3112
Connect: www.scdhec.gov Facebook Twitter

-----Original Message-----
From: Hughes, Andrea W CIV USARMY CESAC (USA) <Andrea.W.Hughes@usace.army.mil>
Sent: Monday, January 13, 2020 4:05 PM
To: Stout, Christopher <stoutcm@dhec.sc.gov>
Subject: Edisto Beach CZC - will a new submission be required?

Hi Chris,

It looks like we are moving forward with the Edisto project. However, the project scope has been reduced. We will only be responsible for beach nourishment including a berm beginning at Groin 1 (plus the taper) and extending to Groin 32. We will not be doing any work beyond Groin 32 with the revised project and we will not be lengthening the groins or constructing a dune. We estimate the sand quantity to be reduced by at least 10% (94,000) and we will utilize the existing borrow area as noted in the original feasibility/EA document. I've attached a copy of the original CZC issued December 2013. Do we need to submit a new CZC request or modification? Or are we covered for the current project since the work we are proposing is included in the initial CZC?

Also, the engineer indicated that there may be some disturbance of vegetation on the existing dune during construction. I noted the feasibility/EA discusses impacts to dune vegetation and proposes replanting. Is this acceptable or do we need to further coordinate with OCRM for any impacts to dune vegetation?

Thanks for any advice/recommendations you can provide.

Andrea

Andrea W. Hughes
Biologist, Planning and Environmental Branch U.S. Army Corps of Engineers, Charleston District 69-A Hagood Avenue Charleston, South Carolina 29403
843.329.8145

D H E C
PROMOTE PROTECT PROSPER

Catherine B. Templeton, Director
Promoting and protecting the health of the public and the environment

December 23, 2013

Mr. Mark Messersmith
Charleston District Army Corps of Engineers
Planning and Environmental Branch
69A Hagood Avenue
Charleston, S. C. 29403

Re: Federal Consistency certification review of integrated General Investigative Study, Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the Edisto Beach Coastal Storm Damage Reduction project;
CZC project ID # CZC-13-0982

Dear Mr. Messersmith:

This is in response to the Army Corps of Engineer's (ACOE) October 24, 2013, consistency determination of the integrated General Investigative Study, Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the Edisto Beach Coastal Storm Damage Reduction project for Edisto Beach, Colleton County, S. C.

The integrated project, as presented, consists of an analysis of the eventual re-nourishment of approximately 16,530 linear feet (~3.13 linear miles) of shoreline from southern end of Edisto Beach State Park on the east end to an area of beach near the end of Palmetto Boulevard at Big Bay Creek on the west end of Edisto Beach. As part of the study, the ACOE evaluated multiple alternatives ranging from:

- Hard solutions consisting of emergent breakwaters, submerged artificial reefs, new groins, groin lengthening, seawalls, revetments, sand fencing;
- Soft solutions consisting of beach fill, dune vegetation planting;
- Avoidance measures consisting of coastal structure retreat, relocation, demolition, floodproofing structures, elevating structures, and regulatory changes.

The proposed project was chosen based upon a detailed alternatives analysis documented within the study and the preferred alternative consists of re-nourishment and groin lengthening.

The quantity of sand that will be placed on the beach during re-nourishment is estimated at approximately 924,000 cubic yards of beach quality sand to be placed (on the beach) seaward of existing dunes, sea walls, and revetments. The borrow area is located approximately 1.5 to 2.5 miles offshore of the midpoint of the island. It is estimated the borrow site contains 7.2 million cubic yards of beach compatible sand. Additionally, the project entails the lengthening of 23 groins ranging from 20 to 80 feet for a total of 1,130 feet and an average of 49 feet per groin.

The planned dune height will range from 14 feet to 15-feet with a width ranging from 15 feet beginning at the northern end of the project and extending southward along the beach for 16,530 feet. This dune would be fronted by a 7-foot high berm. The first 7,740 feet of berm length would have a width of 75 feet. The width would then taper to a 50-foot width for the remaining length of the berm. The width of each end of the berm would taper to tie into the existing beach profile. On the Edisto River portion, the dune would transition into a 14-foot high (elevation), 15-foot wide dune that extends for 5,290 feet. No berm would be constructed in front of this dune because the existing beach profile provides an adequate berm.

The lengthening of the groins will be commensurate with the re-nourishment that is, the effective length of the groins will increase in proportion to the beach re-nourishment causing the shoreline to be displaced seaward by the same amount of the groins. If results of beach profile monitoring determine that the lengthened groins have increased erosion on downdrift beaches, the ACOE is committed to removing the lengthened section of groins.

DHEC staff agrees with the consistency determination that the project is consistent to the maximum extent practible as required by 15 CFR § 930, Subpart C with the following provisions:

- given the integrated nature (Investigative Study, EA and FONSI) of the request, this review constitutes DHEC's final Federal Consistency certification for the project. However, DHEC reserves the right to require additional review (for consistency) of any modification as the project will require additional internal (federal) approvals. Staff should be kept abreast of project meetings, scoping sessions, etc. to ensure continued project compliance.

- if annual monitoring shows negative effects on downdrift properties linked to the groin lengthening, the ACOE must address the issue to the satisfaction of DHEC within an agreed upon timeframe.

DHEC staff's concurrence referrs to the following policies contained within the South Carolina's Coastal Zone Management Program (CZMP): Coastal Industries (*Mining*); Dredging (*Dredging and Spoil Disposal*); Erosion Control (*Funding and General Erosion Control*), the policies associated with Activities in Areas of Special Resource Significance (Barrier Islands, Dune Areas), and the priority of uses associated with Geographic Areas of Particular Concern (GAPC's).

Please do not hesitiate to contact me should you have any questions.

Sincerely,

Curtis M. Joyner
Manager, Coastal Zone Consistency Section
Regulatory Division – DHEC OCRM
1362 McMillan Avenue, Suite 400
Charleston, S. C. 29405
843-953-0205
joynercm@dhec.sc.gov

Cc: Carolyn Boltin - Kelly
Rheta DiNovo
Blair Williams

United States Department of the Interior

FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

January 27, 2010

Mr. Mark J. Messersmith
Biologist
U.S. Army Corps of Engineers - SAW@SAC
69A Hagood Avenue
Charleston, SC 29403-5107

Re: Edisto Beach Shore Protection Feasibility Study Area

Dear Mr. Messersmith:

This letter is in response to your January 6, 2010, email to Craig Aubrey of the U.S. Fish and Wildlife Service (Service) in which you asked the Service to ascertain if the proposed borrow site for the above-referenced project is located within the John H. Chafee Coastal Barrier Resources System (CBRS). After reviewing your email and the official maps for the CBRS, we have determined that the proposed borrow site is not located in the CBRS. Should you have any questions, please call Mr. Aubrey of my staff at (843) 727-4707 ext. 301.

Sincerely,

Diane L. Lynch
Acting Field Supervisor

DLL/CWA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

October 28, 2013 F/SER47:JD/pw

(Sent via Electronic Mail)

Lt. Col. John Litz, Commander
Charleston District, Corps of Engineers
69A Hagood Avenue
Charleston, South Carolina 29403-5107

Attention: Mark Messersmith

Dear Lt. Colonel Litz:

NOAA's National Marine Fisheries Service (NMFS) reviewed the *Draft Integrated Feasibility Report and Environmental Assessment, Coastal Storm Damage Reduction, Edisto Beach, Colleton County,* dated August 2013. Appendix G of the Environmental Assessment is an Essential Fish Habitat (EFH) Assessment. The Tentatively Selected Plan (TSP) is to nourish 4.5 miles (21,820 linear feet) of Edisto Beach, with approximately 924,000 cubic yards of sand from an offshore borrow site and then nourish the beach with approximately 220,400 cubic yards of sand at 8-year intervals. Initial construction is anticipated to occur in 2018. The District lists four purposes for the project: provide coastal storm damage reduction, reduce the risk of damage to SC Hwy 174, preserve sea turtle nesting habitat, and protect shorebird nesting foraging and roosting habitat. The District's initial determination is the impacts to EFH would be temporary and would not result in significant effects on managed fishery species. As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the following comments and recommendations are provided pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Proposed Project Description
The TSP (Environmental Assessment Alternative 4) would require an estimated 924,000 cubic yards of borrow material to be placed on the beach during initial construction, followed by 220,400 cubic yards during subsequent nourishment cycles, which are estimated to occur at 8-year intervals. During the 50-year project, this equates to six nourishment events totaling 2.25 million cubic yards. Initial construction is anticipated to require 120 to 150 days, and subsequent nourishment events are expected to require 30 days. The project design for 2018:

1) Construction of a 15-foot high (elevation), 15-foot wide dune beginning at the northern end of the project (i.e., the southern end of the State Park) and extending southward along the beach for 16,530 feet. This dune would be fronted by a 7-foot high (elevation) berm. The first 7,740 feet of berm length would have a width of 75 feet tapering to a 50-foot width for the remaining length of the berm. The width of each end of the berm would taper to match the existing beach profile.

2) The dune would then transition into a 14-foot high (elevation), 15-foot wide dune that extends around the end of the island for 5,290 feet. No berm would be constructed in front of this dune because the existing beach profile provides an adequate berm.
3) Approximately 1,130 feet of total groin lengthening across 23 existing groins.

The proposed borrow area is within an ebb-tidal shoal 1.5 miles to 2.5 miles southeast of the southern point of Edisto Beach and has approximately 7.2 million cubic yards of beach quality material within 649 acres. While the grain-size distributions of borrow and beach material differ, the District concludes borrow and beach sediments are compatible based on mean grain size and the low concentration of fine material within borrow sediments. A survey conducted in March 2013 showed no hardbottom habitat in the borrow area or within a quarter mile buffer surrounding the borrow area.

A hydraulic cutterhead dredge or a hopper dredge would be used to transport the sand from the borrow site through a pipeline to the beach. The average dredging depth would be approximately 6.4 feet with a maximum of 10.3 feet. The pipeline would run adjacent to the groins and parallel to the beach. A slurry of beach compatible material would be pumped onto the beach behind temporary training dikes, and bulldozers, articulated front-end loaders, and similar machinery would grade the material into the construction profile. To the "maximum extent practicable," construction would occur November 1 through April 30 to minimize impacts to benthic communities and larval fishes migrating into nursery areas.

Essential Fish Habitat
While the EFH Assessment describes several habitats designated as EFH or as an HAPC, surf zone habitat is not discussed, and the South Atlantic Fishery Management Council designates this habitat as EFH for mackerels and cobia in the fishery management plan for coastal migratory pelagic fishes. In addition, estuarine emergent vegetation is list as present within the action area; however, it is unclear if any would be impacted by the project. While NMFS believes this is not the case, it should be clearer in the final Environmental Assessment which habitats would be impacted by the project and which habitats simply occur in the vicinity.

Impacts to Essential Fish Habitat
The Environmental Assessment notes the principal impact to EFH from the project would be destruction of the benthic communities, which serve as prey for fishery species, within the borrow and fill areas from the physical disturbance created by dredging and sand placement. The Environmental Assessment concludes the benthic communities within borrow and beach areas are expected to recover within two years. The basis for this conclusion is not clear. The EFH Assessment does not review relevant sediment and biological monitoring conducted by the South Carolina Department of Natural Resources (SCDNR) at Folly Beach and at Hilton Head Island. For example, Bergquist et al. (2008) and Bergquist et al. (2009) examined the response and recovery of borrow and beach area following the 2005 and 2007 nourishments of Folly Beach and concluded dredging significantly and persistently changed sediment characteristics and biological communities within the borrow areas. Sediments in the Folly Beach borrow areas shifted from sand towards fine and organically-enriched material (i.e., mud) and did not show recovery after one year. Silt and clay content of the borrow area sediments was 3.4 times higher and sand phi size was twice as large following the 2005 project. During the 2007 project, silt/clay content and organic matter increased, calcium carbonate decreased, and sand phi size

increased (became finer) significantly following dredging and had not recovered twelve months later when the formal monitoring ceased. Informal monitoring of the surficial sediments indicates mud is still present in these borrow areas four and six years after dredging stopped (pers. comm., Denise Sanger, SCDNR, August 21, 2013). This sediment shift is consistent with changes documented in other borrow areas in South Carolina excavated deeper than 1 meter by hydraulic dredge and located close to a sources of fine terrigenous and estuarine sediments, such as tidal rivers like the Edisto (Bergquist and Crowe 2009).

Focusing on biological impacts, SCDNR concluded both the 2005 and 2007 Folly Beach projects led to significant declines in benthic macrofaunal density and species richness and substantial changes in benthic community structure (Bergquist et al. 2008, Bergquist et al. 2009). For example, between pre- and post-dredging time frames, total infaunal density decreased 84% at one borrow area with little to no evidence of recovery one year later. Species evenness and diversity were also negatively impacted by dredging. These impacts likely reflect the shift from sand to muddy substrates decrease the value of the borrow areas as fishery foraging habitat. The final Environmental Assessment should provide a complete review of the impacts to benthic communities from dredging and sand placement and conclusions about recovery rates should be tempered to note the recovery rate is based on the borrow area filling with sediments similar to those currently present. On page 96 (Table 9.1), the draft Environmental Assessment states a monitoring program developed with SCDNR would be implemented to determine impacts to and recovery of the macroinvertebrate community within the borrow site. There is no discussion of this monitoring plan in the EFH Assessment. Because the benthic community includes prey for federally managed fishery species, the monitoring should be discussed in the EFH Assessment.

The Environmental Assessment notes that, as a result of these studies, SCDNR now recommends restrictions on dredge pit depths and locations. Specifically, mining of ebb-tidal shoals for sand should occur on the downdrift end of beaches to promote faster recovery of the benthic community impacted by the dredging. The borrow area proposed for the Edisto Beach nourishment meets this recommendation; however, SCDNR also recommends dredging depths be limited to avoid creating deep pits where fine grain material can settle. The Charleston District is proposing to dredge to 10.3 feet below grade. This is approximately the same depth to which the Folly Beach borrow areas were dredged in 2005, and those borrow areas filled with fine grained, muddy sediments and remain in that state today. Due to the location of the proposed Edisto borrow site, NMFS expects the influx of muddy sediment to be limited; however, the depth to which the dredging is proposed remains a concern.

Finally, NMFS expects this EFH consultation to be valid only for the initial construction. Forecasting of EFH impacts from subsequent nourishment events should be based on new information develop by the Edisto monitoring program and similar projects.

Conservation Recommendations
Section 305(b)(4)(A) of the Magnuson-Stevens Act requires NMFS to provide EFH conservation recommendations when an activity is expected to adversely impact EFH. Based on this requirement, NMFS provides the following:

EFH Conservation Recommendations

- The Charleston District shall limit dredge depths within the borrow area to depths shown by modeling or empirical studies to fill with beach compatible material.
- The borrow area monitoring plan shall be provided to NMFS for review and approval prior to commencement of the project. The plan components should be similar to the 2005 Folly Beach borrow area study.

Finally, in accordance with section 7 of the Endangered Species Act of 1973, as amended, it is the responsibility of the lead federal agency to review and identify any proposed activity that may affect endangered or threatened species and their habitat. Determinations involving species under NMFS jurisdiction (e.g., sea turtles in-water, sturgeon) should be reported to our Protected Resources Division at the letterhead address.

We appreciate the opportunity to provide these comments. Please direct related correspondence to the attention of Ms. Jaclyn Daly-Fuchs at our Charleston Area Office. She may be reached at (843) 762-8610 or by e-mail at Jaclyn.Daly@noaa.gov.

Sincerely,

Pete Willer

/ for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc:

COE, Mark.J.Messersmith@usace.army.mil
DHEC, trumbumt@dhec.sc.gov
SCDNR, DavisS@dnr.sc.gov
SAFMC, Roger.Pugliese@safmc.net
EPA, Laycock.Kelly@epa.gov
FWS, Karen_Mcgee@fws.gov
F/SER4, David.Dale@noaa.gov
F/SER47, Jaclyn.Daly@noaa.gov

Literature Cited

Bergquist, D., S. Crowe, M. Levisen, R. VanDolah. 2008. Change and recovery of physical and biological characteristics of the borrow area impacted by the 2007 Folly Beach Emergency Renourishment Project. Final Report prepared for the U.S. Army Corps of Engineers, Charleston District. 111 pages

Bergquist, D., S. Crowe, M. Levisen, and R. Van Dolah. 2009. Change and recovery of physical and biological characteristics of the borrow area impacted by the 2007 Folly Beach emergency renourishment project. Final Report prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division, Charleston, South Carolina, for the U.S. Army Corps of Engineers, Charleston District. 70 pages

Bergquist, D. and S. Crowe. 2009. Using Historical Data and Meta-analyses to Improve Monitoring and Management of Beach Nourishment in South Carolina. Final Report prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division for the South Carolina Department of Health and Environmental Control. 99 pages

USACE Response as published in the Final Integrated Feasibility Report and Environmental Assessment:

Thank you for your comments. Additional information has been added to the Final EFH on surf zone EFH and estuarine emergent vegetation. Also, the final EFH includes your conservation recommendations and the USACE revised conservation measures based on your expert analysis.

US Army Corps
Of Engineers
Charleston District

ESSENTIAL FISH HABITAT ASSESSMENT

COASTAL STORM DAMAGE REDUCTION

GENERAL INVESTIGATION STUDY

EDISTO BEACH, COLLETON COUNTY

SOUTH CAROLINA

JANUARY, 2014

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this document is to present the findings of the Essential Fish Habitat (EFH) assessment conducted for the proposed Edisto Beach Shore Protection Project as required by the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended through 1996 (Magnuson-Stevens Act). The objectives of this EFH assessment are to describe how the actions proposed by the project may affect EFH designated by the National Marine Fisheries Service (NMFS) and the South Atlantic Fisheries Management Council.

The EFH assessment will include a description of the proposed action, an analysis of the direct, indirect, and cumulative effects on EFH for the managed fish species and their major food sources, and our views regarding the effects of the proposed action.

2.0 PROJECT DESCRIPTION

The proposed project (see Figures 1 thru 4) was determined after a detailed alternatives analysis documented within the Feasibility Study/Environmental Assessment. The project consists of the following elements: 1) A 15-foot high (elevation), 15-foot wide dune beginning at the northern end of the project (i.e., the southern end of the State Park) and extending southward along the beach for 16,530 feet. This dune would be fronted by a 7-foot high (elevation) berm. The first 7,740 feet of berm length would have a width of 75 feet. The width would then taper to a 50-foot width for the remaining length of the berm. The width of each end of the berm would taper to match the existing beach profile; 2) The dune would then transition into a 14-foot high (elevation), 15-foot wide dune that extends around the end of the island for 5,290 feet. No berm would be constructed in front of this dune because the existing beach profile provides an adequate berm; and 3) Approximately 1,130 ft of total groin lengthening across 23 of the existing groins (Figure 5 and Table 1). Results of a coastal engineering analysis determined that this minimal amount of lengthening will not have any downdrift impacts as the design is simply to stabilize the proposed berm width. Because the distance between the landward toe of the dune and the seaward edge of the berm for the beach design exceeds the existing condition distance between these same points along certain reaches within the project, the effective length of the groins in these areas will be reduced. Consequently, the length of some groins will need to be increased in order to create beach width necessary to maintain the design cross-section. The proposed groin lengthening is not provided as a means for trapping more sand and increasing beach width or significantly changing the rate of sand bypassing the groins. The renourishment interval for the proposed project has been estimated to occur every 16 years.

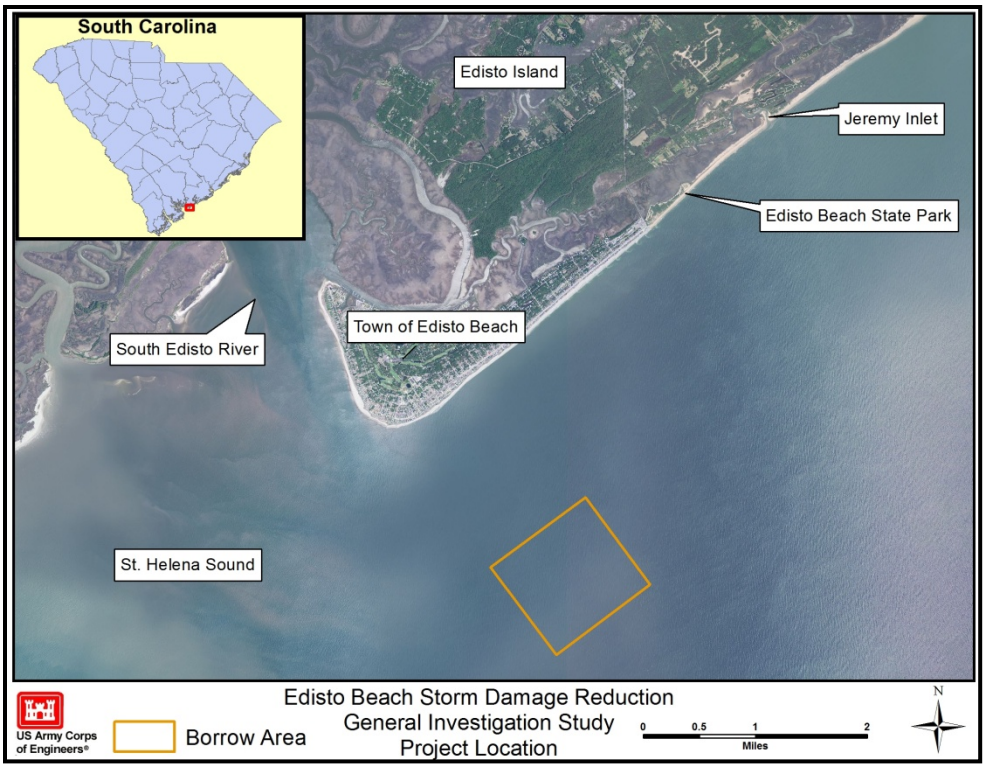


Figure 1. Location of Edisto Beach and proposed borrow site

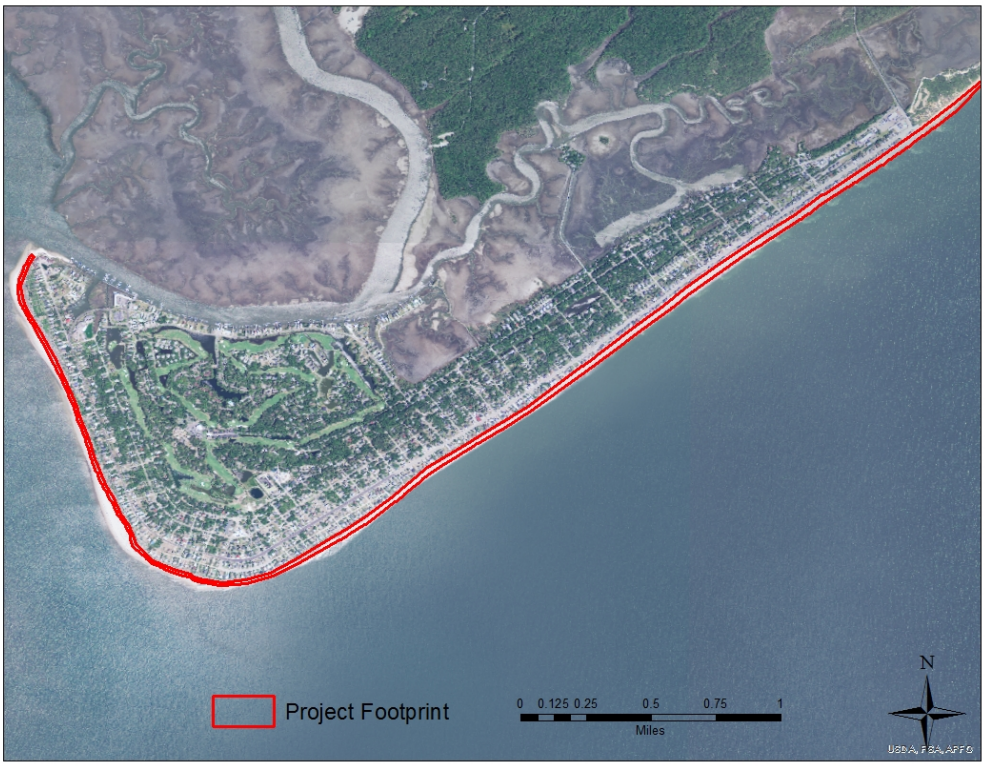


Figure 2. Project footprint from landward toe of dune to seaward berm crest

Figure 3. Project footprint along inlet reaches

Figure 4. Project footprint along Atlantic Ocean facing reaches

Figure 5. Spatial location of proposed groin lengthenings

Table 1. Proposed groin lengthening dimensions by groin number

Groin Extension Lengths			
Groin #	**Extension length (ft)**	**Groin #**	**Extension length (ft)**
1	80	13	40
2	80	14	30
3	90	15	20
4	90	16	20
5	100	17	20
6	100	18	20
7	80	20	20
8	60	21	30
9	50	22	30
10	50	23	20
11	40	24	20
12	40		
Total Groin Lengthening: 1,130 feet			

Construction will be by means of either a hydraulic cutterhead dredge or a hopper dredge that will transport the sand through a pipeline. The pipeline will run adjacent to the groins and parallel with the beach. Beach compatible material (sand) from an offshore source

will be pumped along the 21,820 linear feet of the project and will be discharged as a slurry. During construction, temporary training dikes of sand will be used to contain the discharge and control the fill placement. Fill sections will be graded by land-based equipment, such as bulldozers, articulated front-end loaders, and other equipment as necessary to achieve the desired beach profile. Equipment will be selected based on whatever generates only minimal and acceptable temporary environmental impacts, as well as whatever proves to be the most advantageous economically. The sand will then be graded, raked, and tilled as necessary in coordination with recommendations and requirements from regulatory agencies. It is anticipated that construction will begin in late-2018 and will require approximately 4 to 5 months for completion. A construction window of November 1 through April 30 will minimize impacts to sea turtles, fish, shellfish, and infauna, and will be utilized whenever possible (see USFWS Construction Windows, Appendix A). The schedule could change due to congressional funding, contractual issues, inclement weather, equipment failure, or other unforeseen difficulties.

The borrow area for the proposed project occurs on an ebb-tidal shoal located approximately 1.5 miles to 2.5 miles southeast of the southern point of Edisto Beach and is approximately 649 acres in size (Figure 1). The site was determined from a larger search area and was narrowed down to include sands that most appropriately match the native beach sands on Edisto Beach. The borrow area contains approximately 7.2 million cubic yards of beach compatible sands. Native beach sands were determined based on beach samples collected at 34 stations along Edisto Beach and reflects conditions after the 2006 renourishment project (completed by Coastal Science and Engineering). Each station included four grab samples – one each from the toe of the dune, berm, beach face, and low tide swash zone. Results of this analysis determined that the beach sands have a mean phi size of 1.31, 0.1 % silt/clay mix, and 26.9% visual shell hash. These results compare favorably with the borrow area sands (Table 2).

Additionally, a cultural and hardbottom resources survey was completed at the borrow area in March 2013. The survey utilized three techniques: 1. Side scan sonar, 2. Sub-bottom profiling, and 3. Magnetometer. Results of this survey determined that there are no hardbottom resources within the proposed borrow area. The borrow area location has been shared with multiple resource agencies over the course of the study and no additional issues have been raised to date.

Table 2. Edisto Beach grain size comparison between borrow site and native beach sands

	MEAN (phi)	STD DEV (phi)	% PASSING #5	%PASSING #10	% PASSING #200	% PASSING #230	% VISUAL SHELL
Edisto Native Beach	**1.31**	**1.33**	**97.8**	**93.5**	**0.1**	**0.0**	**26.9**
Borrow - Scenario A	**1.73**	**1.31**	**94.7**	**90.0**	**0.4**	**0.2**	**18.8**
NOTE: The data comparison above is not a Federal requirement, but is provided to gain a perspective as to the quality of material in the borrow area which is proposed for placement as nourishment material on the beach.							

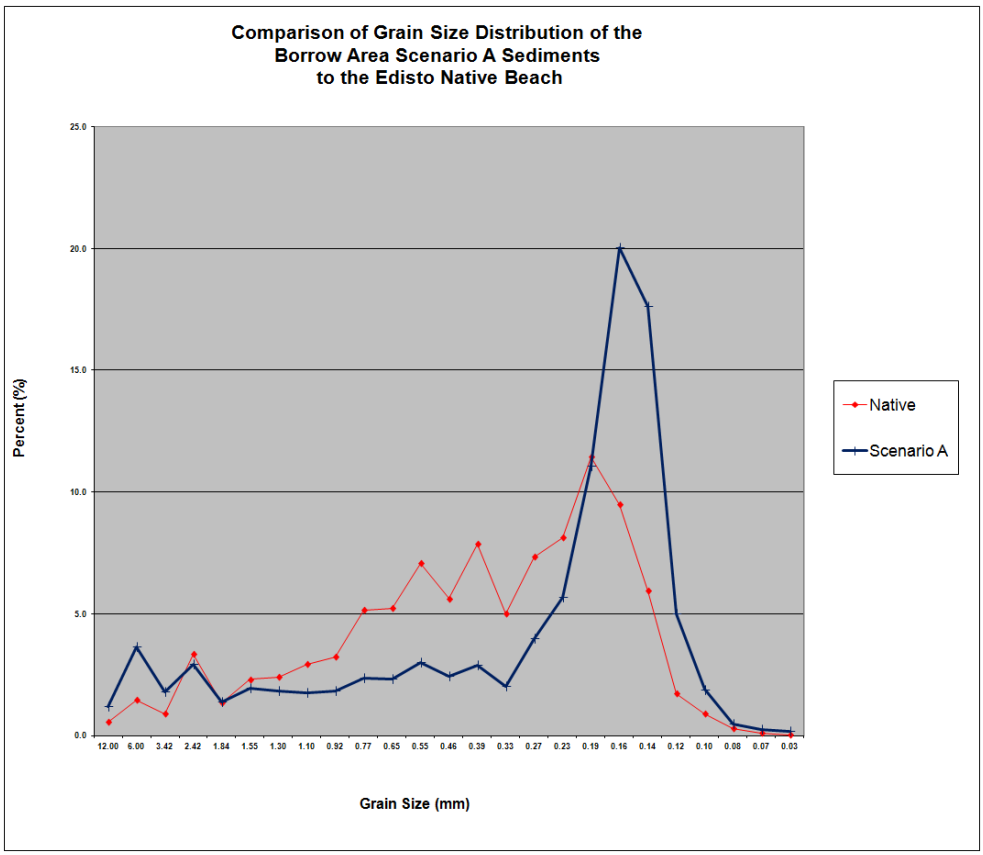


Figure 5. Histogram of native beach sands vs. proposed borrow site

Edisto Beach has very coarse sand and previous attempts at using fencing along a constructed berm to create an eolian transport driven dune have been unsuccessful. Therefore, the proposed project involves the creation of a 14 to 15 foot high dune at 15 feet width and a 3:1 slope. This dune feature may bury existing dune vegetation in some areas, especially along the inlet section of the beach. The proposed project consists of planting dune vegetation along the constructed dune including foreslope and backslope. The use of native vegetation will provide an environmental enhancement to the beach front while helping to stabilize the constructed dune. Plantings will be done in a matrix fashion and consist of native vegetation including but not limited to sea oats, Bitter panicum, and American beachgrass (Bogue variety). The total area of necessary dune planting is 29.68 acres.

3.0 ESSENTIAL FISH HABITAT

The 1996 amendments to the Magnuson-Stevens Act set forth a mandate for NOAA Fisheries, regional Fishery Management Councils, and other Federal agencies to identify and protect EFH of economically important marine and estuarine fisheries. To achieve this goal, suitable fishery habitats need to be maintained. In South Carolina waters, there are three federal entities that manage fish: the NMFS, the South Atlantic Fishery Management Council, and the Mid-Atlantic Fishery Management Council.

Edisto Beach supports significant fish and wildlife resources including many marine and estuarine species. The estuary supports large populations of penaeid shrimp and blue crabs which are economically important species. Demersal fish species include Atlantic croaker, bay anchovy, Atlantic menhaden, spotted hake, weakfish, spot, blackcheek tonguefish, white catfish, and silver perch. Other fish of commercial or recreational value are commonly found around Edisto Beach, including flounder, red drum, spotted seatrout, bluefish, spot, and black drum.

All of the tidally influenced reaches and adjacent wetlands are considered EFH, as well as coastal waters. Some of these areas include estuarine emergent wetlands, oyster reefs/shell banks, intertidal flats, aquatic beds, estuarine water column, and marine water column (Table 3).

Table 3. Essential Fish Habitat list and occurrence

Essential Fish Habitat List and Study Area Occurrence		
Habitat Type	**Habitat Name**	**Project Area**
Estuarine	Estuarine Emergent Wetland (tidal marsh)	Yes
Estuarine	Estuarine Scrub/shurb mangroves	No
Estuarine	Sea grass	No
Estuarine	Oyster reefs and shell banks	Yes
Estuarine	Intertidal flats	Yes
Estuarine	Palustrine emergent and forested wetland	No
Estuarine	Aquatic beds	No
Estuarine	Estuarine Water Column	Yes
Estuarine	Unconsolidated Bottom	Yes
Marine	Live/Hard bottoms	No
Marine	Coral and coral reefs	No
Marine	Artificial/manmade reefs	No
Marine	Sargassum	No
Marine	Marine water column	Yes
Marine	Surf zone	Yes

3.1 Estuarine Emergent Wetland (tidal marsh)

Tidal marshes are one of the dominant features of the coastal plain in South Carolina. Tidal marshes serve many important functions. The basis of the importance of these marsh communities involves the basic high productivity of the marsh itself and its function of trapping nutrients. The dense plant growth in the marsh also provides excellent cover for many species of birds, aquatic and semi-aquatic mammals, reptiles and amphibians, and typically provides spawning grounds, nurseries, shelter, and food for many species of finfish, shellfish, birds, and other types of wildlife. Besides water quality and habitat benefits, marshes also serve to buffer storm waves and slow shoreline erosion.

3.2 Oyster Reefs and Shell Banks

Oyster reefs and shell banks are defined by SAFMC as being the, "natural structures founds between and beneath tide lines, that are composed of oyster shell, live oysters and other organisms". This habitat is usually found adjacent to emergent marsh vegetation and provides the other three-dimensional structural relief in soft-bottom, benthic habitat (Wenner et al., 1996). Optimal salinity for *Crassostrea virginica* ranges from 12ppt to 25ppt, and in South Carolina are 95% intertidal (Lunz 1952). Oyster reefs are extremely important to the aquatic ecosystem in South Carolina as they remove particulate matter, release inorganic and organic nutrients, stabilize sediments, provide habitat cover, etc.

3.3 Intertidal Flats

Intertidal flats serve various functions for many species' life stages. The estuarine flats serve as a foraging ground, refuge, and nursery area for many mobile species as well as the microalgal community, which can function as a nutrient (nitrogen and phosphorus) stabilizer between the substrate and water column. An intertidal flat's benthic community can include, but is not limited to, worms, bivalves, and gastropods. This tidally influenced, constantly changing EFH provides feeding grounds for predators, refuge and feeding grounds for juvenile and forage fish species, and nursery grounds for estuarine dependant benthic species (SAFMC 1998).

Animals that move from a pelagic larval to a benthic juvenile existence make use of these EFH flats for life stage development. These flats can provide a comparatively low energy area with tidal phases which allow species the use of shallow water habitat as well as relatively deeper water within small spatial areas. Species such as summer flounder (*Paralichthys dentatus*), red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), striped mullet (*Mugil cephalus*), gray snapper (*Lutjanus griseus*), blue crab (*Callinectes sapidus*), and shrimp use these EFHs as nurseries. These flats also serve as refuge areas for species avoiding predators, which use the tide cycles for access to estuarine feeding grounds(SAFMC 1998).

3.4 Estuarine Water Column

This habitat comprises multiple salinity regimes, the one most important to this study being euhaline waters (>30ppt) and to a lesser extent polyhaline waters (18-30ppt). The water column has both horizontal and vertical components that result in changing salinity, phytoplankton, oxygen content, nutrients, etc. This habitat provides a rich opportunity for biota to live within whichever parameters they are adapted to. Many marine-spawning species use the water column as larvae as they are transported through inlets.

3.5 Unconsolidated Bottom

This habitat type consists of soft sediments that are inhabitated by a diverse assemblage of macroinvertebrates that serve as prey to demersal fish species. They can be characterized by the lack of large stable surfaces for plant and animal attachment. These areas include all wetland and deepwater habitats with at least 25% cover of particles smaller than stones and a vegetative cover less than 30% (USGS, http://www.npwrc.usgs.gov/resource/wetlands/classwet/unconsol.htm).

3.6 Marine Water Column

The water column serves as EFH for all managed species and their prey, at various life stages, by providing habitat for spawning, breeding, feeding and growth. Species (and life stages) for which the column of seawater has been designated as EFH are discussed in the following section, Managed Fish Species.

3.7 Surf Zone

The surf zone serves as EFH for mackerels and cobia as well as red drum. These species utilize the surf zone for foraging habitat.

4.0 HABITAT AREAS OF PARTICULAR CONCERN

4.1 Penaeid Shrimp

Areas which meet the criteria for HAPC for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp, and state-identified overwintering areas. In South Carolina, since there are no seagrass beds, nursery habitat of shrimp is the high marsh areas with shell hash and mud bottoms. Since there is seasonal movement out of the marsh and into deep water and creek channels during the winter months, the HAPC encompasses the entire estuarine system (Figure 6).

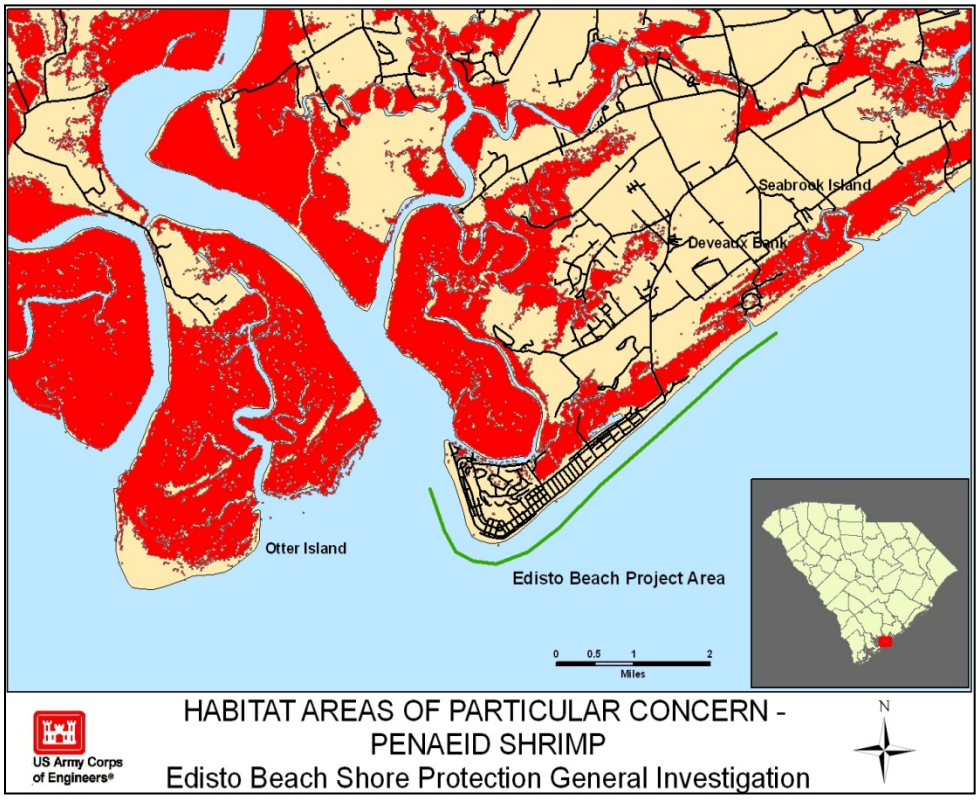


Figure 6. Penaeid Shrimp HAPC

4.2 Snapper-Grouper Complex

HAPC exists for the Snapper-Grouper complex in and around the Edisto Beach project area. These HAPC consist of coastal inlets, oyster/shell habitat, and Special Management Areas (Figure x). The closest Special Management Area is approximately 8 miles from the Edisto beachfront and will not be impacted by the project. Others areas of HAPC include medium to high profile hard bottom, localities of known or likely periodic spawning aggregations, and nearshore hard bottom areas. None of these are in the vicinity of the proposed project (Figure 7).

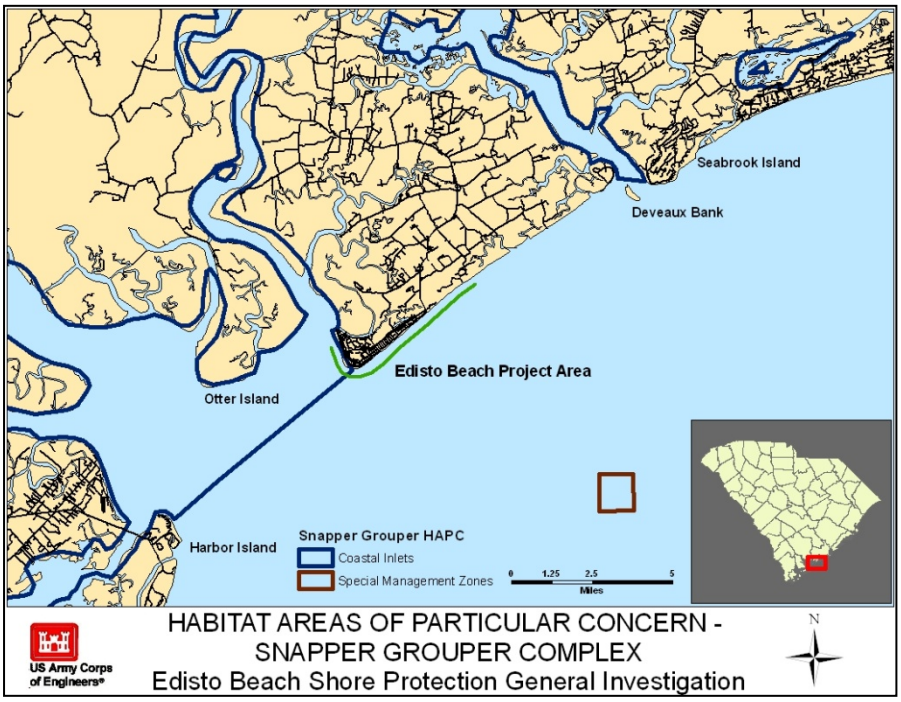


Figure 7. Snapper-Grouper complex HAPC

5.0 MANAGED FISH SPECIES

Table 4 lists the managed species that may occur in the project area.

5.1 Penaeid Shrimp

In the southeastern United States, the shrimp industry is based on the white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), and the deeper water rock shrimp (*Sicyonia brevirostri*). The royal red shrimp (*Pleoticus robustus*) also occurs in deeper water and sustains a limited harvest. For the above

species, coastal inlets have been classified as HAPC. Within the project area, this includes the estuarine and marine water columns within the South Edisto River inlet. These areas are the

Table 4. Fishery Management Plans and managed species for the project area

Fishery Management Plans (FMPS) and Managed Species for the South Atlantic that may Occur in the Project Area	
Common Name	**Species**
Shrimp	
brown shrimp	*Farfantepenaeus aztecus*
pink shrimp	*Farfantepenaeus aduorarum*
rock shrimp	*Sicyonia brevirostris*
royal red shrimp	*Pleoticus robustus*
white shrimp	*Litopenaeus setiferus*
Snapper Grouper Complex	
Jack crevalle	*Caranx hippos*
gag grouper	*Mycteroperca microlepis*
black sea bass	*Centropristis striata*
mutton snapper	*Lutjanus analis*
red snapper	*Lutjanus campechanus*
lane snapper	*Lutjanus synagris*
gray snapper	*Lutjanus griseus*
yellowtail snapper	*Ocyurus chrysurus*
spadefish	*Chaetodipterus faber*
white grunt	*Haemulon plumieri*
sheepshead	*Archosargus probatocephalus*
hogfish	*Lachnolaimus maximus*
Coastal Migratory Pelagics	
king mackerel	*Scomberomorus cavalla*
Spanish Mackerel	*Scomberomorus maculatus*
cobia	*Rachycentron canadum*
Mid-Atlantic FMP species which occur in South Atlantic	
bluefish	*Pomatomus saltatrix*
summer flounder	*Paralichthys dentatus*
Federally Implemented FMP	
lemon shark	*Negaprion brevirostris*
bull shark	*Carcharhinus leucas*
blacknose shark	*Carcharhinus acronotus*
finetooth shark	*Aprionodon isodon*
dusky shark	*Carcharhinus obscurus*
bonnethead shark	*Sphyrna tiburo*
Atlantic sharpnose shark	*Rhizoprionodron terraenovae*

connecting waterbodies between inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity. Essential Fish Habitat for rock shrimp and royal red shrimp occurs in deeper offshore waters. None of these offshore areas occur within the study area.

5.1.1 White Shrimp

White shrimp are offshore and estuarine dwellers. They can be either pelagic or demersal depending on their life stage. They prefer muddy or peaty bottoms rich in organic matter and decaying vegetation when occupying inshore waters. When offshore, they are most abundant on soft muddy bottom sediments. Postlarval white shrimp are benthic dwellers when reaching their nursery areas in estuaries. The juveniles move from estuarine areas to coastal waters as they mature, and adults generally inhabit waters of 27 m or less. White shrimp have centers of abundance in South Carolina, Georgia, and northeast FL.

Spawning area: Most spawning in South Carolina occurs within about 4 miles of the coast, between April and October.

Nursery area: South Edisto River Inlet, Big Bay Creek and Scott Creek

5.1.2 Brown Shrimp

Brown shrimp prefer soft muddy bottom sediments when offshore, and as adults may be found in areas of mud, sand, and shell. They are more active at night and bury into the sediment during the day.

Spawning area: Most spawning in South Carolina occurs in relatively deep water. The season is uncertain, although mature females and males have been found off South Carolina during October and November.

Nursery area: South Edisto River Inlet, Big Bay Creek and Scott Creek

5.1.3 Pink Shrimp

Pink shrimp most commonly found on hard sand and calcareous shell bottom. Similar to brown shrimp, the pink shrimp is more active at night, and generally buries into the sediment during the day.

Spawning area: Most spawning in South Carolina occurs between 3.7 and 15.8 m starting in May.

Nursery area: South Edisto River Inlet, Big Bay Creek and Scott Creek

5.2 Snapper Grouper

The snapper grouper complex utilizes both pelagic and benthic habitats throughout their life cycles. Larvae are free swimming within the water column. During this stage they commonly feed on zooplankton. Juveniles and adults are frequently bottom dwellers that associate with hard structures with moderate to high relief. The principal fishing areas are located in live bottom and shelf-edge habitats in deeper waters. Several patterns are present: (1) for many groupers, spawning occurs over one or two winter months, (2) spawning occurs at low levels year-round with peaks during the warmer months, and (3). The species tend to form sizable spawning aggregations, but this might not be the case with all species.

Ten families of fish containing 73 species are managed by the South Atlantic Fishery Management Council (SAFMC). There is variation in specific life history patterns and habitat use among the snapper grouper species complex. Snapper grouper species utilize both benthic and

pelagic habitats during their life cycle. They live in the water column and feed on zooplankton during their planktonic larval stage, while juveniles and adults are demersal and usually associate with hard structures with high relief. EFH for these species in SC includes estuarineemergent wetlands, estuarine scrub/shrub wetlands, unconsolidated bottom, live/hard bottom, and oyster beds. Coastal inlets, including those waters of the South Edisto River inlet are considered Habitat Areas of Particular Concern (HAPC), along with oyster beds. These areas are critical for spawning activity as well as feeding and daily movements.

5.3 Coastal Migratory Pelagics

King and Spanish mackerel and cobia are coastal migratory pelagic species managed by the SAFMC. EFH for these species include the South Edisto River inlet. Many coastal pelagic prey species are estuarine-dependant in that they spend all or a portion of their lives in estuaries. Accordingly, the coastal pelagic species, by virtue of their food source, are to some degree also dependent upon estuaries and, therefore, can be expected to be detrimentally affected if the productive capabilities of estuaries are greatly degraded.

5.4 Highly Migratory Pelagics

This category consists of Atlantic Bluefin Tuna, Atlantic Bigeye Tuna, Atlantic Yellowfin Tuna, Atlantic Albacore Tuna, Atlantic Skipjack Tuna, Swordfish, Blue Marlin, White Marlin, Sailfish, Longbill Spearfish, and Atlantic sharks. These species tend to occupy deep water and will not occur within the project area.

5.5 Spiny Lobster

The Spiny lobster occurs throughout the Caribbean Sea, and along the shelf waters of the southeastern United States north to North Carolina. They are primarily hard substrate dwellers and are not expected to be located in the project area.

5.6 Mid-Atlantic Species Which Occur in the South Atlantic

Bluefish and summer flounder are two species listed in the Mid-Atlantic Fisheries Management Plan that occur in the South Atlantic. Bluefish juveniles and adults are listed as using estuaries from North Carolina to Florida and are common around the project area.

6.0 ASSESSMENT OF IMPACTS AND MITIGATIVE MEASURES

In this section, potential impacts to managed species and EFH are examined. Impacts will occur as a result of two different actions: 1. the dredging of beach quality sand from an offshore borrow area, and 2. the placement of that sand onto the beachfront.

The borrow area for the proposed project is located between 1.5 and 2.5 miles offshore, and therefore the dredging of these sediments will have no impact on estuarine emergent wetlands, oyster reefs, nor intertidal flats. The borrow area consists of roughly 649 acres of soft sandy bottom habitat, which will be impacted by dredging operations. The post-dredge infilling rate and quality and type of the material are contributing factors to the recovery of the area dredged. A change in the hydrologic regime as a consequence of altered bathymetry may result

in the deposition or scour of fine sediments, which may result in a layer of sediment that differs from the existing substrate. Benthic organisms within the defined borrow area dredged for construction and periodic nourishment would be lost. However, recolonization by opportunistic species would be expected to begin soon after the dredging activity stops. Because of the opportunistic nature of the species that inhabit the soft-bottom benthic habitats, recovery would be expected to occur within 1–2 years. Rapid recovery would be expected from recolonization from the migration of benthic organisms from adjacent areas and by larval transport. SCDNR has recommended the use of ebb-tidal shoal complexes on the downdrift end of beaches in order to assist in the faster recovery of the borrow area, and one of the factors in the selection of the proposed borrow area was the potential for faster recovery and possible re-use of the site. In addition, if a hopper dredge is used at the borrow area, impacts will likely be minimized (Bergquist et al., 2009).

Dredging in the selected borrow area would involve mechanical disturbance of the bottom substrate and subsequent redeposition of suspended sediment and turbidity generated during dredging. Factors that are known to influence sediment spread and water column turbidity are grain size, water currents and depths. During construction, there would be elevated turbidity and suspended solids in the immediate area of sand deposition when compared to the existing non-storm conditions of the surf zone. Significant increases in turbidity are not expected to occur outside the immediate construction/maintenance area (turbidity increases of 25 nephelometric turbidity units [NTUs]) or less are not considered significant). Turbid waters (increased turbidity relative to background levels but not necessarily above 25 NTUs) would hug the shore and be transported with waves either up-drift or down-drift depending on wind conditions. Because of the low percentage of silt and clay in the borrow areas (less than 10 percent), and the high shell content, turbidity impacts would not be expected to be greater than the natural increase in turbidity and suspended material that occurs during storm events. Any increases in turbidity in the borrow area during project construction and maintenance would be expected to be temporary and limited to the area surrounding the dredging. Turbidity levels would be expected to return to background levels in the surf zone when dredging ends. As a result of sediment suspension there is the potential for some change in local dissolved oxygen levels. However, if such a change were to occur it is anticipated it would be short term in nature and not appreciable.

Oceanic nekton are active swimmers, and are distributed in the relatively shallow oceanic zone. Any entrainment of adult fish, and other motile animals in the vicinity of the borrow area during dredging would be expected to be minor because of their ability to actively avoid the disturbed areas. Fish species are expected to leave the area temporarily during the dredging operations and return when dredging ceases (Pullen and Naqvi 1983). Impacts to the nekton community of the nearshore ocean will be temporary and minor.

Beach nourishment may have negative effects on intertidal macrofauna through direct burial, increased turbidity in the surf zone, or changes in the sand grain size or beach profile. While beach nourishment may produce negative effects on intertidal macrofauna, they would be localized in the vicinity of the nourishment operation. Construction and subsequent nourishments will occur during the winter months when possible. Because of this, beach nourishment would therefore be completed before the onshore recruitment of most surf zone

fishes and invertebrate species. To assure compatibility of nourishment material with native sediment characteristics and minimize impacts to benthic invertebrates from the placement of incompatible sediment, all sediment identified for use for this project has gone through compatibility analysis to assure compatibility with the native sediment. In summary, only temporary effects on intertidal macrofauna in the immediate vicinity of the beach nourishment project would be expected as a result of discharges of nourishment material on the beach.

6.1 Species Impacts

The potential for adverse impact to fish with EFH designated in the project area is likely to differ from species to species, depending upon life history, habitat use (demersal vs. pelagic), and distribution and abundance. However, it is anticipated that short-term impacts to older life-stages of fish (both pelagic and demersal) will be limited to temporary displacement during initial dredging, and subsequently, during renourishment projects. There may be some entrainment of eggs and early larval stages of fish species during the dredging process. However, it is anticipated that this displacement will not be significant because pelagic larve and eggs will continue to be carried through the project area with prevailing tides, currents, and wave action and the effect would only be on demersal eggs/larvae.

7.0 CONSERVATION MEASURES

Although the dredging and disposal of sand resources at the Town of Edisto Beach is not likely to result in any adverse impacts to managed species, the following conservation measures are proposed to minimize or reduce the potential for adversely impacting managed species and other living marine resources:

- Use of a borrow area on an ebb-tidal shoal complex at the downdrift inlet of the barrier island
- A monitoring program will be implemented to determine impacts to and recovery of the macroinvertebrate community within the borrow site. This program will be coordinated with SCDNR and NMFS. The monitoring program should include, but not be limited to benthic taxonomy, sediment grain size analysis, and post-construction bathymetric surveys.
- Maintaining a 1’ vertical sand buffer in the borrow area should facilitate faster benthic recovery
- Potential use of a hopper dredge for borrow areas has been recommended in the past by SCDNR and will be implemented where possible
- Construction during the winter months should decrease short term impacts to managed fisheries

7.1 NMFS Conservation Recommendations

NOAA Fisheries Submitted the following Conservation Recommendations in their EHF letter to USACE, Oct. 28, 2013):

- The Charleston District shall limit dredge depths within the borrow area to depths shown by modeling or empirical studies to fill with beach compatible material.

- The borrow area monitoring plan shall be provided to NMFS for review and approval prior to commencement of the project. The plan components should be similar to the 2005 Folly Beach borrow area study.

The Charleston District performed modeling of the borrow area to evaluate shoreline impacts (Appendix E of main report), but no modeling was performed on the re-fill rate of the borrow area. The borrow area was selected based upon previous conservation recommendations provided by SCDNR, and it is not feasible to perform this modeling during the feasibility phase.

7.2 Additional Conservation Measures

Based on the NMFS conservation recommendations, the Charleston District proposes to implement the following additional recommendations:

- The Charleston District will work with the Contractor to optimize the size and depth of each nourishment project borrow area to balance environmental and economic considerations.
- The borrow area monitoring plan will be provided to NMFS for review and comments prior to commencement of the project.

8.0 CONCLUSIONS

The proposed project will involve impacts to marine and estuarine water column and unconsolidated bottom (Table 5). The overall magnitude of these impacts is expected to be short term and minor under the dredging operations to be employed. Recolonization of both the borrow area and beach face are expected to occur within 1 to 2 years, or faster. The use of best management practices should limit the extent and duration of turbidity impacts, which will temporarily alter fish dynamics in the vicinity of the construction activities. Overall, the impacts to EFH and HAPC related to the proposed beach project at Edisto Beach will be temporary and will not result in significant effects on managed species.

Table 5. Potential EFH Impacts for Edisto Beach Storm Damage Reduction Project

Habitat Type	Habitat Name	Project Area	Potential Impacts	
			Dredging at borrow site	Beach Placement
Estuarine	Estuarine Emergent Wetland (tidal marsh)	Yes	No	No
Estuarine	Estuarine Scrub/shurb mangroves	No	No	No
Estuarine	Sea grass	No	No	No
Estuarine	Oyster reefs and shell banks	Yes	No	Yes
Estuarine	Intertidal flats	Yes	No	No
Estuarine	Palustrine emergent and forested wetland	No	No	No
Estuarine	Aquatic beds	No	No	No
Estuarine	Estuarine Water Column	Yes	No	Yes
Estuarine	Unconsolidated Bottom	Yes	Yes	Yes
Marine	Live/Hard bottoms	No	No	No
Marine	Coral and coral reefs	No	No	No
Marine	Artificial/manmade reefs	No	No	No
Marine	Sargassum	No	No	No
Marine	Surf Zone	Yes	No	Yes
Marine	Marine water column	Yes	Yes	Yes

9.0 REFERENCES

Bergquist, Derk C., Stacie E. Crowe and Martin Levisen. 2009. Change and recovery of physical and biological characteristics of the borrow area impacted by the 2007 Folly Beach emergency renourishment project. Final Report submitted to USACE, Charleston District. SC Department of Natural Resources, Marine Resources Division. Technical Report Number 104.

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SUPPLEMENTAL INFORMATION REPORT

Edisto Island Coastal Storm Risk Management Project

Colleton County, South Carolina

US Army Corps of Engineers, Charleston District

January 2021

This Supplemental Information Report (SIR) was prepared in accordance with Section 13(d) of Engineer Regulation (ER) 200-2-2, *Procedures for Implementing the National Environmental Policy Act, (NEPA)* and the Council on Environmental Quality (CEQ) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 Code of Federal Regulations [CFR] Parts 1500-1508), as amended. The SIR accompanies the Edisto Island Hurricane and Storm Damage Protection Final Integrated Feasibility Report and Environmental Assessment (FFR/EA) completed by the U.S. Army Corps of Engineers, Charleston District (USACE) and approved by the Chief of Engineers in 2014, and the Environmental Assessment and Finding of No significant Impacts (EA/FONSI) and environmental clearances associated with the Section 10/404 permit (SAC-2015-00528) issued to the Town of Edisto (Town) on September 28, 2016, which are incorporated by reference. Because of the common geographic scope and impacts (the 10/404 permit authorizes the placement of up to 1.1 million cubic yards (CY) of beach-quality sand along approximately 3.6 miles of ocean-facing shoreline, which includes the area of the 3.1 mile long Federal project), the Federal NEPA and environmental clearances for the Town's project are applicable to the Federal project. This applicability was further confirmed by communications with each of the Federal and State resource agencies providing required input on the Federal project. This SIR will further describe federal and state consistency updates that occurred since congressional authorization. The project was authorized to be carried out under the Water Infrastructure Improvements for the Nation Act of 2016 (WIIN Act, 2016). The conditions, project description, and environmental effects described in the final FFR/EA and the 10/404 permit documents are still valid, and this SIR is designed to provide supplemental information to document compliance with NEPA and CEQ regulations. Supplementation of the FFR/EA is not required per 40 CFR 1502.9(d) because changes to the proposed action do not have significant bearing on the findings of the final FFR/EA.

BACKGROUND

The Edisto Island FFR/EA was conducted in response to a Congressional Resolution adopted on 22 April 1988 by the Committee on Environment and Public Works of the United States Senate. The study purpose was to investigate and make recommendations to reduce damages to coastal development along Edisto Island caused by wind-generated and tide-generated waves and currents. The FONSI was signed in 2014 and the study phase ended on 5 September 2014 with the issuance of the final Chief's Report. The project was authorized for construction by the Water Infrastructure Improvements for the Nation Act of 2016 (WIIN Act, 2016). However, construction was not appropriated for funding until the Bipartisan Budget Act of 2018 (Public Law 115-123, Title IV).

AUTHORIZED PROJECT

Edisto Island is a barrier island located at the mouth of the South Edisto River in Colleton County, South Carolina, approximately 45 miles southwest of Charleston, South Carolina and approximately 20 miles east-northeast of Beaufort, South Carolina (Figure 1). The authorized project that resulted from the 2014 feasibility study consists of the construction of a 15-foot high, 15-foot wide dune beginning at the northern end of the project (the southern end of the State Park) and extending southward along the beach for 16,530 feet. The dune would be fronted by a 7-foot high (elevation) berm. The first 7,740 feet of berm length would have a width of 75 feet. The width would taper to a 50-foot width over the remaining length of the berm. The width of each end of the berm would taper to match the existing beach profile. Beginning at the southern end, the dune would transition to an elevation of 14-feet NAVD 88 and a top width of 15-feet that extends around the end of the island for 5,290 feet. No berm would be constructed in front of this dune because the existing beach profile provides an adequate berm. Total groin lengthening would equal 1,130 feet across 23 existing groins. Average lengthening would be 50 feet ranging between 20-feet and 100-feet per groin. Periodic nourishment of the beach sand would occur in 16-year intervals.

The authorized project (Figure 2) would require about 924,000 cubic yards of borrow material for initial construction and about 476,000 cubic yards during each periodic nourishment cycle (based on 16 year intervals). During the projected 50 year project life, this would equate to initial construction and 3 periodic nourishment events. A total of about 2.4 million cubic yards of beach-compatible sand would be needed to construct and maintain the project

Figure 1. Location of Edisto Beach

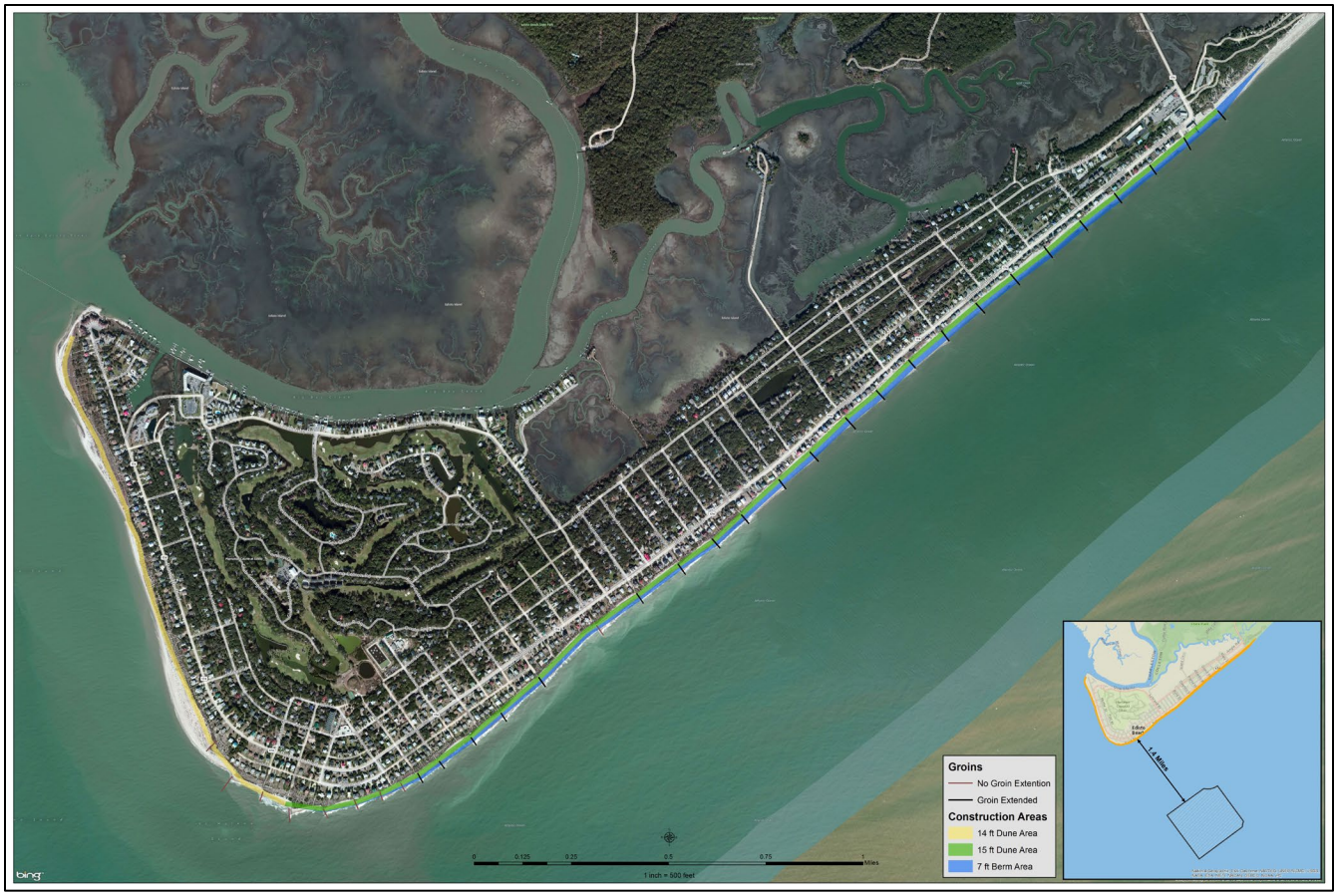

Figure 2. 2014 Authorized Federal Project

DESCRIPTION OF MODIFICATION TO FEDERAL PROJECT

Construction modifications to the authorized project include the removal of two reaches in the inlet portion of the island, sponsor-led placement of 850,000 CY of sand withing the Federal project footprint, and repair and lengthening of 26 groins, meeting or exceeding the authorized project. In 2017, under their 2016 permit (SAC 2015-00528), the Town placed approximately 850,000 CY of sand along the shoreline and extended 26 existing groins within the Federal project footprint. Since the groin extensions were constructed to meet or exceed the USACE authorized project and the groin lengthening is vital to the success of the overall project, USACE will include the non-federally constructed groins into the Federal project. The Town, as the non-federal sponsor, also requested removal of the inlet reaches from the Federal project. This reduces the footprint of the Federal project by 4,244 linear feet of shoreline. (Figure 3).

The modified project (Figure 3) includes a 15-foot high (elevation), 15-foot wide dune beginning at the northern end of the project (the southern end of Edisto Beach State Park) and extending southward along the beach for 16,530 feet. This dune would be fronted by a 7-foot high (elevation) berm. The first 7,740 feet of berm length would have a design width of 75 feet. The width would taper to a 50-foot design width over the remaining length of the berm. The initial construction berm would extend seaward of the design berm by a variable distance (approximately 100-150 ft.) to cover anticipated sand movement during and immediately after construction. As originally planned in the authorized project, the width of each end of the berm

would taper to match the existing beach profile. Beginning at groin 29 near White Cap Street, the dune would transition to a 14-foot high, 15-foot wide dune that extends approximately 1046 linear feet around the end of the island to groin 31. Groin 31 acts as a physical boundary to the southern-most end of the project. No berm would be constructed in front of the dune between groin 29 and groin 31 because the existing beach profile provides an adequate berm.

Figure 3. 2020 Modified Federal Project Footprint

The beach nourishment template for the modified federal project includes the placement of up to 929,000 CY of beach quality sand along approximately 16,530 lf) of shoreline. This represents an increase of 5,000 CY of sand over the initial sand placement proposed in the 2014 FFR/EA. Despite the reduction in the length of the project and the sand placement by the Town under their 2016 permit, the amount of sand required to meet the Federal template increased from the 2014 estimate. The 2020 sand estimate is based on a comparison of the construction template to a beach profile prepared in October 2018. The difference in the sand estimates is likely due to erosion associated with large storm events that occurred between completion of the Town's construction in 2017 and completion of the 2018 beach profile.

The modified project includes an estimated 476,000 CY of sand placement during each renourishment cycle (based on 16 year intervals). During the projected 50 year project life, this would equate to an initial construction and 3 renourishment events. A total of approximately 2.4 million CY of beach-compatible sand would be needed to construct and maintain the project.

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

BORROW AREA

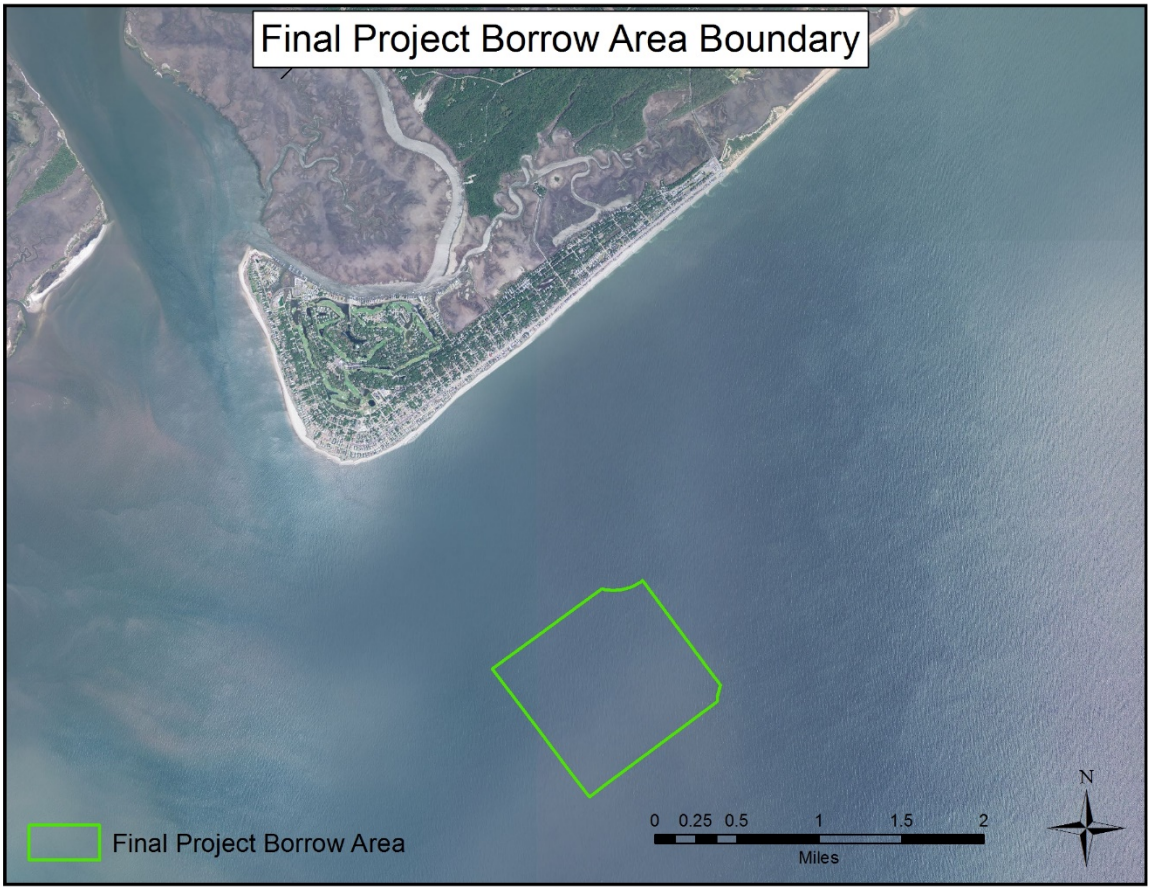

Figure 4. Approximate Location of Borrow Area

The FFR/EA identified one borrow area for the nourishment of Edisto Island. The sand borrow area for the project is an approximately one square mile portion of the ebb tide delta located about 2 miles offshore of the west side of the island (Figure 4). It contains approximately 7.2 million CY of beach quality sand material. The curves depicted in Figure 4 in the northern and eastern corners of the borrow area are due to cultural resource avoidance areas associated with two potential sites of prehistoric interest. Both areas will be avoided using a buffer with a radius of 1,500 feet placed around the center points. No hardbottom habitat was found in the borrow area or within a quarter mile buffer surrounding the area. The proposed borrow area was narrowed down from a larger area containing about 30 million CY of material. The reduction in size was based on the evaluation of 77 sediment cores taken at approximately 1,000 foot spacing throughout the borrow site. The average sediment composition of the borrow area, as compared to the composition of the native beach, is shown in Table 1. No other potential borrow areas were considered because the selected borrow area contains an adequate quantity of beach quality material to nourish Edisto Beach over a 50 year period.

Table 1: Average sediment composition of native beach material and borrow area.

	MEAN (phi)	STD DEV (phi)	% PASSING #5	%PASSING #10	% PASSING #200*	% PASSING #230	% VISUAL SHELL
Edisto Native Beach	1.31	1.33	97.8	93.5	0.1	0.0	26.9
Borrow Area	1.73	1.31	94.7	90.0	0.4	0.2	18.8

*The % passing the #200 sieve is considered the % silt and clay.

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (42 U.S.C. §4321 *et seq*.)
USACE has previously described the affected environment and evaluated environmental effects of the Edisto Island Coastal Storm Risk Management Project (CSRM) in the 2014 FFR/EA. The EA determined that the impacts from the proposed project would not result in impacts significant enough to warrant an Environmental Impact Statement (EIS) and led to a FONSI finalized in 2014. NEPA for the Federal project was also addressed under the Town's 10/404 permit. The findings of the 2014 EA/ FONSI and the EA/FONSI associated with the 10/404 permit are still valid as applied to the current Federal project.

ENDANGERED SPECIES ACT OF 1973 (16 U.S.C. §1531 *et seq*.)
Consultation with the U.S. Fish and Wildlife Service (USFWS) consistent with the Endangered Species Act (ESA) was completed for the FFR/EA. The January 9, 2014 Biological Assessment (BA) considered the effects of the proposed project on threatened and endangered species either known to be present or suspected to be present in the vicinity of the project. Based on conservation measures proposed in the BA, the USFWS concurred with the USACE determination that the proposed project was likely to adversely affect (LAA) the loggerhead sea turtle and not likely to adversely affect (NLAA) the leatherback sea turtle, piping plover, rufa red knot, and West Indian manatee. USFWS issued a 2014 Biological Opinion (BO) for the loggerhead sea turtle, the leatherback sea turtle, piping plover, and West Indian manatee, and a 2014 Conference Opinion (CO) for the rufa red knot (candidate species).

Since the rufa red knot became a Federally listed species in 2015, USACE requested to re-initiate ESA consultation in March 2020. By letter dated April 7, 2020, USFWS advised that the current Federal project could be covered under a January 21, 2016, USFWS Biological Opinion (2016 BO) issued for the Town of Edisto Island Beach Nourishment Project (TEIBNP) since the Federal project footprint falls within the confines of the TEIBNP. The 2016 BO addresses effects on the green sea turtle, leatherback sea turtle, Northwest Atlantic population of the loggerhead sea turtle and its critical habitat, piping plover and its critical habitat, rufa red knot, and the West Indian manatee. USFWS determined that the Town's project was not likely to adversely affect the green sea turtle, leatherback sea turtle, piping plover, rufa red knot, and West Indian manatee. The project may affect but is not likely to adversely affect the loggerhead turtle, or adversely modify or destroy designated critical habitat, provided work is performed in accordance with the terms and conditions (including reasonable and prudent measures, and conservation recommendations) contained in the 2016 BO. Incidental take of listed species that is in compliance with the terms and conditions of the 2016 BO is exempt from the prohibitions against take under the ESA. These terms and conditions will be incorporated into this and all future federal nourishment efforts.

Consultation with the National Marine Fisheries Service with regard to marine species protected under the ESA is not required due to the applicability of a Regional Biological Opinion (RBO) for the South Atlantic Region and the District's past and present commitment to adhere to the Terms and Conditions of the RBO.

FISH AND WILDLIFE COORDINATION ACT OF 1958 (16 U.S.C. §661 *et seq.*)
Coordination with USFWS under this law was conducted through ongoing coordination and submission of Planning Aid letters as the project progressed. By letter dated January 25, 2012, the USFWS concurred that continued coordination and submission of necessary documentation or assessments would satisfy Section 2a of the FWCA and ensure that potential resource concerns would be adequately addressed. Since the project scope provided in the FFR/EA has been reduced, the storm damage reduction measures associated with the Federal project should not result in long-term adverse effects to the subtidal benthic infaunal community. Therefore, the findings are still valid.

NATIONAL HISTORIC PRESERVATION ACT OF 1966 (16 U.S.C. §1531 *et seq*.)
Federal undertakings must comply with the Archaeological and Historical Preservation Act of 1974 (16 USC 469-469c), the Abandoned Shipwreck Act of 1987 (PL 100-298; 43 USC 2101-2106), The National Historic Preservation Act (NHPA) of 1966, as amended (54 USC 306108) and the Advisory Council on Historic Preservation's implementing regulations at 36 CFR Part 800 (protection of Historic Properties). Section 106 of NHPA requires Federal agencies to provide the Advisory Council on Historic Preservation with a reasonable opportunity to comment on any Federal undertaking. The placement of sand on beaches and the use of sand from underwater borrow sites are typically subjected to cultural resources investigations in order to locate potentially significant resources, including historic properties, for purposes of NHPA Section 106 review. There are no historical or archaeological resources within the beach nourishment zone which would be affected by the placement and movement of sand. A comprehensive cultural resources review was conducted in February 2013 for the proposed offshore borrow area, including a quarter mile buffer around the area. Two potential sites of prehistoric interest were identified within the survey area. The survey report was reviewed by the South Carolina Institute of Archaeology and Anthropology (SCIAA), and the South Carolina State Historic Preservation Office (SHPO). By letter dated April 12, 2013, SCIAA concurred with the recommendation to place a 1,500 ft. buffer zone around arbitrary points for the two sites as potential paleolandscape features and advised that no additional surveys would be required. By e-mail dated April 29, 2020, SHPO concurred that no additional surveys would be required and USACE had met their responsibilities pursuant to 36 CFR 800.4.

CLEAN WATER ACT OF 1972 (33 U.S.C. §1341 *et. seq*. and 33 U.S.C. §1344(b) *et seq.*)
The proposed project would occur within the open ocean and on an adjacent beach. These waters are classified as Class SA waters by the SC Department of Health and Environmental Control (SCDHEC). Class SA waters are tidal saltwaters suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. They are also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora. A 401 Water Quality Certification is not required for this project. SCDHEC determined that beach nourishment

activities have very few water quality impacts and waived certifications for beach nourishment activities.

Section 404 of the Clean Water Act governs the discharge of dredged or fill material into waters of the U.S. Although USACE does not process and issue permits for its own activities, USACE authorizes its own discharges of dredged or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, NEPA, and application of the Section 404(b)(1) guidelines. A Section 404(b)(1) evaluation was completed for the 2014 FFR/EA and more recently for the 10/404 permit issued to the Town. The findings of these evaluations are still valid as applied to the current Federal project.

COASTAL ZONE MANAGEMENT ACT OF 1972 (16 U.S.C. §1451 et seq.)
USACE determined that the project was consistent to the maximum extent practicable with the enforceable policies of the South Carolina Coastal Zone Management (CZM) Program and the Office of Coastal Resource Management (OCRM) concurred with the USACE determination by letter dated December 23, 2013. By e-mail dated January 14, 2020, OCRM confirmed that the 2013 Coastal Zone Consistency determination would remain valid and nothing further would be required.

COASTAL BARRIER RESOURCES ACT OF 1982 (16 U.S.C. §3501 et seq.)AND COASTAL BARRIER IMPROVEMENT ACT OF 1990 (16 U.S.C. §3501 *et seq.*)
Coastal barriers along the Atlantic and Gulf coasts provide quality habitat for migratory birds and other wildlife. This habitat is essential for spawning, nursery, nesting, and feeding for a variety of commercially and recreationally important species of finfish and shellfish. Recognizing this and the fact that barrier islands contain recreational and cultural resources and serve as natural protective buffers from storms, Congress passed the Coastal Barrier Resources Act in 1982. In this Act, Congress declared that the purpose of the act is to minimize the loss of human life, wasteful expenditure of Federal revenues, and the damage to fish, wildlife, and other natural resources by restricting future Federal expenditures and financial assistance that could potentially encourage development of barrier islands (16 U.S.C. 3501 et seq.).

The Town of Edisto Beach lies between two Coastal Barrier Resources Systems (CBRS) units, the Edisto Complex Unit (M09 and M09P) and the Otter Island Unit (M10) (Figure 5). Unit M09P is an "Otherwise Protected Area" (OPA) and is not a part of the CBRS. The Edisto Unit is composed of three small marsh islands, Botany Bay Island, Edingsville Beach, part of Jeremy Inlet, and Deveaux Bank. The Otter Island Unit includes the southwestern half of the South Edisto River, Pine Island, Otter Island, and the southeastern tips of Fenwick Island and Hutchinson Island. By letter dated January 27, 2010, the USFWS confirmed that the proposed borrow area is not located in the CBRS.

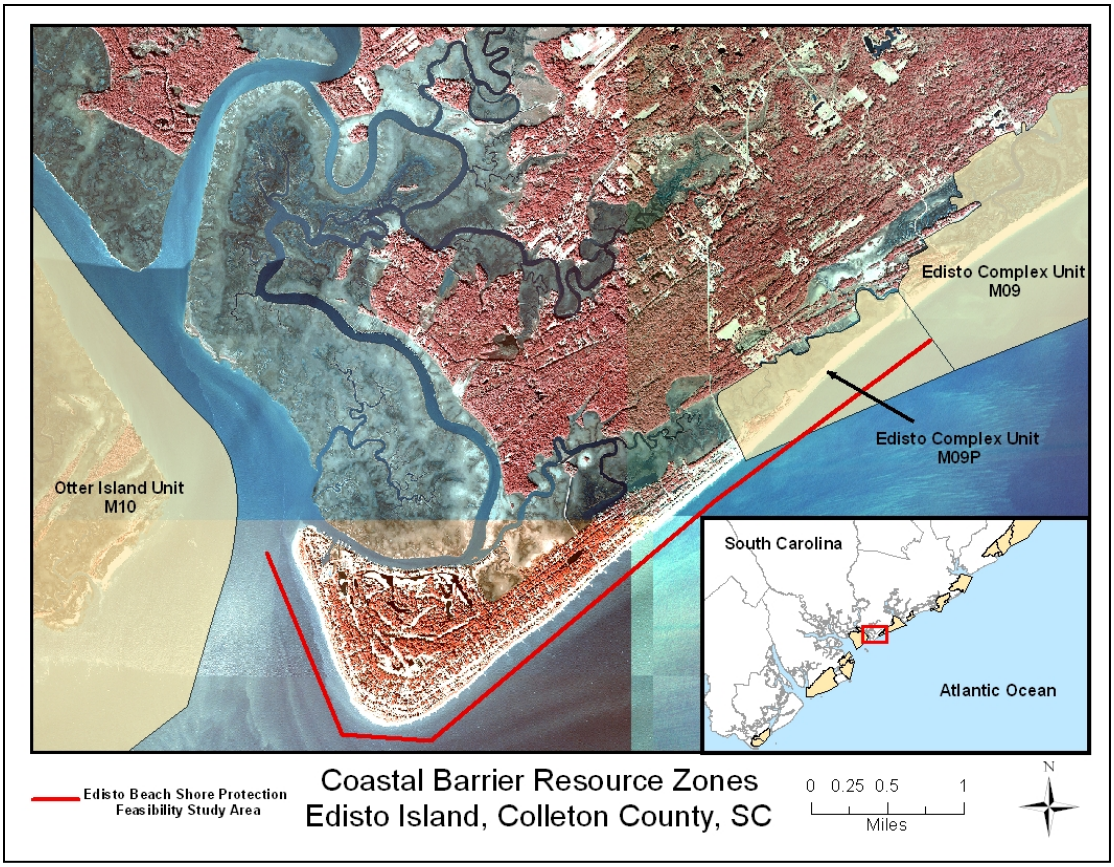

Figure 5. Location of Coastal Barrier Resource Zones in the vicinity of the project area.

ESSENTIAL FISH HABITAT (EFH) MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (16 U.S.C. §1801 *et seq.)*

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Fishery Conservation and Management Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)." The definition for EFH may include habitat for an individual species or an assemblage of species, whichever is appropriate within each Fisheries Management Plan (FMP). Estuarine and inshore EFH within the vicinity of the project consists of estuarine emergent wetlands, oyster reefs/shell banks, intertidal flats, aquatic beds, the estuarine water column, and the marine water column. An EFH Assessment was prepared for the 2014 FFR/EA and National Marine Fisheries Service (NMFS) concurred with the USACE determination that the proposed action would not have substantial individual or cumulative adverse impacts on EFH. An EFH assessment and consultation was also conducted for the 10/404 permit for the Town's project in 2016, and that project has a larger geographic scope and similar ecological setting. Re-initiation of EFH consultation is not required at this time since the 2014 EFH consultation anticipated construction well into the future and the project modification would not result in adverse effects to EFH resources.

CLEAN AIR ACT OF 1972 (42 U.S.C. §7401 *et seq.*)

The Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to establish health and science-based standards for air pollutants that have the highest levels of potential harm to human health or the environment. These National Ambient Air Quality Standards (NAAQS) are

in place for six air pollutants, also referred to as criteria pollutants. The six criteria pollutants are Ozone, Sulfur Dioxide, Particulate Matter, Lead, Nitrogen Dioxide, and Carbon monoxide. Of the six current criteria pollutants, particle pollution and ozone have the most widespread health threats, but they all have the potential to cause damage to human health and the environment. Areas of the country which persistently exceed the NAAQS are designated as "nonattainment" areas and those which meet or exceed the standards are designated "attainment" areas. Colleton County is designated as an attainment area.

With regards to noise pollution, ambient noise levels along Edisto Beach are low to moderate and are typical of recreational environments and are not considered an issue or nuisance. The major noise producers include the breaking surf, residential areas, and traffic (vehicular and to a lesser extent, boat). Noise in the outside environment associated with beach construction activities would be expected to minimally exceed normal ambient noise in the project area. However, construction noise would be attenuated by background sounds from wind and surf. In-water noise would be expected in association with the dredging activities.

E.O. 11988, FLOODPLAIN MANAGEMENT

Executive Order 11988 requires Federal agencies avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The proposed project is in the base flood plain. Relocation of the project outside the floodplain would not be responsive to the problems and needs of the study areas, and was not considered further during project planning. Potential floodplain development would be restricted as a result of local ordinances and State law. The project would not induce development in the flood plain and the project will not impact the natural or beneficial flood plain values. This aspect was previously addressed in the FFR/EA and in the 10/404 permit issued to the Town.

SUMMARY OF DECISION

USACE previously described the affected environment and evaluated environmental effects associated with the Edisto Island CSRM in the FFR/EA and determined the project would not result in impacts significant enough to warrant an EIS. USACE also evaluated the environmental effects of the Federal project in an EA/FONSI for the 10/404 permit issued to the Town which authorized groin extension and beach nourishment activities along 3.6 miles of shoreline, including the footprint of the Federal project. The Town completed the beach nourishment activities authorized under the 10/404 permit in 2017. The timing and scope of the Town's Federally-permitted project and the removal of 4,410 lf of shoreline along the inlet reaches altered the scope for the Federal civil works project. The revised Federal project will involve placement of approximately 929,000 CY of beach quality sand to construct a 15-foot high, 15-foot wide dune and 7 foot high berm along 16,530 lf of shoreline and a 14-foot high, 15-foot wide dune that extends around the end of the island for 1,046 lf. The modifications to the Federal project have been reviewed by the USACE for environmental compliance, and are not expected to result in any significant adverse environmental impacts as described by the National Environmental Policy Act of 1969, as amended. As noted previously, the findings and conclusions of the 2014 Federal project EA/FONSI have been updated by the NEPA and environmental clearances for the Federally-permitted project, as confirmed with Federal and State resource agencies. All NEPA documentation incorporated by reference or mentioned in this SIR can be downloaded from the internet (in PDF format) at http://www.sac.usace.army.mil/Missions/Civil Works/NEPA-Documents/ or copies can be obtained by contacting Andrea Hughes at andrea.w.hughes@usace.army.mil or (843) 329-8145.

DATE:_____

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RACHEL A. HONDERD
Lieutenant Colonel, EN
Commander, U.S. Army Engineer District, Charleston

EDISTO BEACH
COASTAL STORM RISK MANAGEMENT
VALIDATION REPORT

APPENDIX B

COST ENGINEERING

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TABLE OF CONTENTS

B COST ESTIMATES

B1. GENERAL INFORMATION

Corps of Engineers cost estimates for planning purposes are prepared in accordance with the following guidance:

- Engineer Technical Letter (ETL) 1110-2-573, Construction Cost Estimating Guide for Civil Works, 30 September 2008 (Expired)
- Engineer Regulation (ER) 1110-1-1300, Cost Engineering Policy and General Requirements, 26 March 1993
- ER 1110-2-1302, Civil Works Cost Engineering, 30 June 2016
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, as amended
- Engineer Manual (EM) 1110-2-1304 (Tables Revised 30 September 2020), Civil Works Construction Cost Index System, 30 September 2019
- CECW-CP Memorandum for Distribution, Subject: Initiatives to Improve the Accuracy of Total Project Costs in Civil Works Feasibility Studies Requiring Congressional Authorization, 19 September 2007
- CECW-CE Memorandum for Distribution, Subject: Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs, 3 July 2007
- Cost and Schedule Risk Analysis Process, March 2008

The goal of the cost estimates for the Edisto Beach Shore Protection Validation Study are to present a Total Project Cost (Construction and Non-Construction costs) for the recommended plan at the current price level to be used for project justification/authorization and to escalate costs for budgeting purposes. In addition, the costing efforts are intended to produce a final product (cost estimate) that is reliable and accurate, and that supports the definition of the Government's and the Non-Federal sponsor's obligations.

The recommended plan consists of creation of a storm protection berm and dune system which will be periodically re-nourished. In addition, dune vegetation will be planted and replaced, as needed, at the time of the scheduled re-nourishments. The quantity of sand for initial construction was derived using the typical construction profile, designed in the 2014 Feasibility Study, and overlaying it with survey data obtained in 2018 and 2020. The quantities of sand for the periodic nourishments were derived using the Beach-FX Coastal Engineering modeling software. To generate costs for the dredging and placement of the material, it was assumed that a 30" hydraulic pipeline dredge would be utilized. This type of dredge was used due to the proximity of the borrow area to the beach where the material is to be placed. The beach vegetation was assumed to require 30 acres of planting for initial construction and 15 acres of planting for each periodic nourishment cycle. The unknowns for this project include the ability of the sponsor to obtain easements, the quantity of material required when the project is constructed and the availability of adequate competition for an acceptable bidding climate. Due to the types of equipment required, the acquisition strategy was assumed to be full and open for large contractors.

The cost estimating effort for the study also yielded unit costs for dredging per cubic yard and mobilization/demobilization costs that were used within the Coastal Engineering modeling

program Beach-FX to compare a series of alternative plan formulations for decision making based upon net benefits. The final set of plan formulation cost estimates used for plan selection rely on construction feature unit pricing and are prepared in Civil Works Work Breakdown Structure (CWWBS) format to the sub-feature level. The cost estimate supporting the National Economic Development (NED) plan (Recommended Plan) is prepared in MCACES/MII format to the CWWBS sub-feature level. This estimate is supported by the preferred labor, equipment, materials and crew/production breakdown. A fully funded (escalated for inflation through project completion) cost estimate, the Baseline Cost Estimate or Total Project Cost Summary, has also been developed. A risk analysis was prepared that addresses project uncertainties and sets contingencies for the Recommended Alternative Plan's cost items. The final Cost and Schedule Risk Analysis Report produced by Walla Walla District Cost Engineering is attached to this appendix.

B1.1 Recommended Alternative Plan

The final Recommended Plan was chosen by the Project Delivery Team (PDT) according to Cost Effectiveness/Incremental Cost Analysis procedures and resulted directly from the plan formulation described above. The Economics Appendix fully describes the plan selection. The scope of work for the Recommended Plan consists of construction of a mid-size dune and berm fill along approximately 22,000 feet of the beach as shown in Table 5.4 of the main report. The initial construction consists of placement of 922,570 cubic yards of material. Periodic nourishments are calculated to occur every 16 years with a quantity of 476,000 cubic yards of material. In addition, groin lengthening is included at 23 locations for a total of 1,130 feet as outlined in Table 5.5 of the main report. Dune vegetation is also included along approximately 30 acres of the project area. The MCACES/MII cost estimate for the Recommended Alternative Plan (Section L.2, below) is based on that scope and is formatted in the CWWBS. The notes provided in the body of the estimate detail the estimate parameters and assumptions. The cost estimate includes pricing at the Fiscal Year 2022 price level (1 October 2021-30 September 2022). A detailed Cost and Schedule Risk Analysis (CSRA) was done to establish the contingency for the Recommended Plan. Non-construction costs were included as percentages of the total construction contract cost for this level of comparison and screening. For project justification purposes, the estimated costs are categorized under the appropriate CWWBS code and include both construction and non-construction costs.

The construction costs fall under the following feature codes:

- 10 Breakwaters & Seawalls
- 17 Beach Replenishment

The non-construction costs fall under the following feature codes:

- 01 Lands and Damages
- 30 Planning, Engineering and Design
- 31 Construction Management

B1.2 Construction Cost

Construction costs were developed in MCACES/MII and include all major project components categorized under the appropriate CWWBS to the sub-feature level. The Total Project Cost Summary (TPCS) on the final Recommended Plan contains contingencies as noted in the estimate (below) and were determined as a result of the risk analysis. Additional information follows on the risk analysis.

B1.3 Non-construction Cost

Non-construction costs typically include Lands and Damages (Real Estate), Planning Engineering & Design (PED) and Construction Management Costs (Supervision & Administration, S&A). These costs were provided by the PDT either as a lump sum cost or as a

percentage of the total Construction Contract Cost. Lands and Damages are provided by Real Estate and are best described in the Real Estate Appendix, Appendix K. PED costs are for the preparation of contract plans and specifications (P&S) and include percentages of total construction costs, as well as percentages for Engineering During Construction (EDC) and Planning During Construction (PDC) that were provided by the Chief of Engineering. Construction Management costs are for the supervision and administration of a contract and include Project Management and Contract Admin costs. These costs were provided by the Chief of Construction and are included as a percentage of the total construction contract cost.

The main report details both cost allocation and cost apportionment for the Federal Government and the Non-Federal Sponsor. Also included in the main report are the Non-Federal Sponsor's obligations (items of local cooperation).

B1.4 Plan Formulation Cost Estimates

For the plan formulation cost estimates, unit costs for dredging per cubic yard and mobilization/demobilization costs were developed in the Corps of Engineers Dredge Estimating Program (CEDEP) and used within the Coastal Engineering modeling program Beach-FX to compare a series of alternative plan formulations for decision making based upon net benefits. For the plan formulation estimates a contingency of 25% was assumed due to the preliminary nature of design. Unit prices for the remaining major construction elements were developed in MCACES/MII based on input from the PDT. Design details, information and assumptions were provided in the Engineering Appendix. A detailed Cost and Schedule Risk Analysis (CSRA) was done to establish the contingency for the Recommended Plan. Non-construction costs were included as percentages of the total construction contract cost for this level of comparison and screening.

Refer to Economics Section in the main report for final plan formulation cost tables.

B1.5 Construction Schedule

Due to the relatively short durations for the initial construction (3 months) and periodic nourishment cycles (a little over 1 month), a detailed construction schedule was not prepared. However, utilizing input from the PDT, a preliminary schedule was assumed with initial construction to begin in 2025. A 16-year period was calculated between nourishment cycles by Coastal Engineering resulting in 3 cycles through the 50 year life of this project. Since a hydraulic pipeline dredge was assumed to be used for construction, the only environmental restriction is the requirement for sea turtle nest observers during the period from April through October. Costs were included for these observers in the cost estimate and therefore construction can take place anytime during the year. The preliminary project schedule was used for the generation of the Total Project Cost Summary (TPCS), as well as the schedule portion of the Cost and Schedule Risk Analysis (CSRA). The construction schedule will change as the project moves through the various project lifecycle phases.

B1.6 Total Project Cost Summary

The cost estimate for the Recommended Plan is prepared with an identified price level date and inflation factors are used to adjust the pricing to the project schedule. This estimate is known as the Fully Funded Cost Estimate or Total Project Cost Summary. It includes all Federal and Non-Federal costs: Lands, Easements, Rights of Way and Relocations; construction features; Preconstruction Engineering and Design; Construction Management; Contingency; and Inflation.

B2. RECOMMENDED PLAN (NED) COST ESTIMATE

Refer to MII Printout on the next page. During preparation of cost estimates for alternative methods of construction, it was determined that due to the proximity of the borrow area to the placement area; an ocean certified hydraulic pipeline would be more economical than a medium sized hopper dredge. Therefore, the costs shown in the estimate are based upon using a 30” hydraulic pipeline dredge for sand placement on the beach.

Edisto (with Groins)

Edisto Beach, one of the barrier islands on the coast of South Carolina, is located in Colleton County, approximately 45 miles southwest of Charleston, South Carolina.
The US Army Corps of Engineers is studying the creation of a Federal Project to provide shoreline protection to Edisto Beach. This project consists of initial beach nourishment to Edisto Beach to maintain an adequate level of storm protection for the residents and businesses located on Edisto Beach.
The calculations for the dredging portion of this project is imported from the Corps of Engineers Dredge Estimating Program (CEDEP).

This estimate contains no contingency or escalation. These items are added in the Total Project Cost Summary. The contingencies in the TPCS were developed during Cost & Schedule Risk Analysis (CSRA).

Escalation is calculated inside the TPCS used the tables developed in the latest version distributed by the Cost MCX at Walla Walla District.

Estimated by	CESAC
Designed by	CESAC
Prepared by	Brian Clouse
Preparation Date	2/18/2022
Effective Date of Pricing	2/18/2022
Estimated Construction Time	120 Days

Description	Quantity	UOM	ProjectCost
Project Cost Summary Report			**55,678,784.80**
Initial Construction	**1.00**	**LS**	**21,611,115.14**
Lands and Damages	**1.00**	**LS**	**737,280.00**
Breakwaters and Seawalls	**1.00**	**LS**	**2,376,824.01**
Beach Replenishment	**1.00**	**LS**	**18,497,011.12**
First Nourishment Construction	**1.00**	**LS**	**11,355,889.89**
Beach Replenishment	**1.00**	**LS**	**11,355,889.89**
Second Nourishment Construction	**1.00**	**LS**	**11,355,889.89**
Beach Replenishment	**1.00**	**LS**	**11,355,889.89**
Third Nourishment Construction	**1.00**	**LS**	**11,355,889.89**
Beach Replenishment	**1.00**	**LS**	**11,355,889.89**

Labor ID: NLS2021 EQ ID: EP20R03 Currency in US dollars TRACES MII Version 4.4

B3. RISK AND UNCERTAINTY ANALYSIS

A Cost and Schedule Risk Analysis was conducted according to the procedures outlined in the manual entitled, "Cost and Schedule Risk Analysis Process" dated March 2008.

B3.1 Risk Analysis Methods

The entire PDT participated in a cost and schedule risk analysis brainstorming session to identify risks associated with the recommended plan. The risks were listed in the risk register and evaluated by the PDT. Assumptions were made as to the likelihood and impact of each risk item, as well as the probability of occurrence and magnitude of the impact if it were to occur. A risk model was then developed in Crystal Ball in order to develop a contingency to apply to the project cost and schedule. After the model was run, the results were reviewed, and all parameters were re-evaluated by the PDT as a sanity check of assumptions and inputs. Adjustments were made to the analysis accordingly and the final contingency was established. The contingency was applied to the recommended plan estimate in the Total Project Cost Summary in order to obtain the Fully Funded Cost.

B3.2 Risk Analysis Results

Refer to the Project Cost and Schedule Risk Analysis Report provided by Walla Walla District Cost Engineering as an attachment to this appendix.

B4. TOTAL PROJECT COST SUMMARY

The Total Project Cost Summary (TPCS) addresses inflation through project completion (accomplished by escalation to mid-point of construction for each phase of this project (initial construction and three nourishment cycles) per ER 1110-2-1302, Appendix C, Page C-2). It is based on the scope of the Recommended Plan and the official project schedule. The TPCS includes Federal and Non-Federal costs for Lands and Damages, all construction features, PED, S&A, along with the appropriate contingencies and escalation associated with each of these activities. The TPCS is formatted according to the WBS and uses Civil Works Construction Cost Indexing System factors for escalation (EM 1110-2-1304) of construction costs and Office of Management and Budget (EC 11-2-18X, 20 Feb 2008) factors for escalation of PED and S&A costs.

The Total Project Cost Summary was prepared using the MCACES/MII cost estimate on the Recommended Plan, as well as the contingency set by the risk analysis and the official project schedule.

B4.1 Total Project Cost Summary Spreadsheet

Refer to the Total Project Cost Summary Spreadsheet on the next page.

B5. COST MCX TPCS CERTIFICATION

The Recommended Plan estimate as well as the Cost and Schedule Risk Analysis and Total Project Cost Summary has undergone Cost Review and Certification by the Walla Walla Mandatory Center of Expertise prior to submittal of the Final Report.

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
PROJECT NO: P2 - 113475
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA

DISTRICT: CESAC CHARLESTON DISTRICT **PREPARED:** 4/15/2022
POC: CHIEF, GEN ENGINEERING, Lance Mahar

This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022 **Total**

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2022 Effective Price Level Date: 1 OCT 21									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-21 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
10	BREAKWATER & SEAWALLS	$2,377	$523	22.0%	$2,900	0.0%	$2,377	$523	$2,900	$0	$2,900	9.9%	$2,611	$574	$3,186
17	BEACH REPLENISHMENT	$52,565	$13,949	26.5%	$66,514	0.0%	$52,565	$13,949	$66,514	$0	$66,514	111.7%	$110,266	$30,555	$140,821
	CONSTRUCTION ESTIMATE TOTALS:	$54,942	$14,472		$69,413	0.0%	$54,942	$14,472	$69,413	$0	$69,413	107.5%	$112,878	$31,129	$144,007
01	LANDS AND DAMAGES	$737	$184	25.0%	$922	0.0%	$737	$184	$922	$0	$922	7.8%	$795	$199	$993
30	PLANNING, ENGINEERING & DESIGN	$3,077	$810	26.3%	$3,887	0.0%	$3,077	$810	$3,887	$222	$4,109	113.2%	$6,491	$1,795	$8,508
31	CONSTRUCTION MANAGEMENT	$714	$188	26.3%	$902	0.0%	$714	$188	$902	$0	$902	117.0%	$1,534	$424	$1,958
	PROJECT COST TOTALS:	$59,470	$15,655	26.3%	$75,124		$59,470	$15,655	**$75,124**	$222	**$75,346**	106.6%	$121,697	$33,547	$155,466

MAHAR.LANCE.RICHARD.1268025770 Digitally signed by MAHAR.LANCE.RICHARD.1268025770 Date: 2022.05.17 13:42:40 -04'00' — CHIEF, GEN ENGINEERING

WAITE.CHRISSA.LYNN.1384261600 — PROJECT MANAGER

HINELY.JOHN.S.1229914290 Digitally signed by HINELY.JOHN.S.1229914290 Date: 2022.05.12 13:05:28 -04'00' — CHIEF, ACQUISITION BRANCH

Digitally signed by PARRISH.NANCY.A.1035168296 Date: 2022.05.17 15:36:43 -04'00' — CHIEF, PLANNING

CHIEF, ENGINEERING

CHIEF, OPERATIONS

CHIEF, CONSTRUCTION

CHIEF, CONTRACTING

LIVASY.JEFFREY.J.1256603361 Digitally signed by LIVASY.JEFFREY.J.1256603361 Date: 2022.05.16 16:28:33 -04'00' — CHIEF, PM-P

CHIEF, DPM

ESTIMATED FEDERAL COST INITIAL CONSTRUCTION:	65%	$20,197
ESTIMATED NON-FEDERAL COST INITIAL CONSTRUCTION:	35%	$10,875
ESTIMATED TOTAL PROJECT COST INITIAL CONSTRUCTION:		**$31,072**
ESTIMATED FEDERAL COST PERIODIC NOURISHMENTS:	50%	$62,197
ESTIMATED NON-FEDERAL COST PERIODIC NOURISHMENTS:	50%	$62,197
ESTIMATED TOTAL PROJECT COST PERIODIC NOURISHMENTS:		**$124,394**
ESTIMATED FEDERAL COST TOTAL PROJECT:		$82,394
ESTIMATED NON-FEDERAL COST TOTAL PROJECT:		$73,072
ESTIMATED TOTAL PROJECT COST (including spent cost):		**$155,466**

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
PROJECT NO: P2 - 113475
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA

DISTRICT: CESAC CHARLESTON DISTRICT PREPARED: 4/15/2022
POC: CHIEF, GEN ENGINEERING, Lance Mahar

This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022 **INITIAL**

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2022 Effective Price Level Date: 1 OCT 21									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-21 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
10	BREAKWATER & SEAWALLS	$2,377	$523	22.0%	$2,900	0.0%	$2,377	$523	$2,900	$0	$2,900	9.9%	$2,611	$574	$3,186
17	BEACH REPLENISHMENT	$18,497	$4,069	22.0%	$22,566	0.0%	$18,497	$4,069	$22,566	$0	$22,566	9.9%	$20,321	$4,471	$24,791
	CONSTRUCTION ESTIMATE TOTALS:	$20,874	$4,592		$25,466	0.0%	$20,874	$4,592	$25,466	$0	$25,466	9.9%	$22,932	$5,045	$27,977
01	LANDS AND DAMAGES	$737	$184	25.0%	$922	0.0%	$737	$184	$922	$0	$922	7.8%	$795	$199	$993
30	PLANNING, ENGINEERING & DESIGN	$1,169	$257	22.0%	$1,426	0.0%	$1,169	$257	$1,426	$222	$1,648	6.7%	$1,247	$274	$1,743
31	CONSTRUCTION MANAGEMENT	$271	$60	22.0%	$331	0.0%	$271	$60	$331	$0	$331	8.3%	$294	$65	$359
	PROJECT COST TOTALS:	$23,051	$5,093	22.1%	$28,145		$23,051	$5,093	**$28,145**	$222	**$28,367**	9.6%	$25,267	$5,583	$31,072

MAHAR.LANCE.RICHARD.1268025770 — CHIEF, GEN ENGINEERING

WAITE.CHRISSA.LYNN.1384261600 — PROJECT MANAGER

HINELY.JOHN.S.1229914290 Digitally signed by HINELY.JOHN.S.1229914290 Date: 2022.05.12 13:07:18 -04'00' — CHIEF, ACQUISITION BRANCH

Digitally signed by — CHIEF, PLANNING

CHIEF, ENGINEERING

CHIEF, OPERATIONS

CHIEF, CONSTRUCTION

CHIEF, CONTRACTING

LIVASY.JEFFREY.J.1256603361 Digitally signed by LIVASY.JEFFREY.J.1256603361 — CHIEF, PM-P

CHIEF, DPM

ESTIMATED FEDERAL COST INITIAL CONSTRUCTION:	65%	**$20,196.78**
ESTIMATED NON-FEDERAL COST INITIAL CONSTRUCTION:	35%	**$10,875.19**
ESTIMATED TOTAL PROJECT COST INITIAL CONSTRUCTION:		**$31,072**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA
This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022

DISTRICT: CESAC CHARLESTON DISTRICT PREPARED: 4/15/2022
POC: CHIEF, GEN ENGINEERING, Lance Mahar

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared:			**15-Apr-22**	Program Year (Budget EC):			2022					
		Effective Price Level:			1-Oct-21	Effective Price Level Date:			1 OCT 21					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	Initial Construction 2025													
10	BREAKWATER & SEAWALLS	$2,377	$523	22.0%	$2,900	0.0%	$2,377	$523	$2,900	2025Q2	9.9%	$2,611	$574	$3,186
17	BEACH REPLENISHMENT	$18,497	$4,069	22.0%	$22,566	0.0%	$18,497	$4,069	$22,566	2025Q2	9.9%	$20,321	$4,471	$24,791
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$20,874	$4,592	22.0%	**$25,466**		$20,874	$4,592	$25,466			$22,932	$5,045	$27,977
01	LANDS AND DAMAGES	$737	$184	25.0%	$922	0.0%	$737	$184	$922	2024Q3	7.8%	$795	$199	$993
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$104	$23	22.0%	$127	0.0%	$104	$23	$127	2024Q3	6.4%	$111	$24	$135
0.5%	Planning & Environmental Compliance	$104	$23	22.0%	$127	0.0%	$104	$23	$127	2024Q3	6.4%	$111	$24	$135
2.0%	Engineering & Design	$417	$92	22.0%	$509	0.0%	$417	$92	$509	2024Q3	6.4%	$444	$98	$542
0.5%	Reviews, ATRs, IEPRs, VE	$104	$23	22.0%	$127	0.0%	$104	$23	$127	2024Q3	6.4%	$111	$24	$135
0.3%	Life Cycle Updates (cost, schedule, risks)	$63	$14	22.0%	$76	0.0%	$63	$14	$76	2024Q3	6.4%	$67	$15	$81
0.5%	Contracting & Reprographics	$104	$23	22.0%	$127	0.0%	$104	$23	$127	2024Q3	6.4%	$111	$24	$135
0.5%	Engineering During Construction	$104	$23	22.0%	$127	0.0%	$104	$23	$127	2025Q2	8.3%	$113	$25	$138
0.3%	Planning During Construction	$63	$14	22.0%	$76	0.0%	$63	$14	$76	2025Q2	8.3%	$68	$15	$83
0.0%	Adaptive Management & Monitoring	$0	$0	22.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.5%	Project Operations	$104	$23	22.0%	$127	0.0%	$104	$23	$127	2024Q3	6.4%	$111	$24	$135
31	CONSTRUCTION MANAGEMENT													
0.9%	Construction Management	$188	$41	22.0%	$229	0.0%	$188	$41	$229	2025Q2	8.3%	$204	$45	$248
0.2%	Project Operation:	$42	$9	22.0%	$51	0.0%	$42	$9	$51	2025Q2	8.3%	$45	$10	$55
0.2%	Project Management	$42	$9	22.0%	$51	0.0%	$42	$9	$51	2025Q2	8.3%	$45	$10	$55
	CONTRACT COST TOTALS:	$23,051	$5,093		$28,145		$23,051	$5,093	**$28,145**			$25,267	$5,583	**$30,850**

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
PROJECT NO: P2 - 113475
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA

DISTRICT: CESAC CHARLESTON DISTRICT PREPARED: 4/15/2022
POC: CHIEF, GEN ENGINEERING, Lance Mahar

This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022 PERIODIC

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2022 Effective Price Level Date: 1 OCT 21									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-21 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
17	BEACH REPLENISHMENT	$34,068	$9,880	29.0%	$43,947	0.0%	$34,068	$9,880	$43,947	$0	$43,947	164.0%	$89,946	$26,084	$116,030
	CONSTRUCTION ESTIMATE TOTALS:	$34,068	$9,880		$43,947	0.0%	$34,068	$9,880	$43,947	$0	$43,947	164.0%	$89,946	$26,084	$116,030
01	LANDS AND DAMAGES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN	$1,908	$553	29.0%	$2,461	0.0%	$1,908	$553	$2,461	$0	$2,461	174.9%	$5,244	$1,521	$6,765
31	CONSTRUCTION MANAGEMENT	$443	$128	29.0%	$571	0.0%	$443	$128	$571	$0	$571	180.0%	$1,240	$360	$1,599
	PROJECT COST TOTALS:	$36,418	$10,561	29.0%	$46,980		$36,418	$10,561	$46,980	$0	$46,980	164.8%	$96,430	$27,965	$124,394

MAHAR.LANCE.RICHARD.1268025770 Digitally signed by MAHAR.LANCE.RICHARD.1268025770 Date: 2022.05.17 13:44:19 -04'00'
CHIEF, GEN ENGINEERING, Lance Mahar

WAITE.CHRISSA.LYNN.1384061600 Digitally signed by WAITE.CHRISSA.LYNN.1384061600 Date: 2022.05.17 07:55:25 -04'00'
PROJECT MANAGER, Chrissa Waite

HINELY.JOHN.S.1229914290 Digitally signed by HINELY.JOHN.S.1229914290 Date: 2022.05.19 04:51:54 -04'00'
CHIEF, REAL ESTATE, John Hinely

CHIEF, PLANNING, Nancy Parrish

CHIEF, ENGINEERING, Carole Works

CHIEF, OPERATIONS, Joe Moran

CHIEF, CONSTRUCTION, David Dodds

CHIEF, CONTRACTING, Charlenne Figgins

LIVASY.JEFFREY.J.1256603361 Digitally signed by LIVASY.JEFFREY.J.1256603361
CHIEF, PM-P. Jeff Livasy

CHIEF, DPM, Lisa Metheney

ESTIMATED FEDERAL COST PERIODIC NOURISHMENTS:	50%	$62,197
ESTIMATED NON-FEDERAL COST PERIODIC NOURISHMENTS:	50%	$62,197
ESTIMATED TOTAL PROJECT COST PERIODIC NOURISHMENTS:		$124,394

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA
This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022

DISTRICT: CESAC CHARLESTON DISTRICT
POC: CHIEF, GEN ENGINEERING, Lance Mahar
PREPARED: 4/15/2022

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
			Estimate Prepared: 15-Apr-22				Program Year (Budget EC): 2022								
			Effective Price Level: 1-Oct-21				Effective Price Level Date: 1 OCT 21								
WBS NUMBER		Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A		*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
		1st Nourishment 2041													
17		BEACH REPLENISHMENT	$11,356	$3,293	29.0%	$14,649	0.0%	$11,356	$3,293	$14,649	2041Q2	65.7%	$18,811	$5,455	$24,267
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		CONSTRUCTION ESTIMATE TOTALS:	$11,356	$3,293	29.0%	**$14,649**		$11,356	$3,293	$14,649			$18,811	$5,455	$24,267
01		LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30		PLANNING, ENGINEERING & DESIGN													
	0.5%	Project Management	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2040Q3	62.0%	$92	$27	$119
	0.5%	Planning & Environmental Compliance	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2040Q3	62.0%	$92	$27	$119
	2.0%	Engineering & Design	$227	$66	29.0%	$293	0.0%	$227	$66	$293	2040Q3	62.0%	$368	$107	$475
	0.5%	Reviews, ATRs, IEPRs, VE	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2040Q3	62.0%	$92	$27	$119
	0.3%	Life Cycle Updates (cost, schedule, risks)	$34	$10	29.0%	$44	0.0%	$34	$10	$44	2040Q3	62.0%	$55	$16	$71
	0.5%	Contracting & Reprographics	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2040Q3	62.0%	$92	$27	$119
	0.5%	Engineering During Construction	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2041Q2	65.5%	$94	$27	$121
	0.3%	Planning During Construction	$34	$10	29.0%	$44	0.0%	$34	$10	$44	2041Q2	65.5%	$56	$16	$73
	0.0%	Adaptive Management & Monitoring	$0	$0	29.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	0.5%	Project Operations	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2040Q3	62.0%	$92	$27	$119
31		CONSTRUCTION MANAGEMENT													
	0.9%	Construction Management	$102	$30	29.0%	$132	0.0%	$102	$30	$132	2041Q2	65.5%	$169	$49	$218
	0.2%	Project Operation:	$23	$7	29.0%	$29	0.0%	$23	$7	$29	2041Q2	65.5%	$38	$11	$48
	0.2%	Project Management	$23	$7	29.0%	$29	0.0%	$23	$7	$29	2041Q2	65.5%	$38	$11	$48
		CONTRACT COST TOTALS:	$12,139	$3,520		$15,660		$12,139	$3,520	**$15,660**			$20,089	$5,826	**$25,914**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA
This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022

DISTRICT: CESAC CHARLESTON DISTRICT
POC: CHIEF, GEN ENGINEERING, Lance Mahar
PREPARED: 4/15/2022

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:			15-Apr-22 1-Oct-21	Program Year (Budget EC): Effective Price Level Date:			2022 1 OCT 21					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	2nd Nourishment Cycle 2057													
17	BEACH REPLENISHMENT	$11,356	$3,293	29.0%	$14,649	0.0%	$11,356	$3,293	$14,649	2057Q2	149.8%	$28,365	$8,226	$36,590
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$11,356	$3,293	29.0%	**$14,649**		$11,356	$3,293	$14,649			$28,365	$8,226	$36,590
01	LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2056Q3	155.9%	$145	$42	$187
0.5%	Planning & Environmental Compliance	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2056Q3	155.9%	$145	$42	$187
2.0%	Engineering & Design	$227	$66	29.0%	$293	0.0%	$227	$66	$293	2056Q3	155.9%	$581	$169	$750
0.5%	Reviews, ATRs, IEPRs, VE	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2056Q3	155.9%	$145	$42	$187
0.3%	Life Cycle Updates (cost, schedule, risks)	$34	$10	29.0%	$44	0.0%	$34	$10	$44	2056Q3	155.9%	$87	$25	$112
0.5%	Contracting & Reprographics	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2056Q3	155.9%	$145	$42	$187
0.5%	Engineering During Construction	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2057Q2	161.4%	$148	$43	$191
0.3%	Planning During Construction	$34	$10	29.0%	$44	0.0%	$34	$10	$44	2057Q2	161.4%	$89	$26	$115
0.0%	Adaptive Management & Monitoring	$0	$0	29.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.5%	Project Operations	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2056Q3	155.9%	$145	$42	$187
31	CONSTRUCTION MANAGEMENT													
0.9%	Construction Management	$102	$30	29.0%	$132	0.0%	$102	$30	$132	2057Q2	161.4%	$267	$77	$345
0.2%	Project Operation:	$23	$7	29.0%	$29	0.0%	$23	$7	$29	2057Q2	161.4%	$59	$17	$77
0.2%	Project Management	$23	$7	29.0%	$29	0.0%	$23	$7	$29	2057Q2	161.4%	$59	$17	$77
	CONTRACT COST TOTALS:	$12,139	$3,520		**$15,660**		$12,139	$3,520	**$15,660**			$30,383	$8,811	**$39,194**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: EDISTO BEACH FEASIBILITY STUDY REPORT
LOCATION: EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA
This Estimate reflects the scope and schedule in report; EDISTO BEACH VALIDATION REPORT - APRIL 2022

DISTRICT: CESAC CHARLESTON DISTRICT PREPARED: 4/15/2022
POC: CHIEF, GEN ENGINEERING, Lance Mahar

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Apr-22 Effective Price Level: 1-Oct-21				Program Year (Budget EC): 2022 Effective Price Level Date: 1 OCT 21				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	3rd Nourishment Cycle 2073													
17	BEACH REPLENISHMENT	$11,356	$3,293	29.0%	$14,649	0.0%	$11,356	$3,293	$14,649	2073Q2	276.6%	$42,770	$12,403	$55,173
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$11,356	$3,293	29.0%	**$14,649**		$11,356	$3,293	$14,649			$42,770	$12,403	$55,173
01	LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2072Q3	304.3%	$230	$67	$296
0.5%	Planning & Environmental Compliance	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2072Q3	304.3%	$230	$67	$296
2.0%	Engineering & Design	$227	$66	29.0%	$293	0.0%	$227	$66	$293	2072Q3	304.3%	$918	$266	$1,185
0.5%	Reviews, ATRs, IEPRs, VE	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2072Q3	304.3%	$230	$67	$296
0.3%	Life Cycle Updates (cost, schedule, risks)	$34	$10	29.0%	$44	0.0%	$34	$10	$44	2072Q3	304.3%	$138	$40	$178
0.5%	Contracting & Reprographics	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2072Q3	304.3%	$230	$67	$296
0.5%	Engineering During Construction	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2073Q2	313.0%	$235	$68	$303
0.3%	Planning During Construction	$34	$10	29.0%	$44	0.0%	$34	$10	$44	2073Q2	313.0%	$141	$41	$182
0.0%	Adaptive Management & Monitoring	$0	$0	29.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.5%	Project Operations	$57	$16	29.0%	$73	0.0%	$57	$16	$73	2072Q3	304.3%	$230	$67	$296
31	CONSTRUCTION MANAGEMENT													
0.9%	Construction Management	$102	$30	29.0%	$132	0.0%	$102	$30	$132	2073Q2	313.0%	$422	$122	$545
0.2%	Project Operation:	$23	$7	29.0%	$29	0.0%	$23	$7	$29	2073Q2	313.0%	$94	$27	$121
0.2%	Project Management	$23	$7	29.0%	$29	0.0%	$23	$7	$29	2073Q2	313.0%	$94	$27	$121
	CONTRACT COST TOTALS:	$12,139	$3,520		**$15,660**		$12,139	$3,520	**$15,660**			$45,958	$13,328	**$59,286**

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 113475

SAC - Edisto Island Storm Damage Reduction

The Edisto Island Storm Damage Reduction project as presented by Charleston District, has undergone a successful cost update and Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of May 3, 2022, the Cost MCX certifies the estimated total project cost:

INITIAL
FY 22 Project First Cost INITIAL: $28,145,000 (excluding spent costs)
SPENT: $ 222,000
Total Project First Cost: $28,367,000
FULLY FUNDED w/ SPENT: $31,072,000

PERIODIC – 3 Renourishments
FY 22 Project First Cost (2038-70): $46,980,000
SPENT: $ -0-
FULLY FUNDED w/ SPENT: $124,394,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal participation.

2022.05.09 16:46:47 -07'00'

Michael P Jacobs, PE, CCE
Chief, Cost Engineering MCX
Walla Walla District

Attachment A - Cost and Schedule Risk Analysis Report

US Army Corps of Engineers®

EDISTO BEACH, COLLETON COUNTY, SOUTH CAROLINA COASTAL STORM DAMAGE REDUCTION FEASABILITY REPORT RISK ANALYSIS

Prepared by:
U.S. Army Corps of Engineers,
Charleston District

Date: April 29, 2022

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LIST OF TABLES and FIGURES

APPENDIX

EXECUTIVE SUMMARY

Report Purpose

The US Army Corps of Engineers (USACE), Charleston District, presents this cost and schedule risk analysis (CSRA) report for the Edisto Beach Coastal Storm Damage Reduction Feasibility Report. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on the first cost as well as the periodic renourishment costs of the project. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommend 80% confidence level of successful execution to project completion.

Project Scope

The project area is located on Edisto Beach, a barrier island on South Carolina's coast in Colleton County. The entire island is approximately 7 miles in length. However, due to lack of any significant structures on the northern section, the project area consists of approximately 4 mile section of Edisto Beach. Quantity developed by laying the proposed profile over the 2018 Survey. A volume of 922,570 CY was calculated

Material for the project is to be dredged from an offshore location.

Risk Analysis Results

A Cost and Schedule Risk Analysis (CSRA) updated was performed May 2020 on this project to identify the 80% confidence level contingencies for the initial construction and renourishments. The study was performed on the Federal NED plan. The contingencies considered both cost and schedule with the schedule risk being converted to an additional cost risk. The results are that the examination of the of the risks for the first cost result in a 23% contingency at the 80% confidence level and the renourishments risk result in a slightly higher 29% contingency at the 80% level. These contingencies are applied to the remaining project activities such as Lands and Damages, Design and Construction Management as applicable. The following results were observed based on the MCACES Cost Estimate:

Construction Results	**Contingency Amount ($k)**	**Contingency %**
Initial Construction	$4,593	22%
Periodic Re-nourishments	$9,880	29%

High Risk Items

The following were high risk items affecting cost. The complete risk register and analysis can be viewed in Appendix A.

- Dredge Makeup (Type, Size and Fuel Cost)

  Discussion: The choice of dredge size can affect efficiency, fuel cost and productivity, causing a difference between the government estimate and the bid price of the contract. The estimate assumed a 30" hydraulic pipeline dredge will be

utilized, but the actual equipment is not restrictive within the proposed contract. The only restriction is the fact that the borrow area is outside the line of demarcation which requires an ocean certified dredge to be used.

- Quantities

Discussion: Sand quantity can be impacted by wave action, subsidence, coastal storms and sea level rise. Quantities for the project were defined by Beach-FX through a 300 iteration calibration. Deepening on conditions during PED, more or less sand may be required. The quantity of material required to be placed is uncertain and can be affected by increases in erosion due to more frequent storm events. In addition, due to the time period between the feasibility study and initial construction, the expected quantity could change dramatically.

- Market Conditions:

Discussion: Currently many projects planned when considering the number of dredges available. It is a tough bidding climate based on dwindling number of dredging contractors. To allow the greatest flexibility, increase competition, and decrease costs, the contract will specify a large time window for construction, with a defined end-date, but allow the contractor to insert this project into the window as their schedules have gaps.

- Contract Modifications/Claims:

Discussion- Contract modifications are always a risk in dredging. This work has a preferred window for construction and any environmental impacts in the region could potentially stop or delay the work that season resulting in remobilization costs.

Mitigation Recommendations

A positive outcome of the CSRA was a thorough discussion of the risks and their mitigation measures. PDT members worked through each risk item and how the risks would affect the overall project. Most could not be mitigated such as adverse weather and funding issues

Major recommendations are as follows for high risk items:

- To reduce risk in Market Conditions, contract period will allow for access time in period of performance. The intent would be to allow the contract to use this project to fill in voids with other work making it more advantageous to provide competitive pricing.

- Modifications/Claims during Project Construction Execution – Research into specific risk events which cause modification or claim during previous construction periods. Identify potential risk mitigation efforts from results.

- For the periodic renourishments, the quantities of material to be placed should be evaluated each year to ensure that the planned quantities are sufficient to maintain the level of protection required as the project progresses.

Total Project Cost Summary

The following table portrays the first cost of the initial construction and the 3 periodic nourishments features based on the anticipated contracts. The costs are intended to address the necessary costs at authorization of the project. Costs are in thousands of dollars. The contingency is based on an 80% confidence level, as per USACE Civil Works guidance. First Costs are in FY20 dollars.

Table 1 - Project First Cost Summary

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ 737,000	25%	$ 184,250	$ 921,250.00
Total Construction Estimate	$ 20,874,000	22%	$ 4,592,280	$ 25,466,280
Total Planning, Engineering & Design	$ 1,169,000	22%	$ 257,180	$ 1,426,180
Total Construction Management	$ 271,000	22%	$ 59,620	$ 330,620
Total	**$ 23,051,000**	**22%**	**$ 5,093,330**	**$ 28,144,330**

Table 2 – Re-Nourishment First Cost

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0%	$ -	$ -
Total Construction Estimate	$ 34,068,000	29%	$ 9,879,720	$ 43,947,720
Total Planning, Engineering & Design	$ 1,908,000	29%	$ 553,320	$ 2,461,320
Total Construction Management	$ 444,000	29%	$ 128,760	$ 572,760
Total	**$ 36,420,000**	**29%**	**$ 10,561,800**	**$ 46,981,800**

PURPOSE/BACKGROUND

The US Army Corps of Engineers (USACE), Charleston District, presents this cost and schedule risk analysis (CSRA) report for the Edisto Beach Coastal Storm Damage Reduction Feasibility Report. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on the costs to implement the selected alternative. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommend 80% confidence level of successful execution to project completion

REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both the initial construction cost and the periodic nourishments risks for all project features. The project schedule was examined and schedule risks for the initial construction are only considered as the schedule risks for the long term nourishments are primarily limited by the funding received and are beyond the team to influence. The schedule risk for the initial construction is generally minor and is converted to costs and added to the cost risk model. It is assumed that after the initial construction is complete that the project would receive the necessary funding to complete future nourishment of the beach segments. The study and presentation can include or exclude consideration for operation and maintenance or life cycle costs, depending upon the program or decision document intended for funding.

Project Scope

Major Project Features studied from the civil works work breakdown structure (CWWBS) for this project includes:

01 – Lands & Damages

10 - Breakwaters and Seawalls

17 - Beach Replenishment

30 - Planning, Engineering & Design

31 - Construction Management

USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering MCX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted. The risk study utilizes the MCACES cost estimate amount for all features then applies the resultant percentage of risk/contingency to the project first and fully funded costs.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

METHODOLOGY/PROCESS

The CSRA meeting was held via teleconference for the purposes of identifying and assessing risk factors. Participants include the following PDT members:

Chrissa Waite, Project Manager, SAC

Brian Clouse, Cost Engineer, SAC

Kim Callan, Cost Engineer, NWW

Tom Murphy, Civil Engineer, SAC

Elizabeth Godsey, Coastal Engineer, SAM

Ashley Throop, Coastal Engineer, SAM

Susan Horton, Planner, SAC

Andrea Hughes, Environmental, SAC

George Ebai, Economist, SAC

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering MCX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

The initial formal meeting focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Discussions focused primarily on risk factor assessment and quantification.

Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.
- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

Risk discussions focused on the various project features as presented within the USACE Civil Works Work Breakdown Structure for cost accounting purposes. It was recognized that the various features carry differing degrees of risk as related to cost, schedule, design complexity, and design progress.

The resulting product from the PDT discussions is captured within a risk register as presented in Appendix A, for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering MCX guidance, only critical path and near critical path tasks are considered to be uncertain for the purposes of contingency analysis.

KEY CONSIDERATIONS AND ASSUMPTIONS

Key assumptions include the following:

- Adequate Borrow currently exists for the project within the defined borrow area.
- Life Cycle costs have not been included in this cost estimate.
- Contract acquisition strategy will be full and open.

RISK ANALYSIS RESULTS

Risk Register

Risk is unforeseen or unknown factors that can affect a project's cost or schedule. Time and money have a direct relationship due to the time value of money. A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. The risk register describes risks in terms of cost and schedule. A summary risk register that includes typical risk events studied (high and moderate levels) is presented in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register is provided in Appendix A. The detailed risk registers of Appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing and communicating identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

A correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1. Correlations were not identified in this analysis.

The risk register identifies thirty one different risks. There are eight that are either moderate or high risks. An abridged version of the risk register is presented below.

Table 3 – Project Risk Register

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Cost Risk Lev	Schedule Risk Lev
T-2	Quantities of material.	Sand quantity can be impacted by wave action, subsidence, coastal storms and sea level rise. Quantities for the project were defined by Beach-FX through a 300 iteration calibration. Depening on conditions during PED, more or less sand may be required	Quantity developed by laying the proposed profile over survey data from 2018 and 2020. A volume of 755,000 CY was calculated. Estimated that 167,570 cy plus or minus 2,600 cy of background erosion is expected to occur within the project limits over the 2.2 year period from the October 2018 survey to an anticipated start of construction in December of 2021. So 755,000 + 167,570 = 922,570 CY most likely quantity of pumped sand.	MODERATE	MODERATE
ENV-8	Sea level rise	Project area is subject to the impacts of sea level rise	Sea level rise was assessed as part of the feasbility study. If sea level rise is greater than anticipated, it could affect the overall cost by required more sand at renourishment, and more frequent nourishment intervals	MODERATE	MODERATE
CON-1	Contract Modifications	There may be modification issues that have not been captured in current risks.	The normal modifications for dredging is quantities. Each contract will likely carry the intended quantities per contract. Competing work, loss of dredger, quantity assumption can cause modifications such as remobilizations and delays. Other modification potentials could include borrow source remobilization resulting from environmental impacts.	MODERATE	MODERATE
EST-1	Dredge, type & size	Estimate choice can effect efficiency and productivity, causing a change to the estimate.	Estimate assumed a single 30" pipeline dredge but equipment is not restrictive w/in contract. The chosen estimate dredge size can affect the cost and productivity. A large pipeline results in greater efficiency as compared to smaller pipeline dredges, but may be impacted by weather/wave conditions. Due to requirement for ocean certified dredge, expect either 27" or 30" pipeline.	HIGH	MODERATE
EST-2	Fuel	Fuel fluctuations can impact dredging costs.	On dredging projects, fuel is a major cost driver for equipment. Fuel costs have been very volatile in the past 18 months. Study should be for time of funding date estimate.	HIGH	LOW
EST-3	Dredge Productivity	The estimate assumes a certain productivity based on a 30" pipeline dredge. Productivity may vary if different dredge is used.	The current estimate makes assumptions in the size and productivity for a single 30" pipeline dredge with an average pumpimng distance of 18,220 LF. Those estimate assumptions establish the schedule. Productivity of a pipeline dredge can vary due to various conditions such as weather/waves and mechanical failure. Productivity could be 60-80% EWT.	HIGH	LOW
EXT-1	Market Conditions	Market conditions and competing projects may impact bid competition.	Currently, there are a lot of projects planned when considering the number of dredges available. It is a tough bidding climate based on dwindling number of dredging contractors. To allow the greatest flexibility, increase competition, and decrease costs, the contract will specify a large time window for construction, with a defined end-date, but allow the contractor to insert this project into the window as their schedules have gaps.	MODERATE	LOW
EXT-5	Esc exceeds OMB rates	Over longer periods of time, the actual market may be greater than the OMB rates, impacting contract costs.	Volatile fuel, being a larger risk on dredging projects, may not correlate with the OMB rates and may be higher as time passes.	MODERATE	LOW

Cost Risk Analysis - Cost Contingency Results

The project Cost Contingency at the 80% confidence level for the initial construction is 25%. This level was established by analyzing the different cost risk factors that affect the project. Cost contingencies can be either positive or negative. The cost sensitivity chart demonstrates relative cost contingency of individual risks for the initial construction. The chart for the renourishments is similar with long term variables such as escalation, fuel, and the borrow sources having slightly higher rankings. The sensitivity charts for the initial construction cost and re-nourishments areas depicted below.

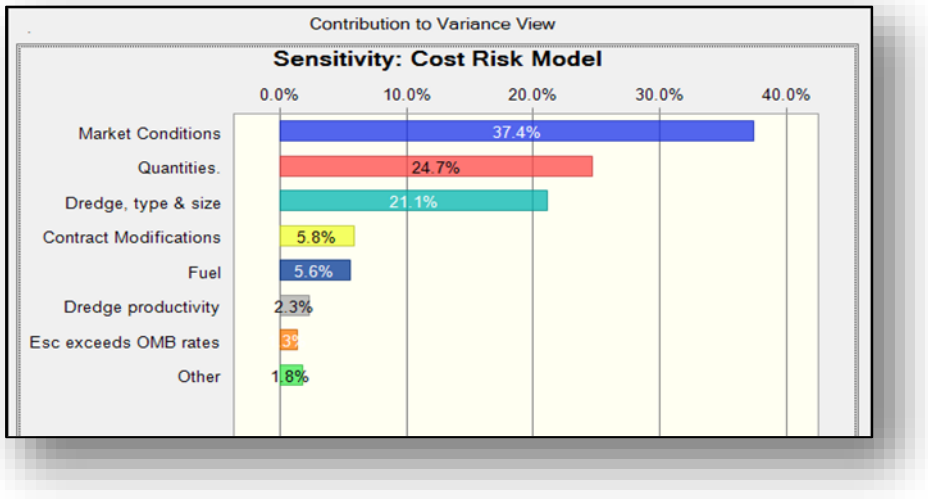


Figure 1 – Initial Work Sensitivity Chart

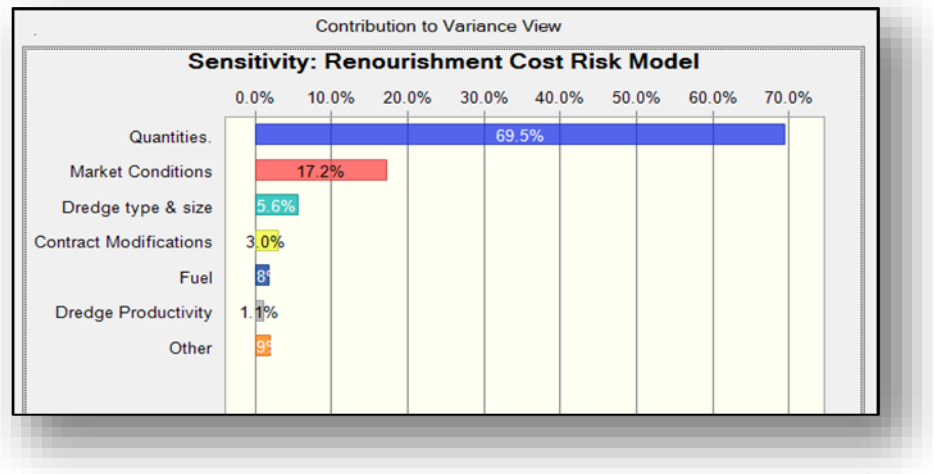


Figure 2 – Re-Nourishment Work Sensitivity Chart

- Dredge type/size

Discussion: The choice of dredge size can affect efficiency and productivity, causing a difference between the government estimate and the bid price of the contract. The estimate assumed a 30" hydraulic pipeline dredge will be utilized, but the actual equipment is not restrictive within the proposed contract. The only restriction is the fact that the borrow area is outside the line of demarcation which requires an ocean certified dredge to be used.

- Quantities:

Discussion- The quantity of material required to be placed is uncertain and can be affected by increases in erosion due to more frequent storm events. In addition, due to the time period between the feasibility study and initial construction, the expected quantity could change dramatically.

- Market Conditions

Discussion: Dredging is a highly competitive industry and there are limited windows when dredging can be performed in this area. The PDT has planned to allow multiple types of dredges to be considered to increase competition for this project.

Schedule Risk Analysis - Schedule Contingency Results

No specific schedule risk was derived from team's analysis. Schedule risks for the construction window were assessed for their impacts to cost and added to the cost contingency for both the first and the nourishment costs. The cost contingency analysis results are in the tables below.

Table 4 – Initial Project Confidence Levels

Percentile	MCACES Construction	Contingency	Baseline w/ Contingency	Contingency %	Rounded %
0%	$ 20,874,000	**$589,217**	**$21,463,217**	**2.82%**	3%
5%	$ 20,874,000	**$1,551,187**	**$22,425,187**	**7.43%**	8%
10%	$ 20,874,000	**$1,928,031**	**$22,802,031**	**9.24%**	10%
15%	$ 20,874,000	**$2,185,403**	**$23,059,403**	**10.47%**	11%
20%	$ 20,874,000	**$2,380,110**	**$23,254,110**	**11.40%**	12%
25%	$ 20,874,000	**$2,589,361**	**$23,463,361**	**12.40%**	13%
30%	$ 20,874,000	**$2,747,639**	**$23,621,639**	**13.16%**	14%
35%	$ 20,874,000	**$2,930,112**	**$23,804,112**	**14.04%**	15%
40%	$ 20,874,000	**$3,140,747**	**$24,014,747**	**15.05%**	16%
45%	$ 20,874,000	**$3,277,161**	**$24,151,161**	**15.70%**	16%
50%	$ 20,874,000	**$3,419,919**	**$24,293,919**	**16.38%**	17%
55%	$ 20,874,000	**$3,559,820**	**$24,433,820**	**17.05%**	18%
60%	$ 20,874,000	**$3,746,200**	**$24,620,200**	**17.95%**	18%
65%	$ 20,874,000	**$3,887,777**	**$24,761,777**	**18.62%**	19%
70%	$ 20,874,000	**$4,077,291**	**$24,951,291**	**19.53%**	20%
75%	$ 20,874,000	**$4,232,007**	**$25,106,007**	**20.27%**	21%
80%	**$ 20,874,000**	**$4,422,557**	**$25,296,557**	**21.19%**	**22%**
85%	$ 20,874,000	**$4,665,237**	**$25,539,237**	**22.35%**	23%
90%	$ 20,874,000	**$5,041,843**	**$25,915,843**	**24.15%**	25%
95%	$ 20,874,000	**$5,556,650**	**$26,430,650**	**26.62%**	27%
100%	$ 20,874,000	**$7,834,268**	**$28,708,268**	**37.53%**	38%

Table 5 – Re-Nourishment Confidence Levels

Percentile	MCACES ESTIMATE of One Re-nourishment Cost	Contingency	Baseline w/ Contingency	Contingency %	Rounded %
0%	$ 11,356,000	**$404,046**	**$11,760,046**	**3.56%**	4%
5%	$ 11,356,000	**$973,670**	**$12,329,670**	**8.57%**	9%
10%	$ 11,356,000	**$1,215,001**	**$12,571,001**	**10.70%**	11%
15%	$ 11,356,000	**$1,378,921**	**$12,734,921**	**12.14%**	13%
20%	$ 11,356,000	**$1,531,545**	**$12,887,545**	**13.49%**	14%
25%	$ 11,356,000	**$1,668,496**	**$13,024,496**	**14.69%**	15%
30%	$ 11,356,000	**$1,825,280**	**$13,181,280**	**16.07%**	17%
35%	$ 11,356,000	**$1,982,507**	**$13,338,507**	**17.46%**	18%
40%	$ 11,356,000	**$2,101,689**	**$13,457,689**	**18.51%**	19%
45%	$ 11,356,000	**$2,220,785**	**$13,576,785**	**19.56%**	20%
50%	$ 11,356,000	**$2,330,576**	**$13,686,576**	**20.52%**	21%
55%	$ 11,356,000	**$2,479,610**	**$13,835,610**	**21.84%**	22%
60%	$ 11,356,000	**$2,629,048**	**$13,985,048**	**23.15%**	24%
65%	$ 11,356,000	**$2,773,115**	**$14,129,115**	**24.42%**	25%
70%	$ 11,356,000	**$2,937,750**	**$14,293,750**	**25.87%**	26%
75%	$ 11,356,000	**$3,101,757**	**$14,457,757**	**27.31%**	28%
80%	**$ 11,356,000**	**$3,271,703**	**$14,627,703**	**28.81%**	**29%**
85%	$ 11,356,000	**$3,529,647**	**$14,885,647**	**31.08%**	32%
90%	$ 11,356,000	**$3,895,294**	**$15,251,294**	**34.30%**	35%
95%	$ 11,356,000	**$4,328,067**	**$15,684,067**	**38.11%**	39%
100%	$ 11,356,000	**$5,612,337**	**$16,968,337**	**49.42%**	50%

APPENDIX A
DETAILED RISK REGISTER

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Project Schedule			Responsibility/POC	Affected Project Component
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*		
Contract Risks (Internal Risk items are those that are generated, caused, or controlled within the PDT's sphere of influence.)											
	PROJECT & PROGRAM MGMT										
PPM-1	Congressional Funding - PED	Concern is that the PED Congressional funding is uncertain, post feasibility.	A portion of PED funding has been received. Complete PED funding pending validation study.	Likely	Negligible	LOW	Unlikely	Marginal	LOW	Project Manager	Project Cost & Schedule
PPM-2	Stakeholder funding capability	Sponsor has small tax base, but is expected to provide cost share agreement for funding.	Sponsors must fund portion of 50% feasibility, 25% PED and 35% initial construction plus 100% real estate acquisition. Sponsor is seeking State Assistance for their Cost-share. These funds have made it through the SC House, and funding is very likely.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Project Sponsor(s)	Project Cost & Schedule
PPM-3	Congressional Funding - Construction	Availability of federal funding for Construction	This project is part of the BBA18 program; Construction funds are authorized and appropriated	Very Unlikely	Significant	LOW	Very Likely	Marginal	MODERATE	Project Manager	Project Cost & Schedule
PPM-4	Adequate PDT Resources	PDT has been through significant personnel changes during study.	The District feels that there is adequate District support and team development for future efforts.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Project Manager	Project Cost & Schedule
PPM-5	Sponsor Support	Sponsor support and agreement with the project plan.	Official Sponsor coordination and support is ongoing. Some concerns about selected plan exists with a small percentage of residents of Edisto. The sponsor is committed to working through these concerns	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Project Sponsor(s)	Project Cost & Schedule
PPM-6	Schedule quality	Concern whether current schedule is realistic, optimistic.	The PM is confident of the schedule for PED and construction durations. The duration of the validation study may have impacts on the schedule	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Technical Lead	Project Cost & Schedule
	CONTRACT ACQUISITION RISKS										
CA-1	Contract Acquisition Strategy	The acquisition strategy could impact the construction cost and schedule.	Work type is not complicated. It is likely that it will be a FFP large business, based on historical and small business does not have capability. The contract packages will consider the estimate schedule projections related to productivity. Expected strategy is for full and open for large business.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Contracting	Project Cost & Schedule
	TECHNICAL RISKS										
T-1	Borrow material Quality	Limited borings done on borrow source. However, there is a pretty good data set from previous projects.	There may be pockets of material that are not suitable but overall there is more than enough material to complete the project. More data will be obtained in PED phase but generally thought to be a low risk. If material is pumped that is not the appropriate quality, it cannot be placed on the beach	Unlikely	Marginal	LOW	Unlikely	Negligible	LOW	Geotechnical/Civil Design	Project Cost & Schedule
T-2	Quantities of material.	Sand quantity can be impacted by wave action, subsidence, coastal storms and sea level rise. Quantities for the project were defined by Beach-FX through a 300 iteration calibration. Depening on conditions during PED, more or less sand may be required	Overall quantities are based on average volumes. There could be variation over time over the models. During PED, there will be a survey conducted, leading to greater confidence in design and sand quantity needed for initial construction	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Hydrology/Hydraulic Design	Project Cost & Schedule
T-3	Hard Bottom Encounter	Hard bottoms may be uncovered later in out years .	Sand bottom may be covering hard bottoms, leaving a risk in the borrow quantity available at each site. It could damage the hopper dredge. Risk is increased in the out years, because in the near term the dredge can simply relocate. Better clarification should occur during PED phase with better surveys.	Very Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
	LANDS AND DAMAGES RISKS										
RE-1	Acquire real estate	Concern that Sponsor cannot acquire real estate easements in timely fashion to support the construction contracts.	There is no historical, knowledge of the sponsors track record of acquiring easements. This is a function of the sponsor who is highly motivated to begin this project. However, as was learned in the last public meeting, the majority of the landowners are not in favor of conveying easements for this project which could lead to the filing of eminent domain.	Likely	Negligible	LOW	Likely	Marginal	MODERATE	Real Estate	Project Cost & Schedule
RE-2	Real Estate Estimate	Real Estate estimate may cause cost impact.	Historical information is good. The estimate currently includes a 25% contingency. This should be re-evaluated within the risk analysis outcome.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Real Estate	Project Cost & Schedule
	REGULATORY AND ENVIRONMENTAL RISKS										
ENV-1	UXO	Area is near sites for Civil War naval battles.	Area surveyed for cultural resources with magnetometer. No UXO detected.	Very Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Environmental	Project Cost & Schedule
ENV-2	Turtle nesting season	If dredging occurs during turtle nesting season, additional monitoring will be required	The project is currently scheduled outside of the sea turtle nesting season	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
ENV-3	SAD Turtle Incidental Take	Other projects encountering sea turtles	Other SAD impacts or "takes" should not impact this project. Project expected to use hydraulic pipeline dredge and should not be impacted.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
ENV-4	Bird Nesting	TES Bird nesting impacts construction.	Nesting areas are generally outside of construction zone. Risk is minimized, but such an encounter may shut down work activity for a period of time.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
ENV-5	Right Whale Restrictions	Encounter potential impacts dredge.	The current estimate assumes hydraulic pipeline dredge which should not encounter right whales during dredging operations due to slow movements.	Very Unlikely	Negligible	LOW	Unlikely	Negligible	LOW	Environmental	Project Cost & Schedule
ENV-6	Environmental Monitoring	Environmental monitoring required during dredging.	Dredge relocation to another borrow source would be required if impacts are found. Environmental group will have a separate monitoring contract. The monitoring costs have been included for the initial construction.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
ENV-7	Dune vegetation	Dune Revegetation required	Estimate includes first vegetation. Smaller Dune Revegetation is included in nourishment cycles.	Likely	Negligible	LOW	Likely	Negligible	LOW	Environmental	Project Cost & Schedule

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Project Schedule			Responsibility/POC	Affected Project Component
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*		
ENV-8	Sea level rise	Project area is subject to the impacts of sea level rise	Sea level rise was assessed as part of the feasibility study. If sea level rise is greater than anticipated, it could affect the overall cost by required more sand at renourishment, and more frequent nourishment intervals	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Environmental	Project Cost & Schedule
ENV-9	Archeological	Concern that there may be uncovered archeological finds during the underwater excavations.	Borrow area has been well established with adequate investigation to determine exclusion areas. If anything was discovered, another section of the larger borrow areacould be used.	Very Unlikely	Marginal	LOW	Very Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
	CONSTRUCTION RISKS										
CON-1	Contract Modifications	There may be modification issues that have not been captured in current risks.	The normal modifications for dredging is quantities. Each contract will likely carry the intended quantities per contract. Competing work, loss of dredger, quantity assumption can cause modifications such as remobilizations and delays. Other modification potentials could include borrow source remobilization resulting from environmental impacts.	Likely	Marginal	MODERATE	Unlikely	Significant	MODERATE	Construction	Project Cost & Schedule
CON-2	Hopper Dredge	The estimate assumes a pipeline dredge because of proximity of borrow site to Edisto.	Hopper dredge not likely due to proximity of borrow area and relatively low quantities of material.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Construction	Project Cost & Schedule
	ESTIMATE AND SCHEDULE RISKS										
EST-1	Dredge, type & size	Estimate choice can effect efficiency and productivity, causing a change to the estimate.	Estimate assumed a single 30" pipeline dredge but equipment is not restrictive w/in contract. The chosen estimate dredge size can affect the cost and productivity. A large pipeline results in greater efficiency as compared to smaller pipeline dredges, but may be impacted by weather/wave conditions. Due to requirement for ocean certified dredge, expect either 27" or 30" pipeline.	Likely	Significant	HIGH	Likely	Marginal	MODERATE	Cost Engineering	Project Cost & Schedule
EST-2	Fuel	Fuel fluctuations can impact dredging costs.	Dredging cost has been updated to highier current fuel cost. On dredging projects, fuel is a major cost driver for equipment. Fuel costs have been very volatile in the past 18 months. Study should be for time of funding date estimate.	Likely	Marginal	MODERATE	Unlikely	Marginal	LOW	Cost Engineering	Project Cost & Schedule
EST-3	Dredge Productivity	The estimate assumes a certain productivity based on a 30" pipeline dredge. Productivity may vary if different dredge is used.	The current estimate makes assumptions in the size and productivity for a single 30" pipeline dredge with an average pumpimng distance of 18,220 LF. Those estimate assumptions establish the schedule. Productivity of a pipeline dredge can vary due to various conditions such as weather/waves and mechanical failure. Productivity could be 60-80% EWT.	Likely	Significant	HIGH	Likely	Negligible	LOW	Cost Engineering	Project Cost & Schedule
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controled exclusively outside the PDT's sphere of influence.)									
EXT-1	Market Conditions	Market conditons and competing projects may impact bid competition.	Currently, there are a lot of projects planned when considering the number of dredges available. It is a tough bidding climate based on dwindling number of dredging contractors. To allow the greatest flexibility, increase competition, and decrease costs, the contract will specify a large time window for construction, with a defined end-date, but allow the contractor to insert this project into the window as their schedules have gaps. Post-45 is wrapping up, so dredges may be more available	Unlikely	Significant	MODERATE	Likely	Negligible	LOW	Cost Engineering	Project Cost & Schedule
EXT-2	External Opposition	External opposition may cause scope or schedule change.	Feds adhering to the environmental requirements. Sponsors in favor of project. No serious historical intervention because it is a beach renourishment project.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Project Manager	Project Cost & Schedule
EXT-3	Acts of God	Severe weather may impact cost or schedule.	Nor'easters, tropical storms or hurricanes could impact construction as well as beach profile. Due to turtle nesting season, construction will most likely occur from October 15 thru April 15 which is outside of hurricane season and storms are not a likely impact. Due to the short duration of construction, 4 months for initial and less than 1 month for nourishment cycles, the likelihood of an impact is very unlikely.	Very Unlikely	Critical	LOW	Unlikely	Marginal	LOW	Project Manager	Project Cost & Schedule
EXT-4	Borrow Competition	Similar borrow area was used for a 2017 project funded by the sponsor. External entities may compete for the borrow sources.	For initial construction this is unlikely. Due to the exclusion of the state park from the Federal Project, the state may decide to nourish state park in the future. Due to the large borrow area for this project and the relatively small quantities required for the nourishment cycles, there should not be a significant impact.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW	Project Manager	Project Cost & Schedule
EXT-5	Esc exceeds OMB rates	Over longer periods of time, the actual market may be greater than the OMB rates, impacting contract costs.	Volatile fuel, being a larger risk on dredging projects, may not correlate with the OMB rates and may be higher as time passes.	Likely	Marginal	MODERATE	Unlikely	Negligible	LOW	Cost Engineering	Project Cost & Schedule

Appendix C

Miscellaneous Documentation

Validation Report

Edisto Beach, South Carolina

US Army Corps of Engineers ®
Charleston District

January 2021

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

January 21, 2016

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, DC 20310-0108

Dear Ms. Darcy:

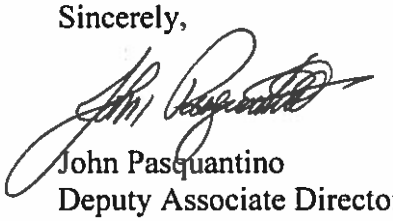
As required by Executive Order 12322, the Office of Management and Budget has reviewed a March 2014 Army Corps of Engineers feasibility report (report) that proposes periodic beach nourishment to reduce hurricane and storm damage in Edisto Beach, SC, at a first cost of $55.1 million (October 2014 prices).

According to the information provided in the Corps' report, one of the three proposed component segments—the Inlet segment—in the report relies on the use of recreation benefits to justify its construction when using the 7 percent discount rate. As a matter of Federal investment policy, a Federal flood damage reduction project must have enough flood damage reduction and related benefits to justify its construction on its own, independent of any recreation benefits. Army has concluded that the Inlet segment could be considered a separable element of the Edisto Beach project. Based on an analysis of costs and benefits, the Corps estimated that the benefit-to-cost ratio for that segment, without considering recreation benefits, is 0.98 to 1 at a discount rate of seven percent, which suggests the project may not provide a positive return from a National investment perspective at this time. This is the discount rate that the Administration uses in the Budget to measure the performance of Corps construction projects whose primary purpose is to provide an economic return to the Nation. We would like to work with you to ensure that in the development of future Corps reports, non-Federal sponsors are made fully aware of the basis upon which the Executive Branch evaluates projects.

The Office of Management and Budget does not object to your submitting this report to Congress. However, when you do so, please advise the Congress that the Administration will be requesting the Corps, after it completes all pre-construction design and engineering work on this project, to update the estimates of the benefits and costs of each separable element of this project before determining whether to recommend funding to construct it. In addition, should the Congress authorize this project for construction, the project would need to compete with other

proposed investments for funding in future budgets. We anticipate future Budgets will continue to be limited to investments that demonstrate a high return to the Nation.

Sincerely,



John Pasquantino
Deputy Associate Director
Energy, Science, and Water

FINAL REPORT

2017 BEACH RESTORATION AND GROIN LENGTHENING PROJECT

Edisto Beach Colleton County SC

Prepared for:

Town of Edisto Beach
2414 Murray Street Edisto Island SC 29438

Prepared by:

High Value Services
Sustainable Solutions
COASTAL SCIENCE & ENGINEERING
PO Box 8056 Columbia SC 29202-8056

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EXECUTIVE SUMMARY

This final report outlines a beach restoration and groin extension project at Edisto Beach (SC), which was sponsored by the Town of Edisto Beach. The project occurred January–June 2017 and included nourishment of the beach and extension of 26 of the groins along the Atlantic Ocean facing shoreline of the beach. The work included placement of 1,006,000 cubic yards (cy) of sand over ~19,000 linear feet of beach between Edisto Beach State Park and Edisto Street. Groins were extended between 20 and 100 feet (ft) with a total lengthening of 1,630 ft. Sand was excavated by cutterhead dredge from the shoal on the north side of the South Edisto River Inlet.

Nourishment was completed by Marinex Construction (Charleston SC). The groin work was completed by Crowder Construction (Charlotte NC). The total project was completed under authorization by state (SCDHEC–OCRM) and federal (USACE) permit P/N 2015-00528. Coastal Science & Engineering Inc (CSE) (Columbia SC) served as project engineer.

Planning for the project evaluated nourishment alternatives and volume requirements, groin extension design, coastal processes, potential downdrift impacts, costs, and potential environmental impacts. Design and planning documents included submission of groin analysis studies, monitoring reports, cultural resource assessments, geotechnical investigations, and environmental assessments. The project permit application was submitted on 27 April 2015 with public notice being issued 3 June 2015. The state permit was issued by South Carolina Department of Health and Environmental Control–Office of Ocean & Coastal Resource Management (SCDHEC–OCRM) on 26 May 2016, and the US Army Corps of Engineers (USACE) permit on 19 August 2016. Hurricane *Matthew* (October 2016) forced the Town to postpone the bid opening so that the project could be reassessed, allowing incorporation of minor changes to the design.

Funding for the project was provided by a combination of sources including the Town of Edisto Beach, Colleton County, the state of South Carolina, and the Federal Emergency Management Agency (FEMA). The total nourishment cost was $12,198,780 including $2,683,800 for mobilization and an average of $9.46 per cubic yard of sand. Groin extensions totaled $5,424,642.29, which is an average cost of $3,328 per linear foot of extension.

Mobilization for the work began in December 2016 with heavy equipment being delivered to the site. Crowder initiated work on the groins on 3 January 2017 and completed the work on 7 June. Marinex began pumping on 25 January and completed the fill on 14 April 2017. All equipment was removed from the beach by 15 June.

The nourishment design was based on pre-project beach conditions and included a dune in areas where no existing dune was present and varying berm widths based on design volume. The northern end of the beach (Reach 1 and the state park) generally showed lower pre-project volumes and, therefore, received the greatest fill quantity. Reach volumes ranged from 32.4

cubic yards per foot (cy/ft) to 68.3 cy/ft. The initial berm widths reached up to 125 ft in the highest fill density areas.

Groins were lengthened based on a combination of recommended scenarios by CSE and the USACE. Extensions were designed to extend the sloping section as necessary until the elevation reached −1 ft NAVD, then extensions were built seaward at −1 ft elevation. Thirteen of the extensions included composite sheet-pile and armor-stone scour aprons, and the remaining were constructed with grouted armor stone. Groins with sheet pile included a concrete cap along the top edge of the sheets to protect the sheets from wave action and moving armor stone. Marine mattresses were placed under all armor-stone areas to prevent the stones from settling lower in the sand.

Following construction, the Town installed sand fencing and planted dune vegetation along the project area. Similarly, South Carolina Department of Parks, Recreation & Tourism (SCPRT) installed fence and dune plants along the state park area. CSE completed a post-project survey of the nourished beach in April 2017 and surveyed each groin extension in August 2017.

Aerial view of the Edisto Beach project on 31 January 2017. [Photo by SB Traynum]

ACKNOWLEDMENTS

CSE would like to acknowledge the council and staff of the Town of Edisto Beach for their support and dedication to the project as well as for their support of CSE and our team. We would especially like to thank Iris Hill (Town Administrator) and Jane Darby (Mayor) for their leadership in planning and executing the project. The Edisto Beach Police Department (EBPD) was also instrumental in execution of the project and in maintaining a safe working environment for the crews and public. CSE also wishes to acknowledge the Town staff, EBPD, South Carolina National Guard, and many local volunteers for their efforts in damage relief and restoration following Hurricane *Matthew* in the fall of 2016. Their hard work allowed the project to proceed in a timely manner and restored the beach for the residents of South Carolina and beyond.

CSE would also like to thank the South Carolina Department of Parks, Recreation & Tourism (SCPRT) for their partnership in the project, both financially and logistically. A special thanks to Phil Gaines, David Simms, and Jon Greider for their assistance in planning and executing the project.

Marinex Construction (Charleston SC) was the nourishment contractor. We thank Thomas Payne and the shore and dredge crews for accomplishing the work in a timely manner and for the donation of additional sand beyond the contract amount to rebuild a dune at the state park.

Groin construction was performed by Crowder Construction (Charlotte NC). Kyle Wylie served as project manager, and Patrick Merli served as site superintendent. CSE appreciates Crowder's efforts in working in a difficult environment, constantly dealing with changing tides, unpredictable weather, and difficulty in scheduling material delivery around uncertain conditions and new uses of material.

CSE's work was supervised by Dr. Tim Kana (project director). Project engineer, Dr. Haiqing Kaczkowski (PE), was responsible for final design of the nourishment and groin extensions. Mike Rentz (PE) and Jason Cothran (Rentz Engineering) prepared the detailed structure design and material recommendations for the groin extensions. CSE's project manager was Steven Traynum. Technical assistance was provided by Trey Hair, Captain Andrew Giles, and Luke Fleniken. Diana Sangster and Julie Lumpkin provided editorial assistance and liaison. The final report was written by Mr. Traynum with graphics preparation by Trey Hair and report production by Diana Sangster.

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TABLE OF CONTENTS

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1.0 INTRODUCTION

This report is prepared following completion of the 2017 beach restoration and groin lengthening project at Edisto Beach, South Carolina. It provides a summary of the project rationale, design, and implementation. The Town of Edisto Beach sponsored the project. Nourishment was accomplished by Marinex Construction (Charleston SC). Groin extensions were completed by Crowder Construction Co (Charlotte NC). Project engineering was provided by Coastal Science & Engineering Inc (CSE – Columbia SC).

This report includes:

- Summary of the project setting, purpose, and project description.
- Summary of historical beach processes and rationale for the project.
- Project time line.
- Summary of project implementation.
- Summary of surveys and as-built conditions.
- Summary of sediment analysis.
- Summary of regulatory compliance measures.
- Project photos.
- Maintenance and monitoring recommendations.

1.1 Project At-a-Glance

Nourishment

Design quantity of 1,006,000 cy placed over 19,000 linear feet (lf) of beach:

- State Park – 200,000 cy along 3,300 lf (60.6 cubic yards per foot—cy/ft)
- Reach 1 – 410,000 cy along 6,000 lf (68.3 cy/ft)
- Reach 2 – 141,000 cy along 3,000 lf (47.0 cy/ft)
- Reach 3 – 165,000 cy along 5,100 lf (32.4 cy/ft)
- Reach 4 – 90,000 cy along 1,900 lf (47.4 cy/ft)

Nourishment Cost

$12,198,780 including $2,683,800 for mobilization and demobilization and an average of $9.46 per cubic yard.

Nourishment Schedule

- 4 January 2017 – Mobilizing equipment to the beach
- 25 January 2017 – First Pumping
- 14 April 2017 – Last Pumping
- 26 April 2017 – Demobilization Complete

Groin Construction

- 26 extensions totaling 1,630 linear ft
- 10,130 tons of armor stone
- 37,800 square feet of marine mattress
- 13 concrete caps
- 1,165 ft of composite (CMI UC95) sheet pile

Groin Cost — $5,424,642.29

Groin Construction Schedule

- December 2016 – Mobilization of Equipment
- 3 January 2017 – First Rock Work
- 12 January 2017 – First Grout Work
- 3 March 2017 – First Concrete Cap
- 7 June 2017 – Last Cap Finished
- 15 June 2017 – Crowder Demobilized

Funding Sources

• Town of Edisto Beach:	$3,000,000
• Colleton County Capital Project Sales Tax:	$4,000,000
• State of South Carolina Grant:	$6,070,843
• South Carolina Parks Recreation & Tourism:	$3,270,624
• FEMA:	$2,509,465
TOTAL	**$18,850,932**

2.0 BACKGROUND

2.1 Setting

Edisto Beach is a ~5.8-mile-long barrier island situated on the northern boundary of St. Helena Sound in South Carolina (Fig 2.1). It is bounded by Jeremy Inlet to the northeast and South Edisto River Inlet to the southwest. Edisto Beach makes up the southern half of the larger littoral system which includes Edingsville Beach and Botany Bay. The littoral system encompasses the length between the North and South Edisto Rivers, and there is a general divergence of sediment transport away from the center of the littoral cell (Fig 2.2).

FIGURE 2.1. Aerial image of Edisto Beach in October 2016 following Hurricane *Matthew*.

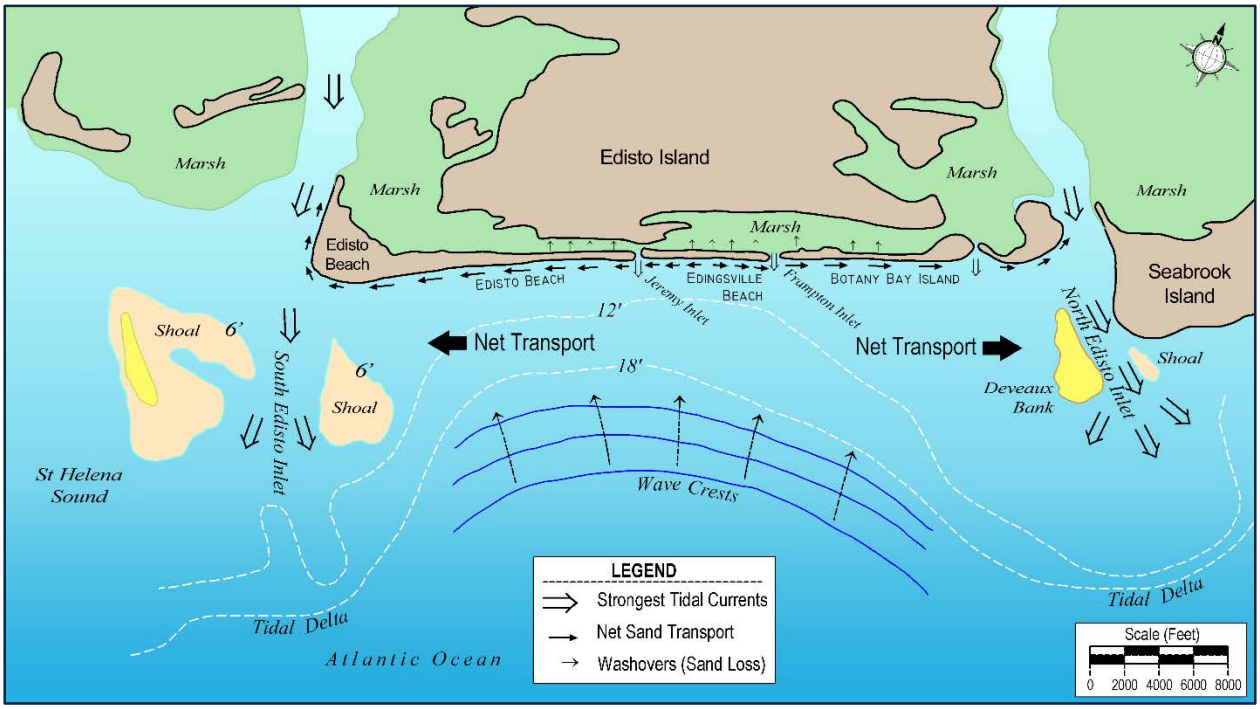


FIGURE 2.2. Schematic of sediment transport pathways at Edisto Beach (SC).

The ~1.4-mile-long portion of Edisto Beach north of Hwy 174 is maintained by the South Carolina Department of Parks, Recreation & Tourism (SCPRT) and is the site of Edisto Beach State Park. The park has designated camping areas and a day-use area with facilities. The Town of Edisto Beach is responsible for the portion of the beach south of Hwy 174 (~4.4 miles). Along most of the island, one row of houses is present seaward of Hwy 174 with relatively narrow lots separating the ocean from the highway. Along the southern end of the front beach, the island widens, accommodating two rows of ocean-side beach homes. These homes are located on Point Street, which lies between the Atlantic Ocean and Hwy 174. A network of 34 groins are in place, extending from the southern end of the state park to Ebbtide Street on the South Edisto River Inlet shoreline.

2.2 Erosion History

During the past century, depletion of the sand supply along Edingsville Beach and Botany Bay Island has left a low washover beach and exposed marsh at the seaward edge (Fig 2.3). The result is high erosion rates and insufficient downcoast movement of sand toward Edisto Beach. Edingsville Beach (just north of Edisto Beach) has been retreating at upward of 15 feet per year (ft/yr) (Stephen et al 1975, CSE 2003a). Further, the sediments being supplied to Edisto Beach tend to have a high proportion of mud and shells derived from the eroding marsh deposits.

FIGURE 2.3. Aerial image of Edingsville Beach and Botany Bay Island in April 2018. Note exposed marsh on the active beach.

By the 1950s, erosion near the Pavilion (Groin 1) on Edisto Beach reached upward of 10 ft/yr. The downcoast end of Edisto Beach (at "The Point" and along St. Helena Sound) has generally remained stable or accretional during the past century. Erosion along Edisto Beach led to construction of the first groins in 1948 near the Pavilion (Fig 2.4).

During the next decade, 17 groins were built from north to south in an attempt to halt the loss of sand, or at least to slow its southerly movement. However, erosion continued downcoast of the structures as each group of groins was built, sometimes to "The Point" where houses were washed out (CSE 2001). This prompted construction of more groins up to 1975 (Table 2.1). Groin 34 (the last one built) is situated along the South Edisto River Inlet shoreline about 3,000 ft from Big Bay Creek.

The sand-trapping capacity of individual groins impacts erosion rates along the beachfront. Gaps in deteriorating groins allow sand piping and leaking, which results in erosion within the groin cell and accretion downcoast. Conversely, when updrift groins are repaired and their trapping capacity is restored, downcoast areas may erode (unless repairs are accompanied by nourishment). Sand volumes around "The Point" area (at the southern tip of Edisto Beach) are particularly influenced by the condition of groins along the oceanfront (Kana et al 2004).

TABLE 2.1. Edisto Beach groin construction chronology. Groins are numbered from updrift to downdrift. [After Cubit 1981]

Groin #	Constructed
1	1948
2	1948
3-4	1949
5-8	1954
9-12	1953
13-17	1958
18-19	1962
20-21	1964
22-25	1969
26	1970
27-29	1972
30-33	1974
34	1975

FIGURE 2.4. Typical Edisto Beach (SC) groin prior to the 1995 repair project.

2.3 Previous Projects

In the mid-1950s, erosion near the Pavilion had progressed so far that groins alone were not sufficient to protect Palmetto Boulevard. The South Carolina Highway Department combined groin construction with the first nourishment of Edisto Beach in 1954 using sand, shells, and mud from the marsh behind the island (Fig 2.5). Excavations created the "boat basin" and reclaimed nearly 1.2 miles of shoreline between Groins 1 and 12. Although dredging volumes totaled 830,000 cy, much of the material was unsuitable for the beach, washing away quickly because it was too fine. The coarser sand and broken shells remained, adding to the accumulations of sediment derived from Edingsville Beach.

In April 1995, selected areas of Edisto Beach were nourished (a total of ~155,000 cy were placed between Groins 1 to 17 and Groins 24 to 28), and groins were repaired [CSE 1996(a,b), 1997, 1999a, 2001]. The borrow area was located ~2,500 ft off "The Point" at the southern tip of Edisto Beach and was characterized by coarse, beach-quality sand. By summer 2001 (six years after construction), roughly one-third of the nourishment volume was still present in the project area (CSE 2001). With erosion of the 1995 nourishment sand, Edisto's groins became more exposed and therefore effective for sand retention. Thus, less sand was available to downcoast areas, which was the case some years after the 1954 nourishment project as well. Between 2001 and 2006, erosion downcoast of the groin field accelerated (CSE 2003b).

The 2006 beach restoration project was necessitated by increased erosion rates in downcoast areas, insufficient protection for beachfront properties, and insufficient beach width to support dune formation and recreational beach access. The cleanup costs of frequent washovers onto Palmetto Boulevard, along with the possibility of decreased tax revenues due to loss of properties and tourist revenues, were among the factors that led the Town Council to pursue the project.

FIGURE 2.5. Aerial image (1954) of Edisto Beach showing the first restoration project. The dredge is visible in the marsh.

Nourishment was considered the only viable alternative allowed under the South Carolina Beach Management Act to improve beach conditions, given an inadequate natural supply of sand from Edingsville Beach.

Low sand volumes before 2006 nourishment provided little or no recreational high-tide beach and little storm protection to numerous properties. Whereas in 1995, a relatively small nourishment quantity was required to satisfy trapping of the groins after repairs, the 2006 project involved nourishment volumes that greatly exceeded the trapping capacity of the groins.

Engineered by CSE, the project was constructed between March and May of 2006 by Great Lakes Dredge & Dock Company (GLDD) of Oakbrook (IL). The length of the project area was 18,258 linear feet, including 3,200 linear feet in the state park area. Fill volumes varied along the beach with the goal of achieving a standard, minimum profile volume of at least 100 cy/ft (+9 ft to −7 ft NGVD'29) for the length of the project area. Average design fill volumes were 20–70 cy/ft. The greatest volumes were added to the park and updrift areas in anticipation of sand moving south.

The total measured volume of sand added during the 2006 restoration was 922,000* cy, of which 325,775 cy (24.6 percent) were placed along the park (north of Groin 1) and 694,900 cy (75.4 percent) were placed along the Town (between Groins 1 and 27) (CSE 2006). The contract volume of 850,000 cy was exceeded; however, the excess sand was not a pay quantity as per terms of the contract.

*[*Note that volumes reported here differ from prior reports due to adjustments in the volume calculation limits.*]

The final cost of the project was $7,697,500, of which $1,960,000 (25.5 percent) covered mobilization and demobilization. The Town of Edisto Beach and SCPRT sponsored the project with a combination of local, county, and state funds. Details of the restoration project and nourishment volumes are given in the 2006 project final report (CSE 2006).

2.4 2006 Project Performance

The Town of Edisto Beach has sponsored annual beach monitoring every year since completion of the 2006 project. CSE established or reoccupied over 85 monitoring stations between Jeremy Inlet and Big Bay Creek. Additional surveys were completed of the channel at Big Bay Creek to monitor potential infilling of the channel. Surveys include stations along the state park, three stations for each groin cell between cells 1 and 22, and 2 profiles per cell between cells 23 and 28. Stations along the South Edisto River correspond to previously established OCRM monitoring stations. Figure 2.6 shows the monitoring stations and monitoring reaches, which are used to generalize beach changes into larger areas.

Annual volume changes in the 2006 project area ranged from −8.2 cubic yards per foot per year (cy/ft/yr) to +0.9 cy/ft/yr with an average annual loss of 3.0 cy/ft/yr between August 2006 and December 2016. This includes the impacts of Hurricanes *Joaquin* and *Matthew* in 2015 and 2016 (respectively). Generally, the northern end of the island was more erosional, losing an average of 3.3–3.6 cy/ft/yr along the campground and Reaches 1 and 2 (100–1100 blocks). Reaches 3 and 4 lost 2.4 cy/ft and 1.3 cy/ft (respectively), while the downcoast reaches along St. Helena Sound were stable or accretional. Including the non-nourished areas, all of Edisto beach lost an average of 1.8 cy/ft/yr of sand between 2006 and 2016. Overall, the project reaches lost 583,900 cy of the 922,000 cy gained in the 2006 project, which equals 63.3 percent. Approximately 37 percent of the sand placed in 2006 remained in the project area as of December 2016.

Figure 2.7 shows beach unit volumes for each reach and for the project areas and entire island between 2006 and 2017. The beach volume increase due to the 2006 nourishment is visible in the volume difference between November 2005 (pink) and August 2006 (orange) bars. The 2017 nourishment is shown by the increase between the December 2016 (blue) and April 2017 (yellow) bars.

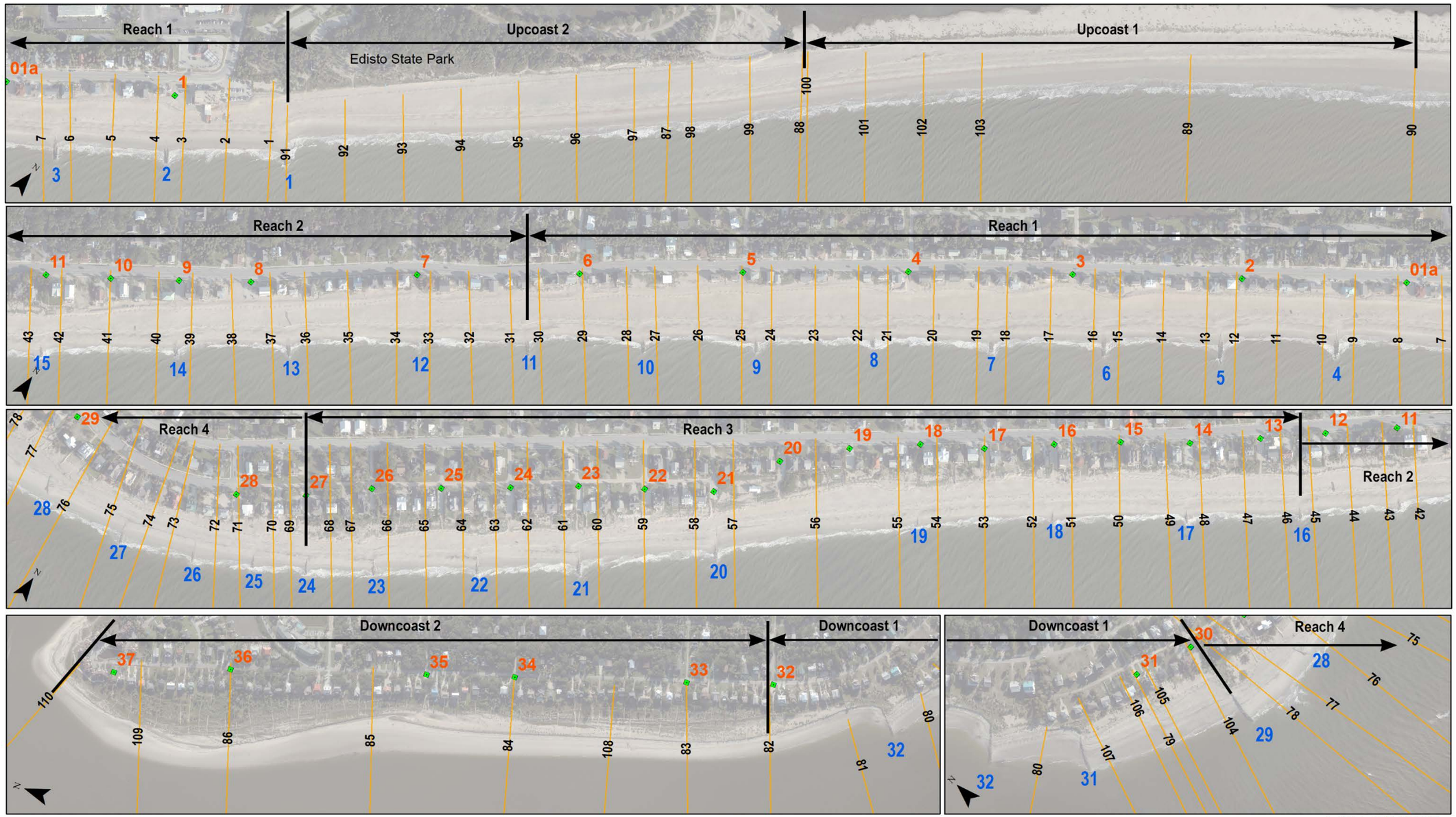


FIGURE 2.6. Map panels showing monitoring reaches (arrows), beach profile stations (black numbers), groins (blue numbers), and beach access points (red numbers) at Edisto Beach.

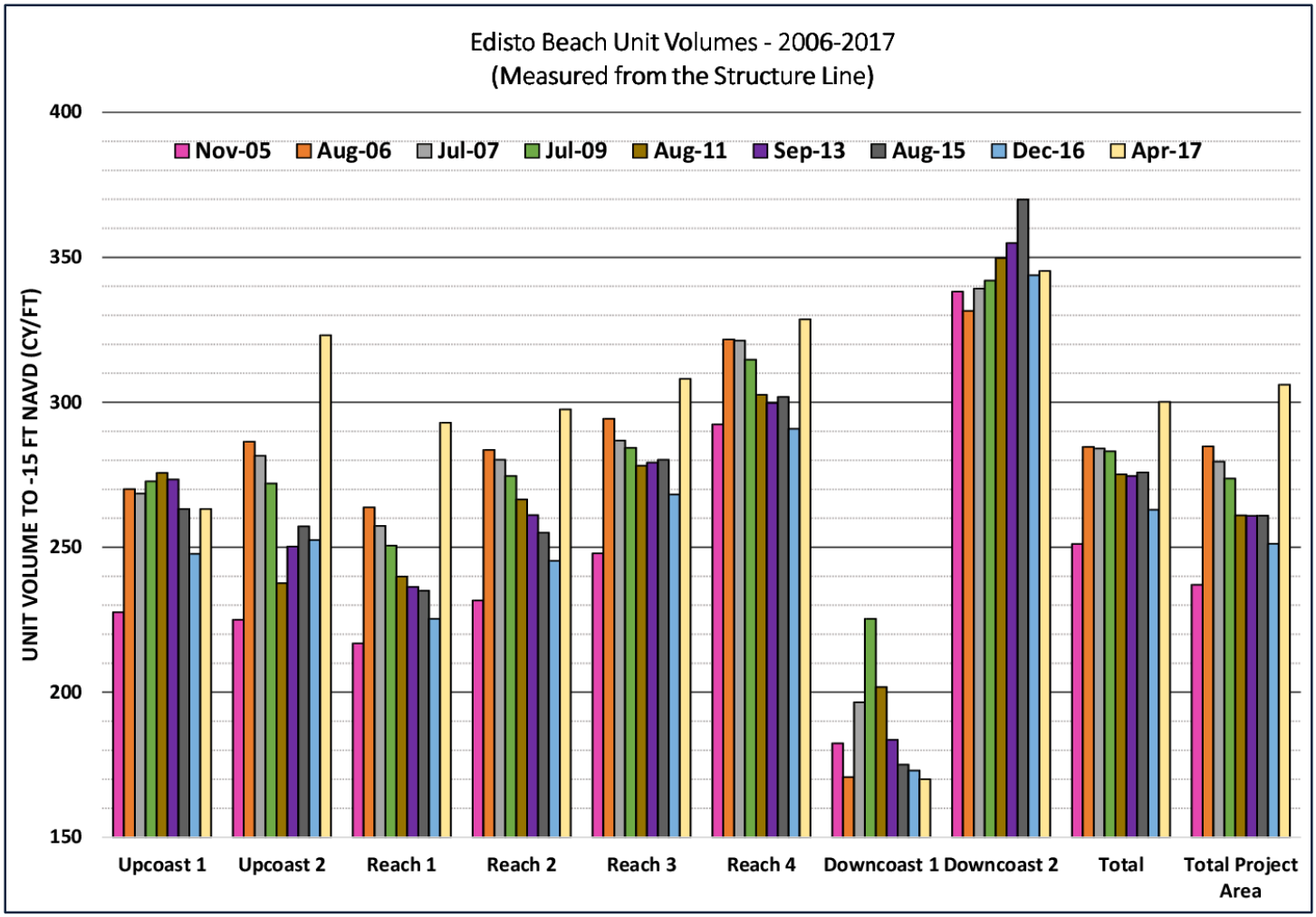


FIGURE 2.7. Unit volumes for each monitoring reach since 2005 at Edisto Beach. Impacts of the 2006 and 2017 nourishment projects are visible. Volumes are measured from the structure line to −15 ft NAVD.

Figure 2.8 shows the total island volume from 2005 to 2017 and includes a projection of the theoretical volume if 10 percent (85,000 cy) of the 2006 nourishment project was lost each year (forecast of a 10-year design life). The chart shows that for the first five years, the project was tracking fairly well with the 10-year projection. The next five years showed less erosion, and the actual beach volume within the project area was 350,000 cy above the 10-year projection by August 2016.

Photos of the beach condition near the 100 block before and after the 2006 project are shown in Figure 2.9 as well as the 2016 pre- and post-*Matthew* conditions. Immediately following nourishment, the majority of the groins were mostly buried by sand. Initial adjustment of the profile led to more exposure of the structures, and over time, additional sand losses resulted in significant exposure of each groin (typically 4–6 ft high). Aerial images show that the first several groin cells had little-to-no vegetative buffer between the houses and the high-tide line by the time Hurricane *Matthew* hit in October 2016. Little dune also existed near the point (cells 25–28).

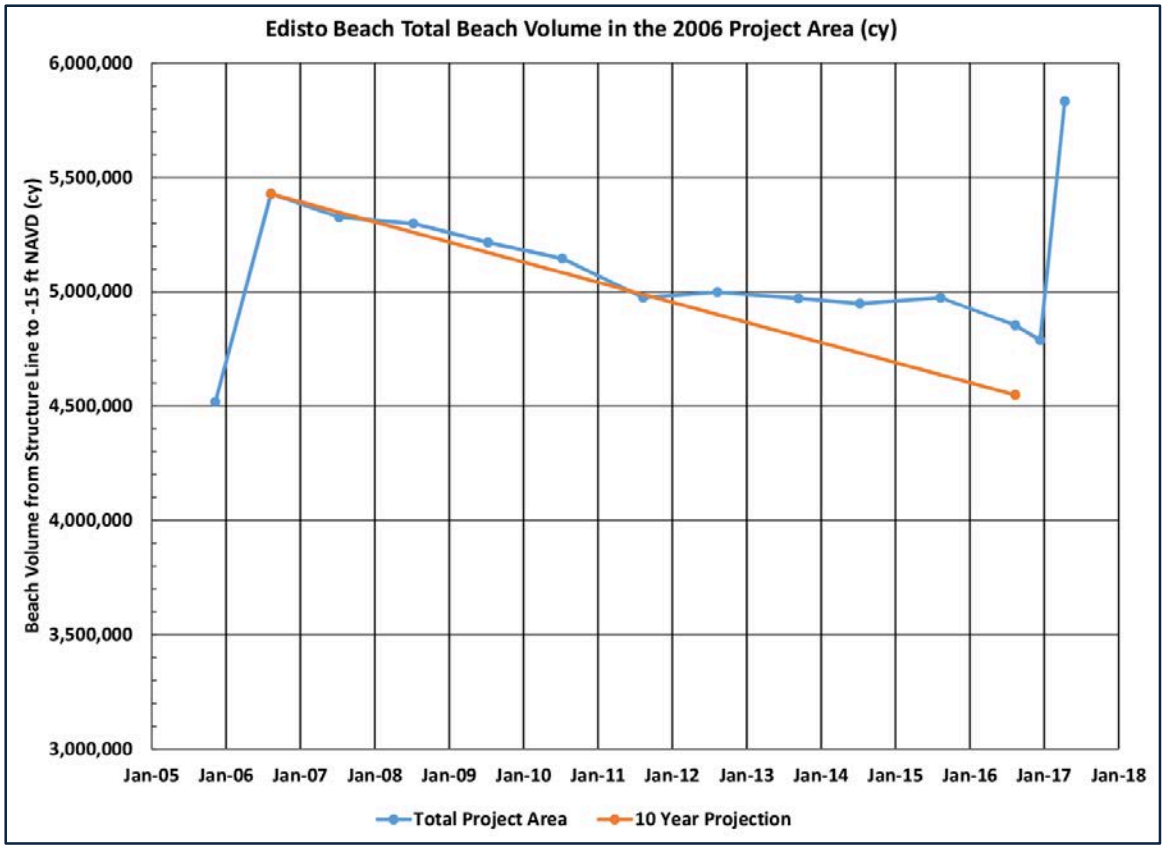


FIGURE 2.8. Total beach volumes for the 2006 project area, showing the gradual loss of sand and comparison to a "10-year" project life scenario. Note that the erosion rate followed the ten-year projection through 2011, then slowed through 2016.

FIGURE 2.9. Image of the beach in the 100 block before (top left) and after (top right) the 2006 project. The middle left and right photos show the same locations in 2016 before and after Hurricane *Matthew*. The aerial photos show the beach after the 2006 project (lower left) and after Hurricane *Matthew* in October 2016 (lower right).

2.5 Project Planning

Following the 2006 nourishment project, the Town of Edisto Beach anticipated the need for another project around 2016. The Town accumulated local funds each year to build a reserve for the next project. Planning for the project began in 2012 with the initiation of a groin-lengthening study by CSE. Following this study, the Town and CSE initiated Phase 1 work which involved preliminary design of the nourishment fill and groin extensions as well as preparation of permit applications, drawings, and environmental assessment reports. Where possible, CSE utilized work completed by the US Army Corps of Engineers (USACE) for the federal storm-damage reduction project feasibility report. Specific studies generated in the planning and execution of the project include:

- CSE 2013b – Assessment of the Groin Field and Conceptual Plan for Groin Lengthening – Edisto Beach, South Carolina, 51 pp.
- TAR 2016 – Submerged Cultural Resource Remote-Sensing Survey of a Proposed Borrow Site off Edisto Island, South Carolina, 26 pp.

Additionally, a supplement to the USACE (2013) environmental assessment was completed to facilitate Section 7 consultation for the Town project.

The beach restoration and groin construction project had several objectives, including:

- Restoring a recreational beach.
- Restoring protective dunes.
- Restoring sea-turtle nesting habitat.
- Extending longevity of nourishment sand and increasing the renourishment interval.
- Protecting park infrastructure and maintaining revenues dependent on park attendance.

2.5.1 Groin Extensions

2.5.1.1 Length Analysis

Lengthening of certain groins was incorporated into the project for the primary reason of maintaining an adequate berm width to support the protective dune and beach, which aid in storm damage reduction. Essentially, several of the groins are too short to hold a beach that can withstand seasonal fluctuations in the shoreline position. The rationale and methods for the USACE groin-lengthening plan are provided in the USACE feasibility study (Section 9 of Appendix A in USACE 2013).

CSE completed an independent, groin-lengthening feasibility study in 2013 (CSE 2013a,b), obtaining two alternatives for lengthening. One alternative was based on an ideal beach profile (similar in nature to the USACE method, but using a more substantial beach profile), while the other was based on comparison of the widths of vegetated areas and existing groin conditions (Fig 2.10).

The applicant also received input from local citizens and the Town's Beachfront Management Committee. Results of the above-referenced studies were compiled into a proposed groin lengthening plan, which called for extension of up to 26 groins at a cumulative total of up to 1,765 linear feet. The maximum extension for a single groin would be limited to 100 ft. CSE recommended that a minimum extension be considered for any groin to justify the expense of mobilizing equipment and material to any structure.

The original groins were built by South Carolina Department of Transportation (SCDOT) and were constructed solely of timber with a typical slope of ~1 on 50. Deterioration of the timber led to the addition of armor stone and, in some cases, overall shortening of some groins. A 1995 project (P/N 94-1T-009-P) restacked loose stone and added grout in the void spaces to make a monolithic structure, but did not lengthen the groins. The extension design attempted to adjust the profile of the groins to match modern design guidelines, which include a beach-face section sloping to match the native beach and horizontal low-tide-terrace section (Figs 2.11–12). The slope of the extension was determined by the length of each extension and the existing profile of each groin, seeking to match the native beach to the maximum extent practicable (generally 1 on 15 to 1 on 20). The final lengths for the extended groins as constructed were 1,630 ft. Table 2.2 shows the final constructed extension length and material for each groin.

Per state regulations, enough sand to meet or exceed the trapping capacity of each extension had to be placed into the updrift (north) groin cell of any lengthened groin. Trapping capacity was determined by applying the Brunn (1952) Rule to each extension and assuming a triangular fillet extending four times the length of the extension. This method was based on recent observations at Hunting Island (SC) (Traynum et al 2010) and Folly Beach (SC) and is considered conservative (requiring more sand) as it assumes a 1 to 1 ratio of groin lengthening to increased berm width. For the maximum 100-ft individual groin lengthening, ~15,500 cy of sand are required in each applicable cell to meet the trapping capacity of the extension. If all groins are lengthened the maximum distance, the total trapping volume is ~221,000 cy.

Prior to the project, Groins 29–32 consisted of loose armor stone without grout or timber. This allowed sand to pass through the structure and resulted in slumping of the stone at Groin 29. As part of the project, the Town planned to restacked stone at Groin 29 so that the slope of the groin matched the natural slope of the beach in the area.

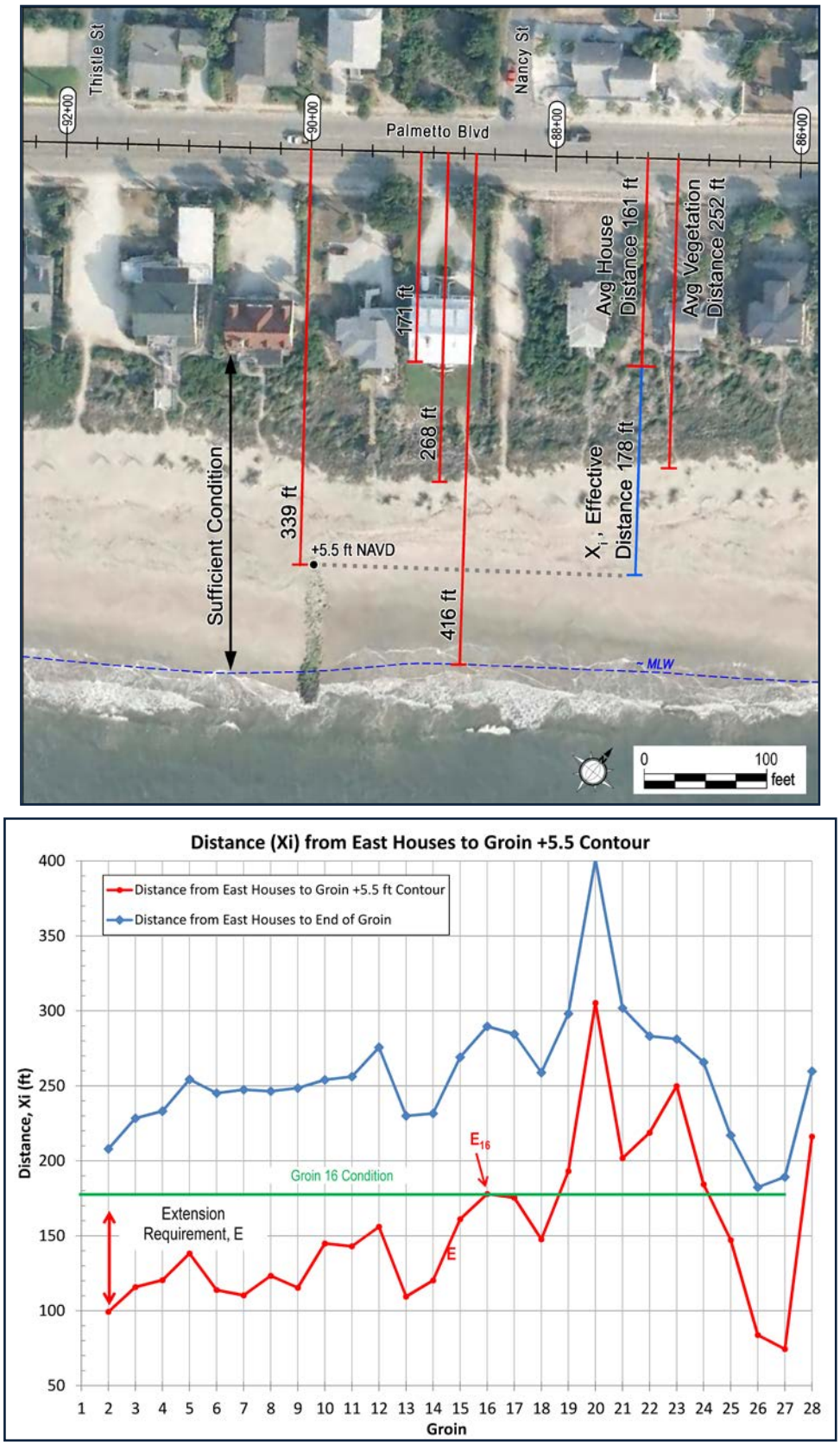
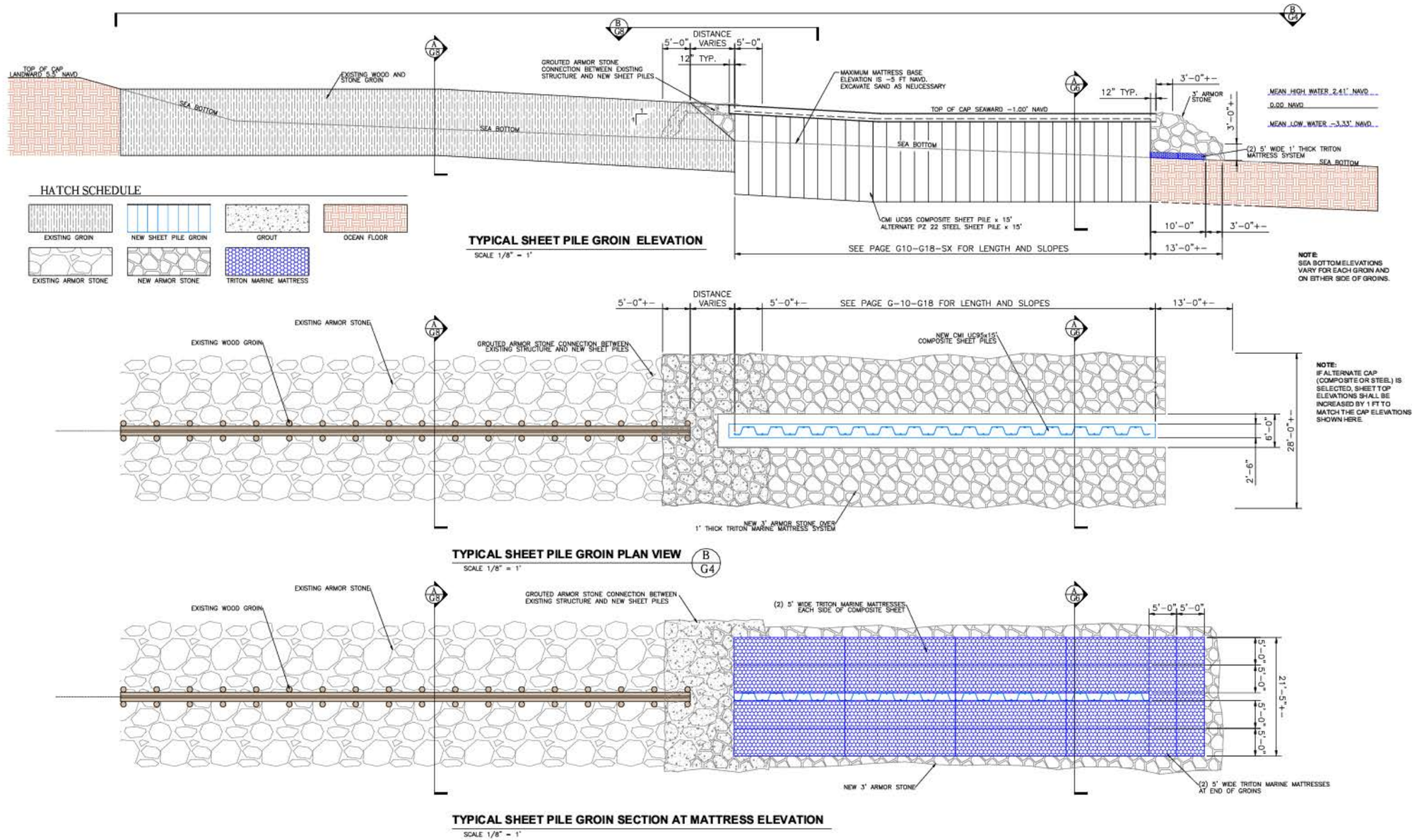


FIGURE 2.10. CSE's groin-lengthening plan was based on the condition of the beach across the island, comparing an "ideal" area at Groin 16 to other areas.

TABLE 2.2. Final constructed extension lengths and materials for the groins.

Groin No.	Estimated Maximum Extension (ft)	Extended By Sheetpile	Extended By Armor Stone
1	90	✔	
2	85	✔	
3	90	✔	
4	90	✔	
5	100	✔	
6	100	✔	
7	90	✔	
8	90	✔	
9	95	✔	
10	95	✔	
11	95	✔	
12	45		✔
13	80	✔	
14	65	✔	
15	40		✔
16	20		✔
17	20		✔
18	40		✔
19	0		
20	40		✔
21	30		✔
22	30		✔
23	30		✔
24	30		✔
25	40		✔
26	50		✔
27	50		✔
28	0		
Total	1,630	1,165	465



NOTES:

FIGURE 2.11. Typical sheet-pile groin extension.

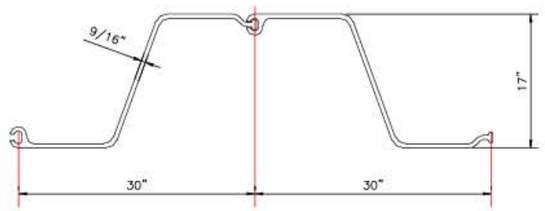
CLIENT:
Town of Edisto Beach
2414 Murray St
Edisto Island, SC 29438

PROJECT:
EDISTO BEACH
GROIN LENGTHENING PROJECT

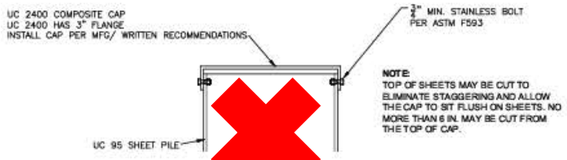
DRAWING TITLE:
TYPICAL GROIN EXTENSION

SCALE: AS SHOWN
DATE: 19 Sep 2016
DRAWN BY: JC
APPROVED BY: MR
PROJECT #: 2416

SHEET NO: **G6**



UC 95 COMPOSITE SHEET PILE PROFILE
SCALE 1 1/2" = 1'



UC95 COMPOSITE CAP DETAIL B G6
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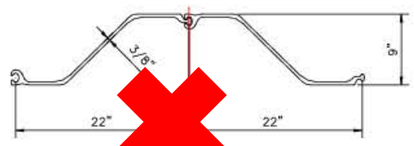

PZ22 STEEL SHEET PILE PROFILE
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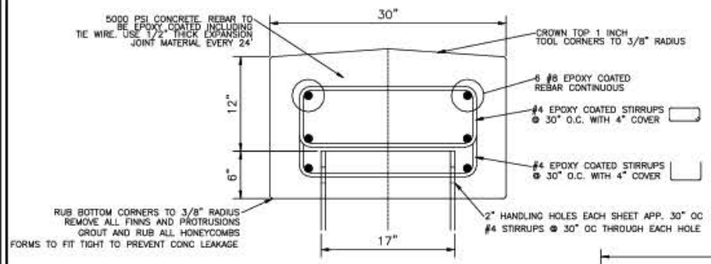

UC95 CONCRETE CAP DETAIL B G6
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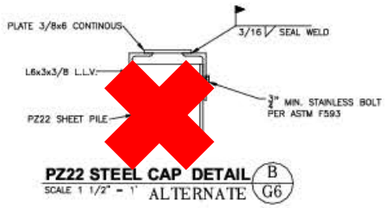

PZ22 STEEL CAP DETAIL B G6
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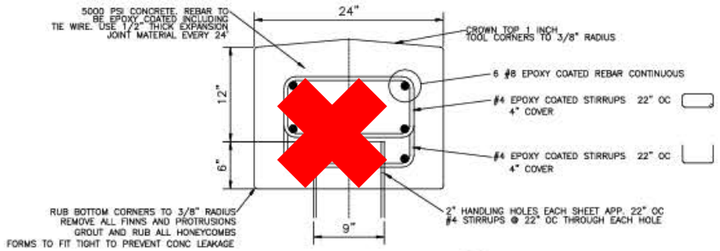

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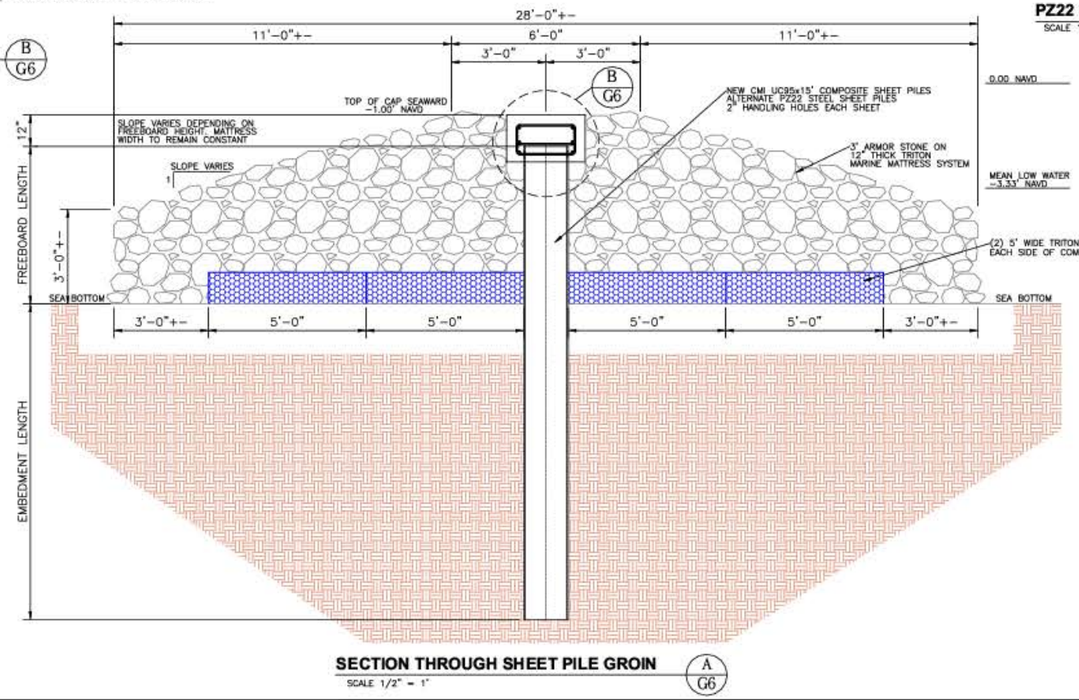


SECTION THROUGH SHEET PILE GROIN A G6
SCALE 1/2" = 1'

NOTE:
THE MAXIMUM ELEVATION OF THE BASE OF THE MATTRESS LAYER IS -5 FT NAVD. IF SAND LEVEL IS HIGHER THAN -5 FT NAVD, THE CONTRACTOR SHALL EXCAVATE SUFFICIENT SAND TO PLACE THE MATTRESS AT -5 FT NAVD. ONCE THE SEABED REACHES ELEVATIONS LOWER THAN -5 FT, THE MATTRESS CAN REST ON THE SEAFLOOR FOLLOWING THE EXISTING CONTOURS. SAND LEVELS WILL VARY ON EITHER SIDE OF THE GROINS AND WITH NOURISHMENT PROGRESS.

CONTRACTOR MAY UTILIZE EXISTING SAND NEAR EACH GROIN AS NECESSARY TO FACILITATE CONSTRUCTION (INCLUDING CREATING TEMPORARY BERMS).

CONTRACTOR SHALL ASSUME SOME WORK MAY BE IN THE WATER FOR PORTIONS OR ALL OF A TIDAL CYCLE. NOURISHMENT ALONG THE GROIN FIELD WILL BE COMPLETE BY 27 JANUARY 2017.

NOTES:

FIGURE 2.12. Groin cap details.

CLIENT:
Town of Edisto Beach
2414 Murray St
Edisto Island, SC 29438

PROJECT:
EDISTO BEACH
GROIN LENGTHENING PROJECT

DRAWING TITLE:
GROIN CAP DETAILS

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 24737 — 4/19/16

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 9934 GEORGE MICHAEL MORTE

SCALE:	AS SHOWN
DATE:	19 Sep 2016
DRAWN BY:	JC
APPROVED BY:	MR
PROJECT #	2416

SHEET NO: **G8**

2.5.1.2 Materials and Design

The groins were constructed using fiberglass-reinforced vinyl composite sheet pile, marine mattresses, armor stone, and concrete (see Figs 2.11–2.12). Groin extensions exceeding 60 ft were constructed using sheet pile with concrete caps and armor stone. Groin extensions of less than 60 ft were constructed using stone only; however, concrete grout was added to these groins.

The Town received bids for steel and composite sheet pile, electing to use the composite sheets for increased longevity and reduced maintenance of the piles (Fig 2.13). The sheets were model UC–95 from Crane Materials International (Atlanta GA). Each sheet was 20 ft long with a 17-inch width and 30-inch longitudinal run (meaning each pair of sheets creates a 60-inch length of wall). The sheeting is 9/16-inch-thick, fiberglass-infused vinyl that will not rust as steel sheets are prone to do. Sheets are connected via integrated channel locks running the vertical length of each sheet.

FIGURE 2.13. Staging of UC95 composite sheet piles.

Sheet piles were capped with a reinforced poured concrete cap. The design called for a 30-inch-wide by 18-inch-deep cap to cover at least the top 6 inches of each sheet. Concrete would be poured in sections up to 40 ft in length with expansion joints between sections. Six lengths of rebar ran the length of the cap, and stirrups were spaced 30 inches on center and running through handling holes of the sheets. The top of the concrete cap was crowned to improve water runoff.

South Carolina Department of Transportation (SCDOT) Class F armor stone would serve as scour protection for sheet-pile groins and would serve as the main sand-trapping component of the shorter groins when coupled with grout. Stone would generally be no larger than 3 ft along the longest axis. The stone design included a 3-ft crest width extending on either side of the cap and a slope extending a total of 13 ft on either side of the sheets. With a relatively low freeboard height and large stone sizes, the slope would be fairly insignificant along most of the stone width. Stone would also extend 13 ft past the seaward end of the sheet pile in a similar configuration.

The design called for armor stone to be placed on 1-ft-thick marine mattresses manufactured by Tensar®. The mattresses are made of a heavy-duty plastic grid woven together with UV-resistant polyrope. Mattresses would be filled with granite stone between 2 inches and 6 inches in diameter. Each mattress section is 5 ft wide and of a variable length.

2.5.2 Nourishment

2.5.2.1 Slope / Berm / Dune

The design for the nourishment portion of the project followed similar parameters as the 2006 project. The design berm elevation was set at +7 ft NAVD, similar to the natural berm elevation during normal tides. Following the 2006 project, the berm elevation increased naturally due to sand washing over the berm. CSE elected to maintain the elevation to allow this process to continue as, over time, it provides a more natural looking berm. The design berm widths ranged from 55 ft to 165 ft, generally increasing from south to north. The seaward slope of the fill was set at 1 on 10 based on the pre-project beach slope and expected grain-size distribution of the borrow material; however, the contractor was allowed to adjust the slope during construction to account for variation in sediment characteristics in the borrow area. A typical design section from Reach 1 is shown in Figure 2.14.

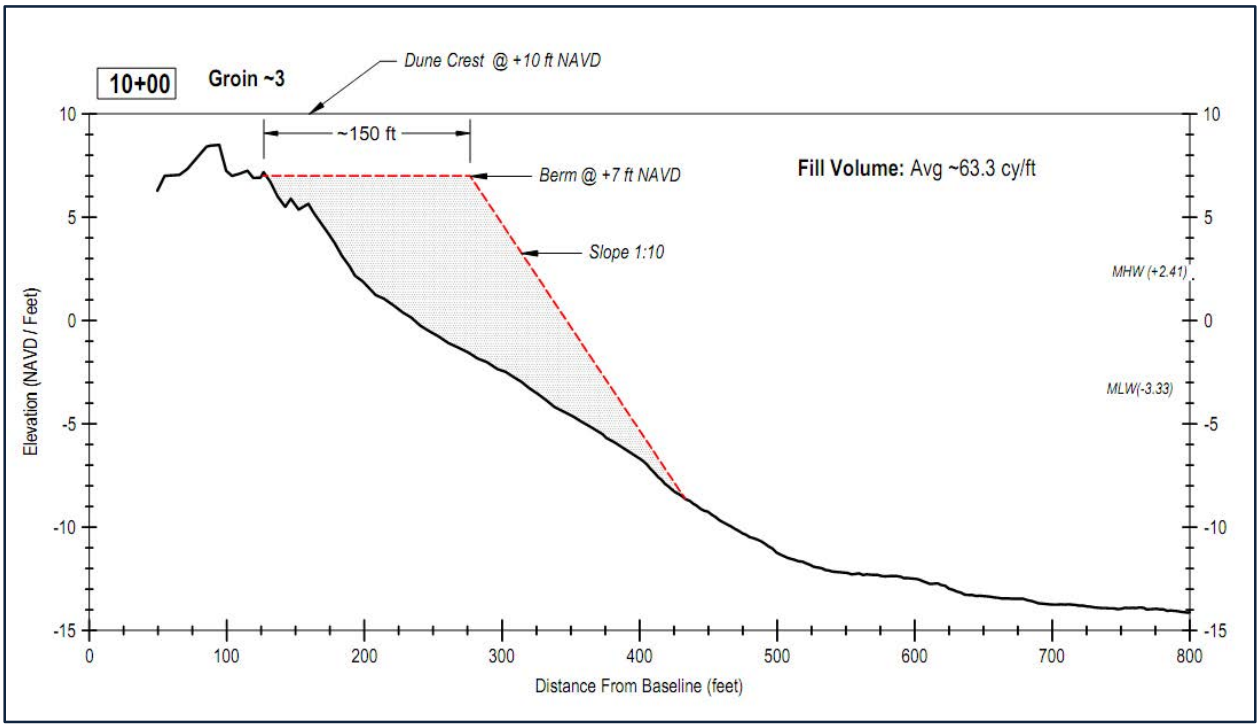


FIGURE 2.14. Typical nourishment design fill section in Reach 1. Note the dune placement is not indicated on the graphic. The contractor worked onsite with CSE to determine the best dune placement as the project progressed.

2.5.2.2 Fill Schedule

The nourishment fill schedule was determined by evaluating the existing condition of the beach and expected erosion rates for the post-project beach. As per state regulations, the fill quantities needed to ensure the trapping capacity of each groin were included in the fill design. Nourishment quantities were generated for each groin cell based on the volume of sand seaward of the structure line prior to construction. The structure line represents an average position of the seaward side of beachfront structures. Individual houses may lie landward or seaward of this line.

Figure 2.15 shows the pre-project beach volumes for each reach (blue bars) and the design nourishment fill quantity (red bars). The graphic highlights the lower beach volume in Reach 1 and Reach 2, which were both below 250 cy/ft. (See Figure 2.6 for reach limits.) The fill design accounted for the variation in existing sand volume by placing more fill in areas with less volume. Reach 4 was an exception due to the desire to have additional sand available to feed downcoast beaches. The design attempted to work within the available project budget to provide a fairly even post-project beach volume. The final design called for between 33 cy/ft and 68 cy/ft of sand to be added to each reach, which would result in each reach holding ~300 cy/ft or more sand volume. Excess sand placed in the state park and in Reach 4 would help account for "end losses," which occur in all nourishment projects as sand shifts more rapidly from the nourished to non-nourished areas.

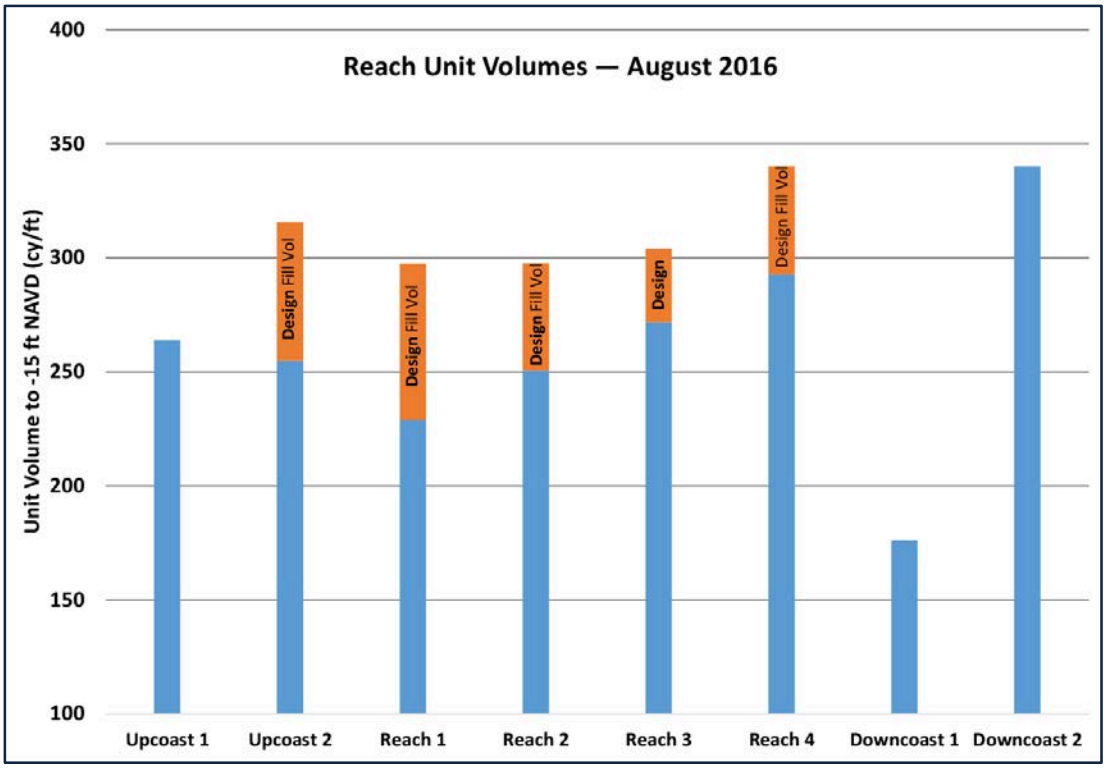


FIGURE 2.15. Pre-project and design fill volumes for the 2017 nourishment project at Edisto Beach.

Within each groin cell, the fill template would be adjusted to the site conditions at the time of the project to produce a straight seaward edge of the fill berm. Since the groins typically produce a fillet on the south side of each groin cell in the winter, more fill would be needed on the north side to produce a consistent final beach width.

2.5.2.3 Borrow Area

For planning purposes, CSE sought to identify a borrow area containing at least 1.5 million cubic yards of beach-compatible material. Providing excess material in the designated borrow areas allows the contractor to account for handling losses and relocate to other areas if unsuitable material is encountered. CSE utilized data collected as part of the federal feasibility study (USACE 2013) to identify a potential borrow area for the USACE project (Fig 2.16). That project included collection of ~100 borings and collection of detailed bathymetry stretching from Otter Island to Deveaux Bank. CSE provided the data to the USACE for development of a borrow area holding sufficient sand volume for a 50-year federal project. The level of coverage was intended to provide a general assessment of sediment resources; however, it was not sufficient for final design purposes.

For the final design of the locally funded project, CSE obtained an additional ~25 borings at the northwestern end of the USACE search area. Figure 2.17 shows the location of the final borrow areas identified for the project. Borrow Area A and the western portion of Area B were the original primary borrow areas identified; however, between initial the survey completed in 2014 and another survey in 2016, the area northeast of Area B (portion of the 2006 borrow area) infilled substantially with clean beach-compatible sand. A permit modification was obtained to allow this area to be included in the 2017 project.

CSE sampled each boring to determine the grain size distribution of the sediment and the amount of shell material present. The borrow areas were determined based on these sediment characteristics, as well as consideration of the sediment color. Figure 2.18 is an example core log showing the typical data utilized for confirming suitable borrow material. The final borrow areas were drawn around a group of 17 borings (Borrow Area A) and 12 borings (Borrow Area B) located landward (northwest) of the USACE-identified borrow area (see Fig 2.17). Table 2.3 provides the sediment characteristics for the borrow areas. Borrow Area A showed a mean grain size of 0.719 millimeters (mm) with 31 percent shell content. Borrow Area B contained finer sand with an average grain size of 0.656 mm and 26.7 percent shell content. These averages were skewed by a few borings, which showed a higher average grain size due to higher shell concentrations.

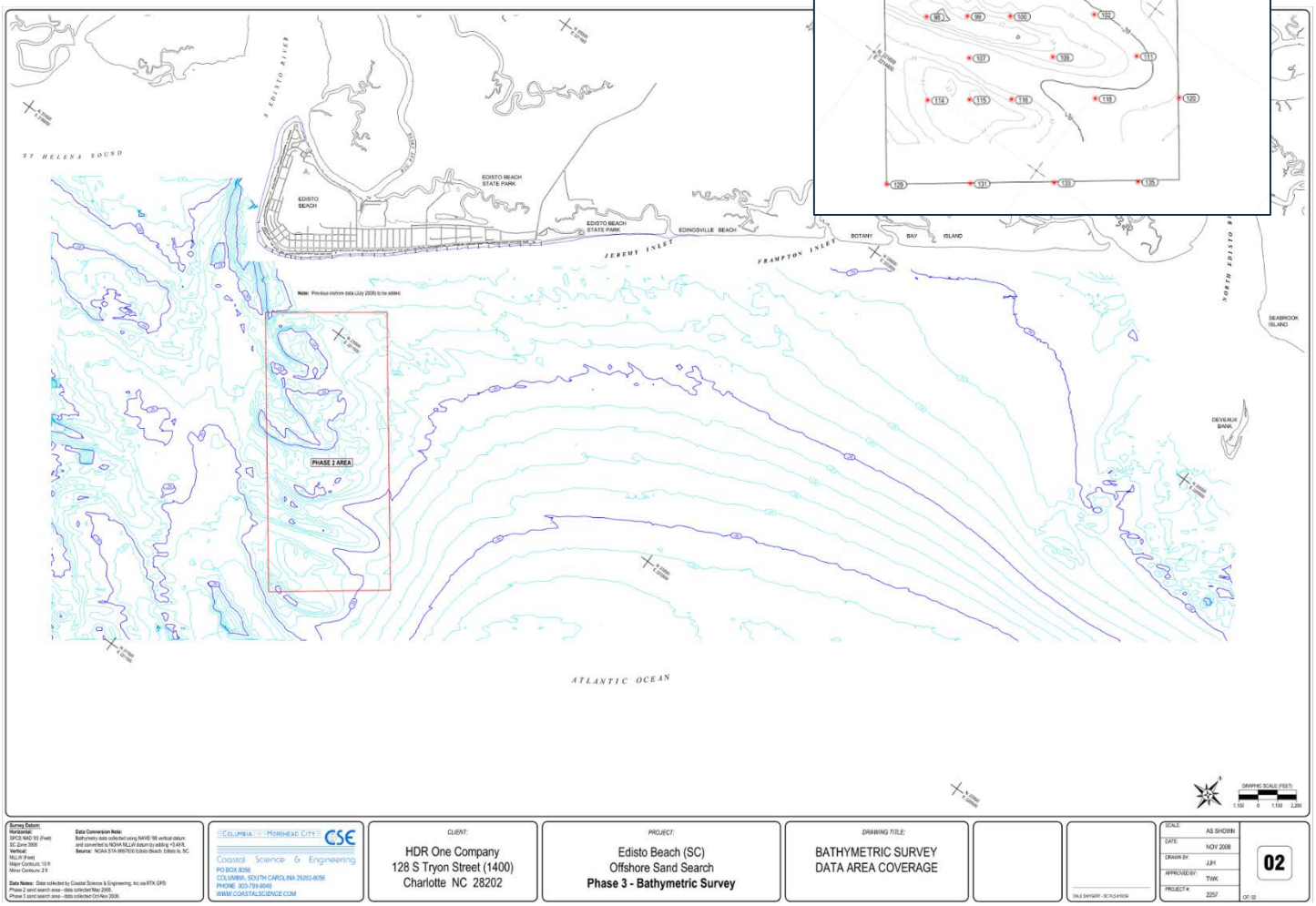
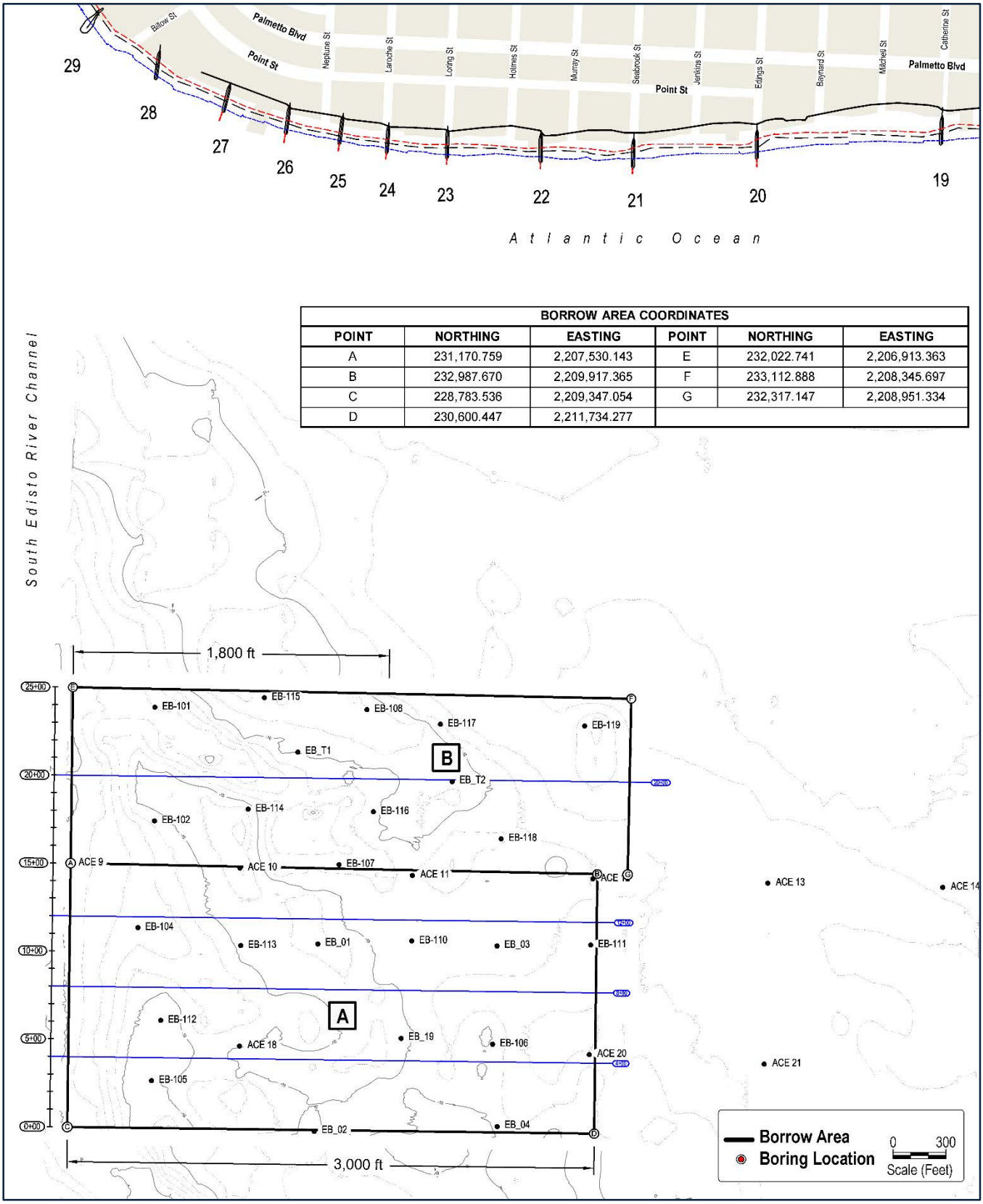


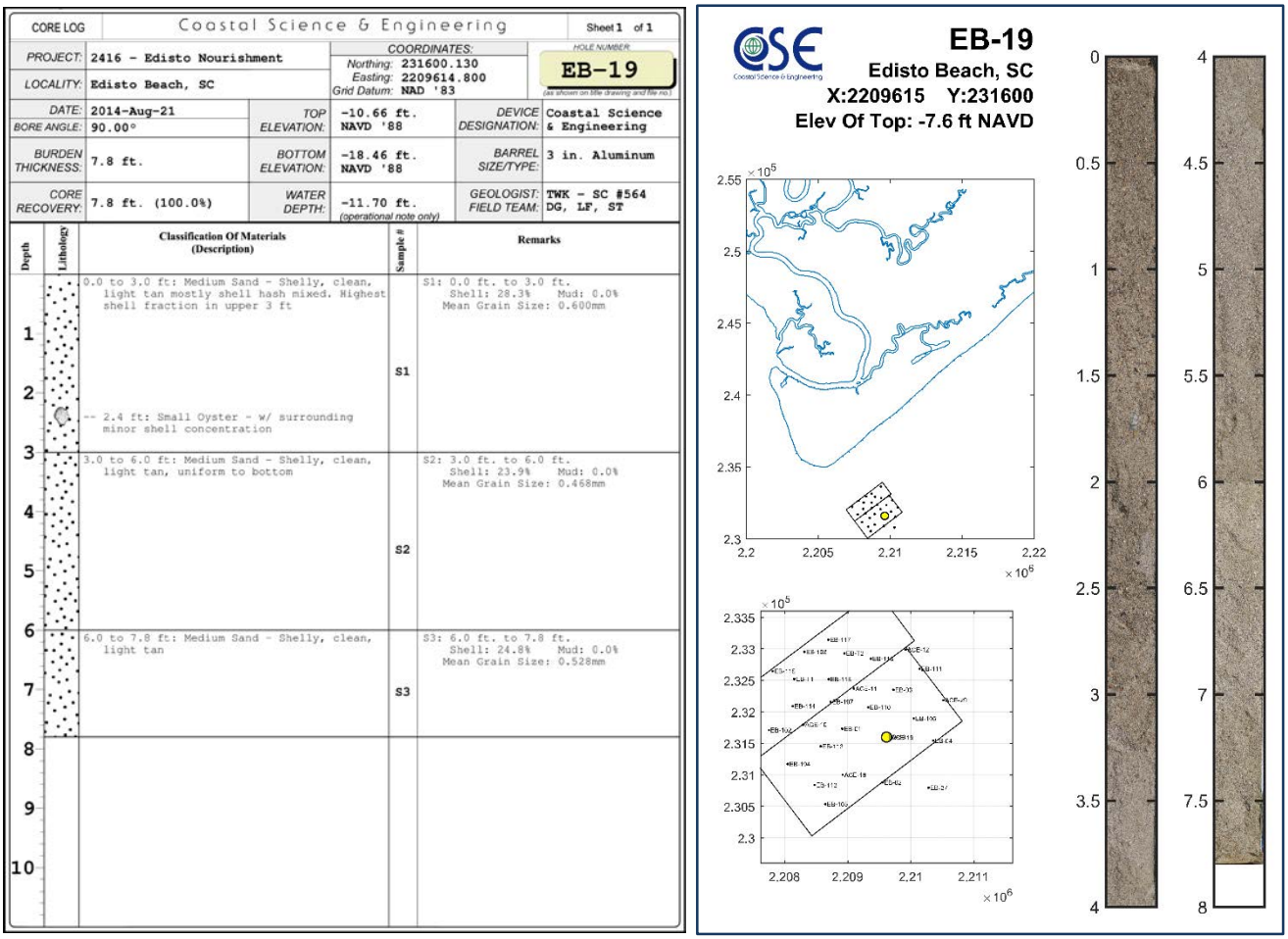
FIGURE 2.16.

Bathymetric map (lower) and boring location map (right) produced as part of the geotechnical investigations for the USACE (2013) federal feasibility study.



BORROW AREA COORDINATES					
POINT	NORTHING	EASTING	POINT	NORTHING	EASTING
A	231,170.759	2,207,530.143	E	232,022.741	2,206,913.363
B	232,987.670	2,209,917.365	F	233,112.888	2,208,345.697
C	228,783.536	2,209,347.054	G	232,317.147	2,208,951.334
D	230,600.447	2,211,734.277			

FIGURE 2.17. Map showing boring locations and borrow area limits for the 2017 project at Edisto Beach. Borrow Area B was also used in 2006 and has infilled with beach-compatible sand.



CORE LOG — Coastal Science & Engineering — Sheet 1 of 1

PROJECT:	2416 – Edisto Nourishment	COORDINATES:		HOLE NUMBER:	EB-19
LOCALITY:	Edisto Beach, SC	Northing: 231600.130 Easting: 2209614.800 Grid Datum: NAD '83			(as shown on title drawing and file no.)
DATE:	2014-Aug-21	TOP ELEVATION:	-10.66 ft. NAVD '88	DEVICE DESIGNATION:	Coastal Science & Engineering
BORE ANGLE:	90.00°				
BURDEN THICKNESS:	7.8 ft.	BOTTOM ELEVATION:	-18.46 ft. NAVD '88	BARREL SIZE/TYPE:	3 in. Aluminum
CORE RECOVERY:	7.8 ft. (100.0%)	WATER DEPTH:	-11.70 ft. (operational note only)	GEOLOGIST: FIELD TEAM:	TWK – SC #564 DG, LF, ST

Depth	Lithology	Classification Of Materials (Description)	Sample #	Remarks
1–2		0.0 to 3.0 ft: Medium Sand - Shelly, clean, light tan mostly shell hash mixed. Highest shell fraction in upper 3 ft -- 2.4 ft: Small Oyster - w/ surrounding minor shell concentration	S1	S1: 0.0 ft. to 3.0 ft. Shell: 28.3% Mud: 0.0% Mean Grain Size: 0.600mm
3–5		3.0 to 6.0 ft: Medium Sand - Shelly, clean, light tan, uniform to bottom	S2	S2: 3.0 ft. to 6.0 ft. Shell: 23.9% Mud: 0.0% Mean Grain Size: 0.468mm
6–7		6.0 to 7.8 ft: Medium Sand - Shelly, clean, light tan	S3	S3: 6.0 ft. to 7.8 ft. Shell: 24.8% Mud: 0.0% Mean Grain Size: 0.528mm
8–10				

FIGURE 2.18. Example boring log showing the sediment characteristics of a portion of the borrow areas. Data like these were used to identify the borrow areas for the project.

TABLE 2.3. Borrow area sediment characteristics. Gravel is considered any sediment/shell greater than 2 mm in size.

		Mean Grain Size	STD	Shell	Gravel
Sample	Interval	mm		%	%
EB-1-1	Composite	1.510	0.366	53.9	34.4
EB-2-1	Composite	0.239	0.583	10.0	2.0
EB-3-1	Composite	0.475	0.324	28.9	11.0
EB-4-1	Composite	0.584	0.257	15.3	23.4
EB-19-1	Composite	0.600	0.491	25.8	5.6
EB-104	Composite	0.854	0.392	32.9	16.8
EB-105	Composite	1.226	0.495	26.3	20.7
EB-106	Composite	0.225	0.526	20.7	1.5
EB-110	Composite	0.447	0.410	45.4	5.9
EB-111	Composite	0.617	0.291	28.0	18.2
EB-112	Composite	1.077	0.458	58.0	20.2
EB-113	Composite	0.779	0.531	26.6	7.7
EB-101	Composite	0.919	0.315	9.3	24.6
EB-102	Composite	0.953	0.498	50.4	18.6
EB-107	Composite	0.759	0.516	33.8	7.7
EB-108	Composite	0.258	0.500	9.5	2.8
EB-114	Composite	1.110	0.488	48.9	18.1
EB-115	Composite	0.299	0.592	8.0	0.7
EB-116	Composite	1.136	0.425	24.2	22.6
EB-117	Composite	0.213	0.583	27.4	1.4
EB-118	Composite	0.399	0.466	23.5	4.4
EB-119	Composite	0.657	0.596	27.1	3.8
T-101-1	Composite	1.006	0.395	36.5	21.0
T-102-1	Composite	0.160	0.750	22.1	0.1
Borrow Area A	Average	**0.719**	**0.427**	**31.0**	**13.9**
Borrow Area B	Average	**0.656**	**0.510**	**26.7**	**10.5**

2.6 Permitting

The Town and CSE initiated permitting in 2014, beginning with a pre-application interagency meeting in October. CSE prepared a joint permit application and submitted it to the agencies in April 2015. CSE received comments from environmental resource agencies and interested parties, responding to the comments in October 2015. Additional correspondence was provided during the permitting phase to individual homeowners or other parties. On 10 September 2015, CSE provided the USACE a supplement to the existing environmental assessment [created as part of the USACE (2013) federal study]. This would allow US Fish and Wildlife Service (USFWS) to revise the biological opinion (BO) that was provided for the federal study with the updated project information for the local project. USFWS (2016) issued a BO for the local project on 21 January 2016. The Town received a permit from SCDHEC–OCRM on 26 May 2016, and the USACE permit followed on 19 August 2016. The permits are provided in Appendix A.

Following Hurricane *Matthew* in October 2016, the Town requested a permit modification to allow for additional sand volume, additional borrow area acreage, and an extended construction window for groin work. The permit modification would allow the total project volume to increase from 835,000 cy to 1.1 million cubic yards. The USACE issued an approval for the requested changes on 30 November 2016, and SCDHEC–OCRM issued a revised permit on 15 December 2016.

A final modification was requested on 17 February 2017 that would allow for installation of sand fencing and vegetation following construction. CSE prepared a modification request letter and drawings showing the details of the sand-fence installation. The modification would allow installation of fencing and vegetation over the full 19,000 linear feet of beach within the project area.

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3.0 PROJECT IMPLEMENTATION

3.1 Bidding

CSE prepared a bid specification package and plan drawings for the project. Bids were released to the public on 19 September 2016 that contained separate packages for the groin and nourishment projects. Mandatory pre-bid conferences were scheduled for 28 September for each project, and bids were scheduled to be due on 11 October. Hurricane *Matthew* impacted the beach around 8–10 October, and CSE and the Town elected to postpone the bid opening until the damage could be assessed and any modifications to the project scope or design could be determined. An optional pre-bid meeting and site visit were held on 9 November 2016 to enable contractors to view the post-*Matthew* beach. Bids were opened on 16 November 2016 at Edisto Beach Town Hall.

One bid was received for the groin extension project. Crowder Construction Company bid a total of $5,324,000 for the full scope of groin repair. This included extending a total of 26 groins (13 by composite sheet pile and 13 by grouted armor stone). The following unit prices were agreed to by Crowder for modifications for quantities and progress payments:

15-ft-long Composite Sheet Piles	$450/lf
20-ft-long Composite Sheet Piles	$550/lf
30-inch-wide Concrete Cap	$265/lf
Armor Stone	$90/ton
Marine Mattress	$17/sq ft
Concrete Grout	$650/cy
Repair Work	$200/hr

Two bids were received from dredging contractors, Great Lakes Dredge and Dock (Oak Brook IL) and Marinex Construction (Charleston SC). The bids were similar in total price for the maximum potential project quantity; however, the budget for nourishment limited the scope of the project. After considering the cost of the groin repair, the Town had a nourishment budget of $11.7 million. Table 3.1 provides a summary of the project scenarios possible for each contractor given the provided bids. Marinex was the low bidder at that budget with a total volume of 896,000 cy possible. GLDD would allow for 846,000 cy at the same price. CSE recommended the Town award the project to Marinex to allow for the greatest volume of sand to be placed. Following the notice of award, Marinex offered to provide an additional 60,000 cy of sand at no cost to the Town. The Town and Marinex signed an agreement for a 956,000-cy project for a total lump-sum price of $11,698,780. Table 3.1 (lower) provides the final fill plan as specified in the agreement. Figure 3.1 shows the contract fill plan (prior to any change orders).

TABLE 3.1. Bid prices and cost scenarios for nourishment. The cost scenarios assumed a budget of $11.7 million. At that budget, Marinex was able to place a higher quantity of sand. Following contract award, Marinex offered to increase the contract quantity at no coast as shown in the adjusted fill quantity in the bottom table.

Edisto Beach Bid Tabulation

Nourishment Project

Bidder	Mobilization ($)	Base Bid Lump Sum Price ($)	Alt - Park Unit Price ($/cy)	Alt Reach 1 Unit Price ($/cy)	Alt Reach 2 Unit Price ($/cy)	Alt Reach 3-4 Unit Price ($/cy)
GLDD	4,258,000	5,580,000	10.30	7.50	7.90	5.50
Marinex	2,683,900	6,053,400	10.74	10.23	9.36	9.62

Nourishment Scenarios for Nourishment Budget of $11.7 Million.

Marinex Final Plan	Length (ft)	Base Quantity (cy)	Alternate Quantity (cy)	Alt Fill Density (cy/ft)	Total Fill Density (cy/ft)	Base Price ($)	Alt Price ($)	Total Price ($)
Park	3,300	150,000	35,000	10.6	56.1	1,513,350	375,900	1,889,250
Reach 1	6,000	220,000	146,000	24.3	61.0	2,219,580	1,493,580	3,713,160
Reach 2	3,000	80,000	55,000	18.3	45.0	807,120	514,800	1,321,920
Reach 3	5,100	100,000	50,000	9.8	29.4	1,008,900	481,000	1,489,900
Reach 4	1,900	50,000	10,000	5.3	31.6	504,450	96,200	600,650
Total	19,300	600,000	296,000	15.3	46.4	6,053,400	2,961,480	9,014,880
		Total CY	**896,000**				Mobilization ($)	2,683,900
							Project Total ($)	**11,698,780**

GLDD Final Plan	Length (ft)	Base Quantity (cy)	Alternate Quantity (cy)	Alt Fill Density (cy/ft)	Total Fill Density (cy/ft)	Base Price	Alt Price	Total Price
Park	3,300	150,000	35,000	10.6	56.1	1,395,000	360,500	1,755,500
Reach 1	6,000	220,000	110,000	18.3	55.0	2,046,000	825,000	2,871,000
Reach 2	3,000	80,000	50,000	16.7	43.3	744,000	395,000	1,139,000
Reach 3	5,100	100,000	45,000	8.8	28.4	930,000	247,500	1,177,500
Reach 4	1,900	50,000	6,000	3.2	29.5	465,000	33,000	498,000
Total	19,300	600,000	246,000	12.7	43.8	5,580,000	1,861,000	7,441,000
		Total CY	**846,000**				Mobilization ($)	4,258,000
							Project Total ($)	**11,699,000**

FINAL FILL PLAN

	Base Bid Quantity	Alternate Bid Quantity	Adjusted Quantity	Total Fill Quantity	Change Order Quantity	Final Project Quantity
State Park	150,000	35,000	15,000	200,000		200,000
Reach 1	220,000	146,000	14,000	380,000	30,000	410,000
Reach 2	80,000	55,000	6,000	141,000		141,000
Reach 3	100,000	50,000	15,000	165,000		165,000
Reach 4	50,000	10,000	10,000	70,000	20,072	90,072
Total	**600,000**	**296,000**	**60,000**	**956,000**	**50,072**	**1,006,072**

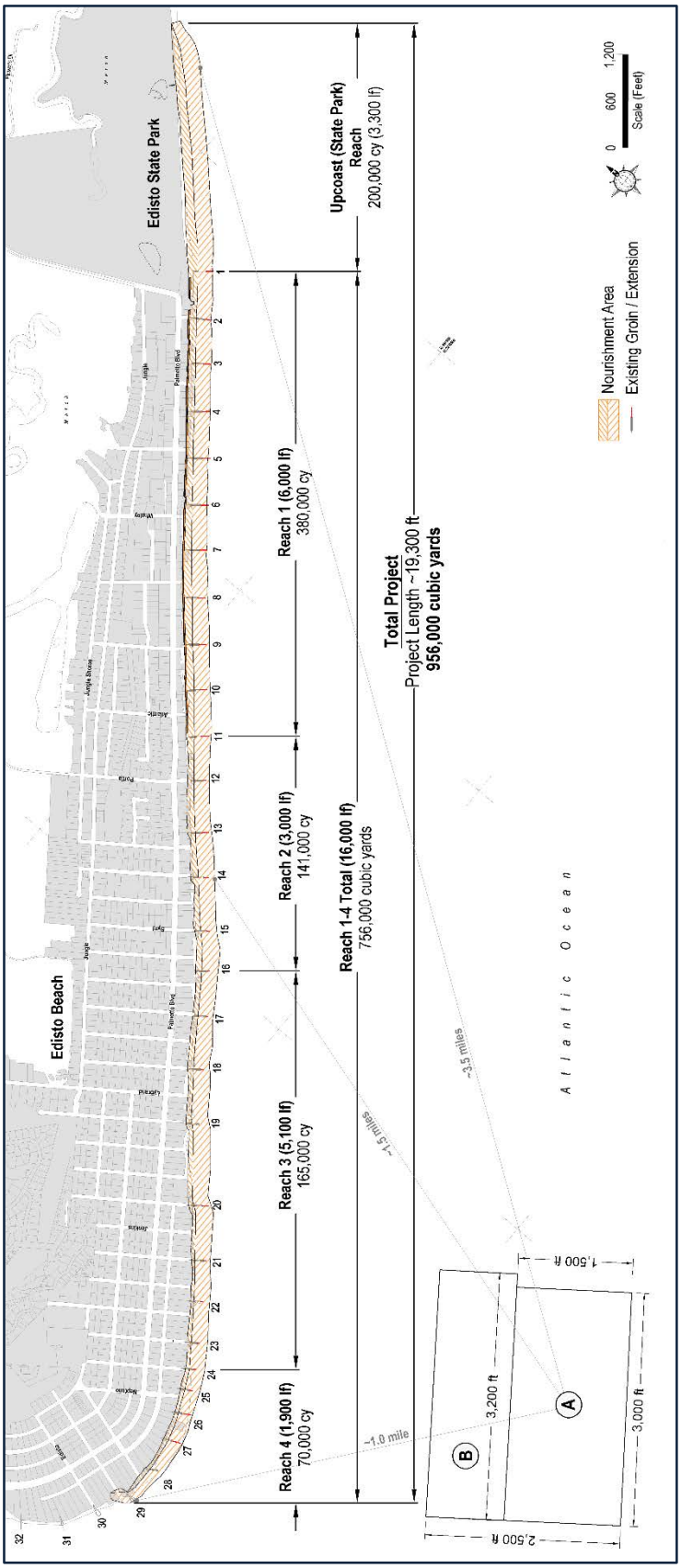

FIGURE 3.1. Contract fill plan (prior to any change orders).

3.2 Nourishment

Mobilization for the nourishment project began on 4 January 2017 with delivery of a bulldozer to the beach. Additional equipment continued to arrive over the next several days, along with the first shore pipe on 7 January. Marinex focused delivery of equipment and pipe near the 500 block, and effort was made to ensure that material was staged off vegetated areas (Fig 3.2). A total of ~10,000 lf of shore pipe was mobilized to the beach. The dredge *Savannah* arrived at Edisto Beach on 16 January and staged along the South Edisto River. Pumping started the night of 25–26 January in the 500 block between Groins 9 and 10. The initial work sought to build a "pad," which is a broad platform used as a landing site for the subline and begins the berm at the design elevation. Once the pad was complete, pipe was placed on the new berm directed to the north to begin the normal fill plan (Fig 3.3).

FIGURE 3.2.

[UPPER] The dredge, *Savannah*, offshore of Edisto Beach. **[MIDDLE]** Shore pipe staged prior to first pumping. **[LOWER]** The subline that connects the dredge to the beach comes ashore between Groin 9 and Groin 10.

FIGURE 3.3. **[UPPER LEFT]** Early in the nourishment project, showing the subline coming onshore and the nourishment fill moving north. **[CENTER RIGHT]** The active fill area showing slurry coming from the discharge pipe. **[CENTER LEFT]** A tug towing new 500-ft sections of plastic shore pipe to the beach. **[LOWER RIGHT]** Fill in the state park area.

Nourishment progressed in a northerly direction with production of up to 27,000 cy per day. Typical daily averages ranged from 15,000 cy to 20,000 cy per day. Weather and mechanical delays are typical of any dredging project and periodically reduced daily production or forced the dredge to return to the river. Marinex would construct temporary dikes to keep nourishment sand in the upper beach profile, especially as they approached each groin (see Fig 3.3). The project reached the state park on 19 February 2017. Work continued north through the state park through 7 March.

Following completion of the state park, Marinex repositioned the subline to the beach between Groins 19 and 20 (near Baynard Street). Pumping resumed on 9 March, building a new pad. Marinex initially pumped sand to the north, reaching Groin 18 before switching back and pumping south. Work continued south to the southern end of the project at Groin 30 (Edisto Street), reaching it on 28 March (Fig 3.4).

FIGURE 3.4. **[LEFT]** The completed beach at the state park. **[RIGHT]** Fill progress around Groin 27 at "The Point."

The last area of beach to be filled was the area between Groins 9 and 18. Marinex continued working to the north from where they previously left off at Groin 18. The final pumping occurred on 14 April 2017 where the original subline was placed between Groins 9 and 10. A total of 79 working days were required for placement of the 1,006,072 cy fill volume. Production averaged ~12,700 cy per day including all weather and mechanical delays. Marinex submitted daily construction logs that included information on estimated production and delays, quantities and locations of discharge pipe, and weather information (Appendix B). Before and after photos are shown in Figure 3.5.

FIGURE 3.5 (page 1 of 2). Before (left) and after (right) images of the beach nourishment project at Edisto Beach (SC). **[UPPER]** Edisto State Park area. **[LOWER]** Reach 1.

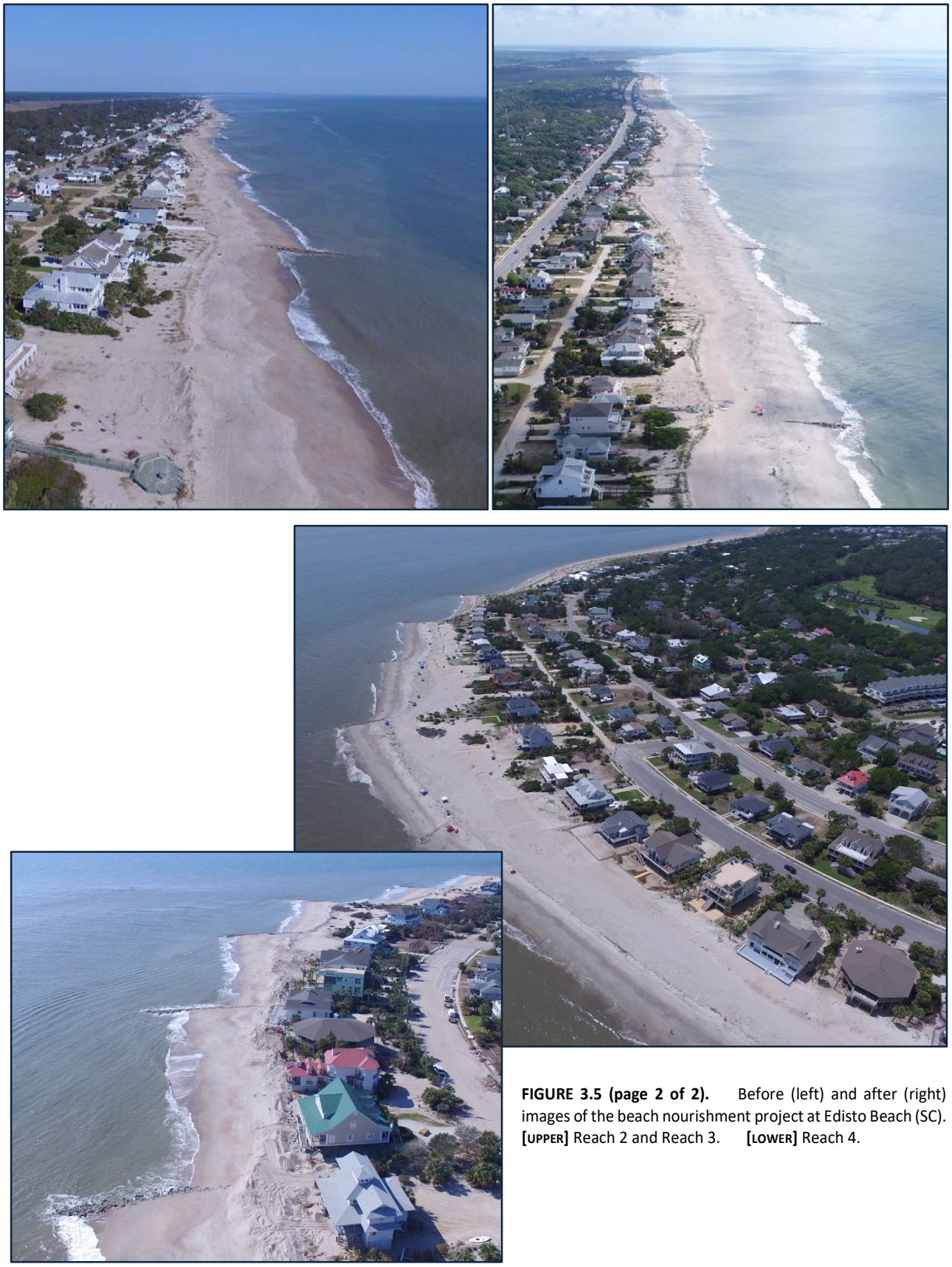

FIGURE 3.5 (page 2 of 2). Before (left) and after (right) images of the beach nourishment project at Edisto Beach (SC). **[UPPER]** Reach 2 and Reach 3. **[LOWER]** Reach 4.

Sand was dredged from the permitted borrow areas. The limit for dredging was −20 ft NAVD, which resulted in a thickness of cut of up to 14 ft. The dredge would shift within the borrow area if unsuitable material was present, which only occurred when higher-than-anticipated shell content was observed in the discharge. Overall, the material met expectations from pre-project borings in the borrow area. Details on grain-size characteristics of the fill material are provided in Section 5.

3.3 Groins

The groins extension portion of the project began with mobilization of equipment in December 2016. The contractor used the beach access and adjacent empty lot at the 800 block for the majority of staging and also used the old parking lot adjacent to Finn's Restaurant for initial mobilization and staging of stone. The first material delivery was a load of stone on 3 January 2017, and Crowder immediately began working on repairing Groin 4 by adding additional stone along the trunk section of the structure (Fig 3.6). Crowder completed repair work on Groins 1, 2, 4, 28 and 29 between 3 and 12 January. Repairs were completed by restacking loose stone or adding additional armor stone. Grout was added to Groins 1, 2, and 28 to hold the stones in place.

FIGURE 3.6. Before (left) and after (right) images of the beach nourishment project at Edisto Beach (SC). **[UPPER]** Reach 2 and Reach 3. **[LOWER]** Reach 4.

Material for the mattresses arrived on site beginning 16 January 2017. Crowder subcontracted with JLS (Kennesaw GA) to fill and tie the mattresses. The mattresses (manufactured by Tensar®) consisted of a plastic grid held together by UV-resistant polyrope. Mattresses were filled with stone typically 4–6 inches in size. To fill the mattresses, JLS would tie three sides of each ~20-ft-long unit and position the mattress on a rotating table. The mattress would be rotated vertically, and rocks would be placed in the opened end of each cell (Fig 3.7). Once filled, the top side would be tied closed, and the mattress would be rotated horizontally and

lifted from the table with a long-reach forklift. Filled mattresses were stockpiled in staging areas near each groin.

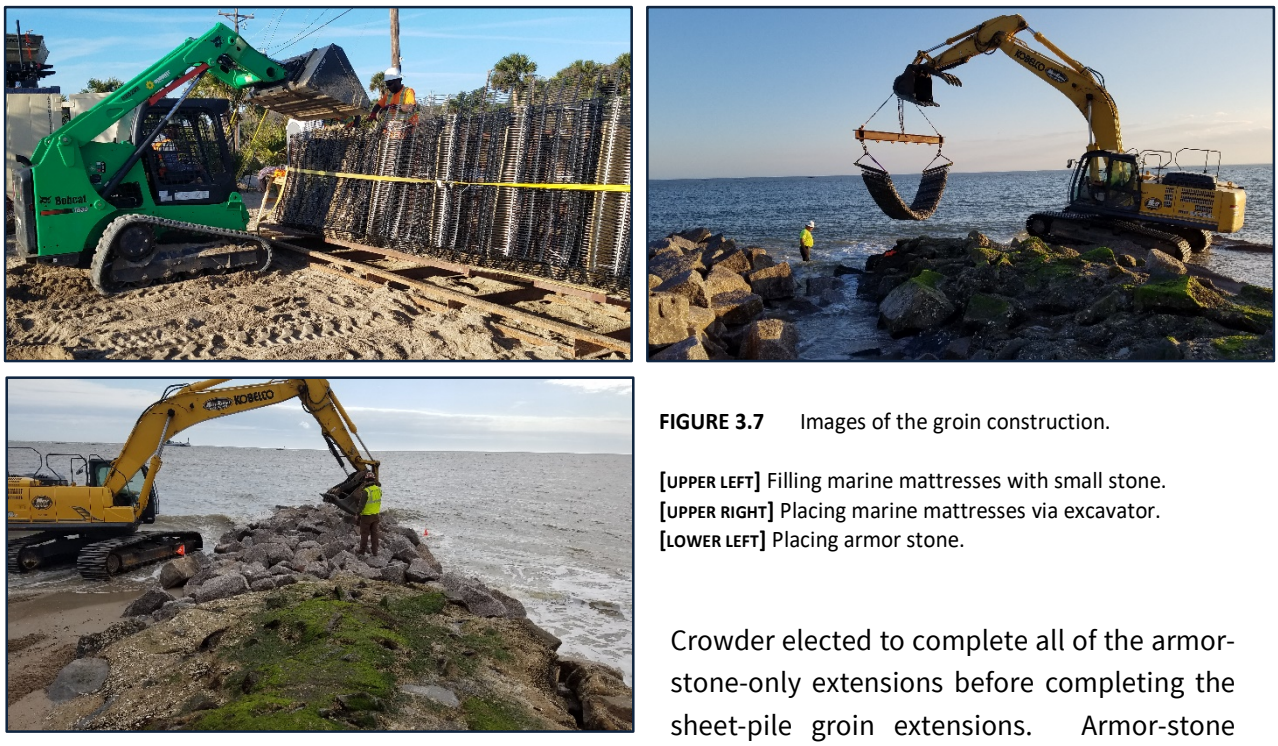

FIGURE 3.7 Images of the groin construction.

[UPPER LEFT] Filling marine mattresses with small stone.
[UPPER RIGHT] Placing marine mattresses via excavator.
[LOWER LEFT] Placing armor stone.

Crowder elected to complete all of the armor-stone-only extensions before completing the sheet-pile groin extensions. Armor-stone groins were extended by excavating sand to the design depth, then placing mattresses with an excavator or crane. Once the mattresses were in place, armor stone was placed to the design grade using an excavator. All mattresses were completed by 12 February 2017, which was also the last day of stone additions to the armor-stone-only groins. Crowder added grout to the armor-stone-only groins as weather, tides, and availability allowed.

The installation of sheet-pile groins began on 13 February at Groin 9. Crowder elected to begin at the landward end of the extension and initially used a moveable platform as a guide to drive the sheets; however, they quickly determined that a more robust template would be required to accurately drive the sheets. Crowder constructed a new form out of I–beams that would surround the sheet piles on two sides as they were being driven. The first sheets were driven using the excavator, which proved to be difficult with the composite sheets, as any variation from vertical would result in cracking of the top of the sheet. Crowder switched the vibratory hammer to the crane, and sheet driving improved. Crowder would drive a series of sheets until they reached the end of the template, and then would shift the template seaward (Fig 3.8). Once all of the sheets were driven to an elevation near mean sea level, the operators would drive the sheets to the final grade, checking elevations with a rod and level.

FIGURE 3.8. **[UPPER]** Installation of UC–95 composite sheets. **[LOWER]** Installation of marine mattress at the end of a sheet-pile groin.

Following installation of the sheet pile, Crowder placed mattresses and a portion of the armor stone alongside the sheets. Once the armor stone was at an elevation near the bottom of the concrete cap design, Crowder placed forms around the tops of the sheets in preparation for pouring the concrete caps (Fig 3.9). Concrete pours needed to occur during periods of lower-than-average tides and very calm weather to prevent the concrete from washing away before it could cure. Once the concrete was poured, workers shaped a crown on the surface and the forms were left in place for at least 24 hours to allow the concrete to cure. Once the concrete was cured and the forms were removed, Crowder added additional armor stone to bring the section to the design grade. At that point, the groin extension was complete (Fig 3.10). Generally, multiple groin extensions were being constructed at any given time.

Crowder completed the groin extension work on 12 June 2017 and began demobilizing equipment from the beach. Daily construction logs are included in Appendix C. The majority of equipment, including the crane, were removed by 15 June. Crowder rebuilt the dune in front of their worksite at Beach Access 8 and cleaned the worksite to complete demobilization.

FIGURE 3.9. **[UPPER]** Pouring concrete into the forms. Note the epoxy-coated rebar (green). **[LOWER]** Aerial view of groin construction at Groin 2.

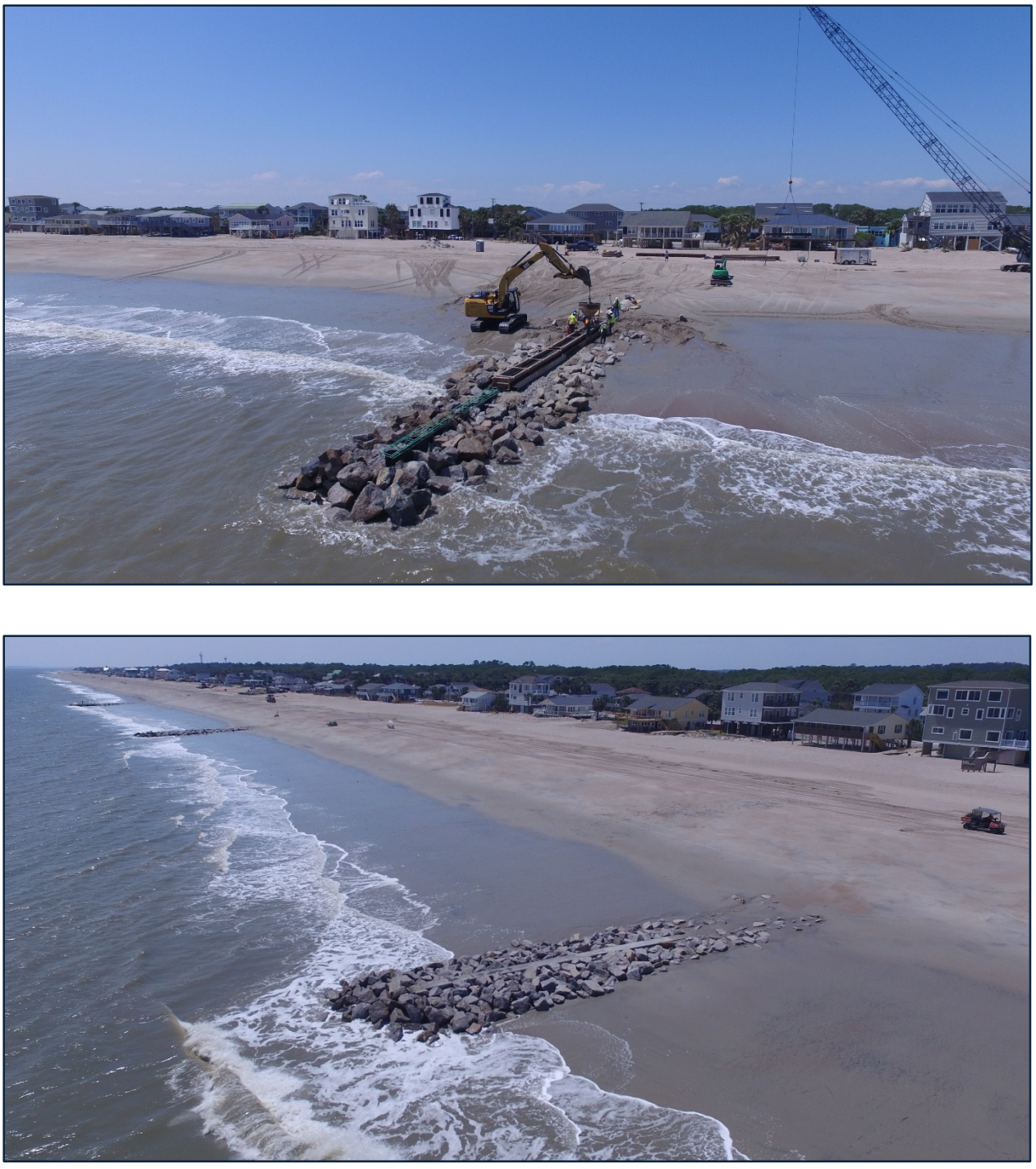

FIGURE 3.10. **[UPPER]** Pouring concrete cap on the landward end of groin extension. **[LOWER]** Completed extensions for Groin 7 (foreground), Groin 8 (middle), and Groin 9 (background).

4.0 SURVEYS AND AS BUILTS

4.1 Nourishment

Surveys before and after fill placement (BD – Before Dredging; AD – After Dredging), were completed by the contractor as the work was being completed. These surveys were used to determine payment quantities and to track fill progression according to the design volumes. Survey data were collected every 100 ft along the fill area and extended landward and seaward of the fill limits. Marinex provided cross-section profiles and x-y-z data to CSE for confirmation of volume calculations. For payment purposes, compensating slopes were allowed, which means that the contractor is credited for sand placed beyond the design template to account for a steeper slope of the fill material. The overall design section volume may not exceed 10 percent above the design quantity per project specifications. The complete set of BD/AD cross-sections is provided in Appendix D.

The BD/AD survey data show a total of 1,176,209 cy of sand were added to the beach during the project; however, the payment quantity was capped at 1,006,000 cy. Any additional sand was not included in payment calculations.

CSE completed additional BD and AD surveys to use as final design (BD) and pre-project baseline conditions for future project monitoring. CSE obtained profile data including three profiles per groin cell from Groins 1 to 22, and two profiles per groin cell from Groins 23 to 31. Additional data were collected along the state park at 300-ft intervals and along the South Edisto River shoreline. The BD survey served as the basis for final design and was collected following Hurricane *Matthew* in December 2016. AD survey data were collected in April 2017 following nourishment.

Appendix E shows CSE's BD and AD survey data as well as the 2006 post-nourishment condition. CSE computed volume for each profile using custom software, and calculated volumes for each groin cell and for the eight monitoring reaches identified in previous reports to the Town (Fig 4.1). Volumes from before and after the 2006 project are also provided for reference. The increase in volume is shown by the difference between the red (pre-project) and black (post-project) lines, and tabular data are provided in Table 4.1. Unit volumes for each station are shown in Figure 4.2. Fill volumes ranged from ~30 cy/ft to ~80 cy/ft with a few higher values due to isolated overpumping. **Overall, CSE data shows a net gain of 1,096,176 cy between December 2016 and April 2017.** This volume accounts for any background erosion occurring during the survey interval and compares well with the contractor BD/AD surveys.

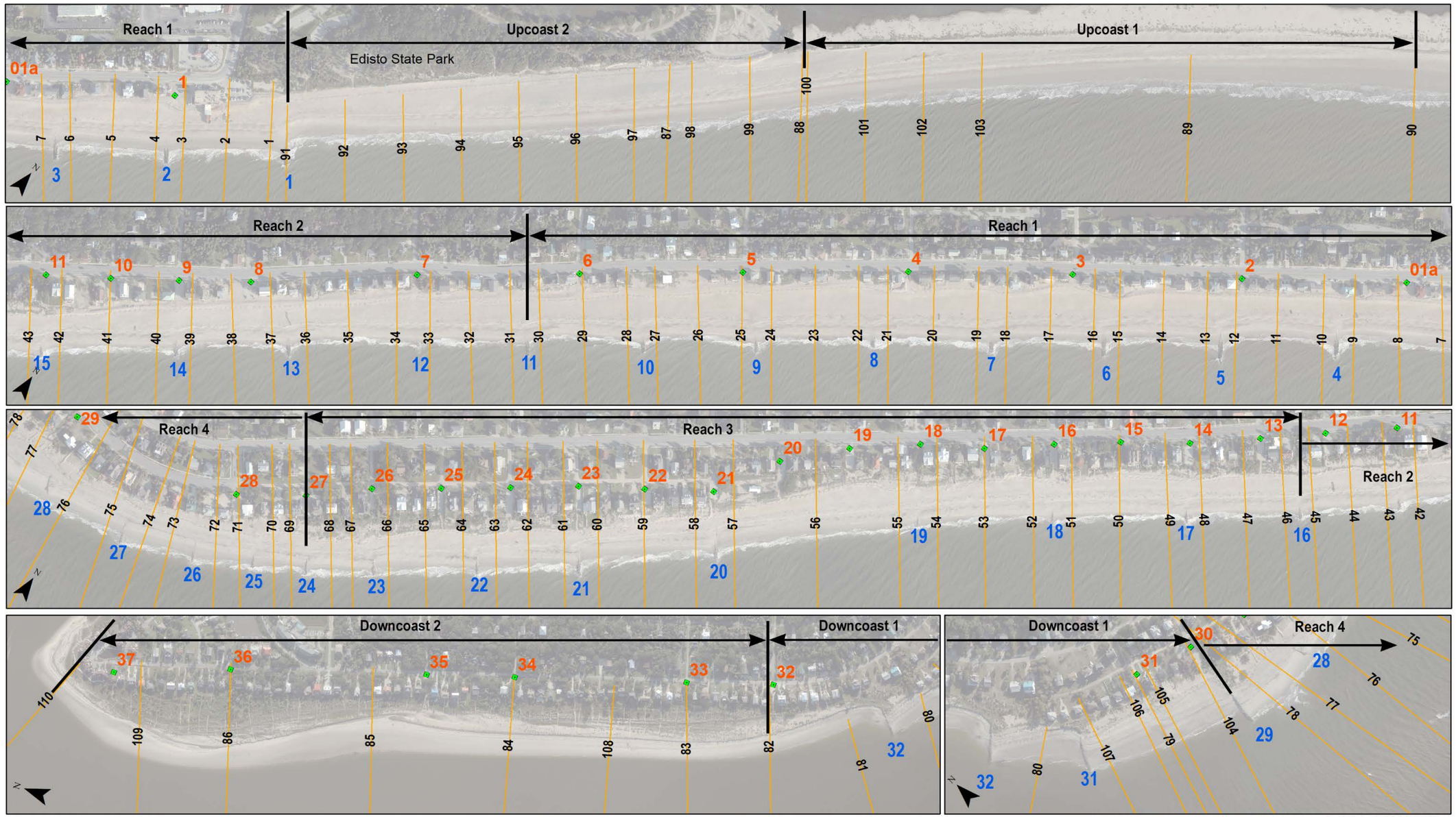

FIGURE 4.1. Location map showing beach profile lines surveyed by CSE before and after the project (orange lines with black labels). Groin number are shown in blue, and beach access points are shown in red.

TABLE 4.1. Station unit volumes for the post-2006 (August) project, and pre- and post-2017 nourishment project. Volumes are −15 ft NAVD.

Line Number	Station	Aug-06	Dec-16	Apr-17	Added Volume	Line Number	Station	Aug-06	Dec-16	Apr-17	Added Volume
90	SCCC 2270	295.5	282.3	280.2	-2.1	31	14+100	266.6	214.2	275.7	61.5
89	SCCC 2250	241.4	243.1	243.3	0.2	32	14+350	278.6	244.5	286.4	41.9
103	Park 3600		249.3	267.0	17.6	33	14+600	278.2	267.3	308.6	41.2
102	Park 3300	251.6	234.5	265.9	31.4	34	15+65	295.7	266.3	312.4	46.1
101	Park 3000	264.3	223.6	278.7	55.0	35	15+245	308.6	279.3	316.7	37.4
100	Park 2700	274.8	218.4	286.7	68.3	36	15+450	300.4	282.8	319.3	36.5
88	SCCC 2230	289.6	236.5	308.6	72.1	37	16+75	304.0	271.0	322.5	51.4
99	Park 2400	299.8	257.0	343.7	86.7	38	16+300	316.1	279.6	322.0	42.5
98	Park 2100	303.1	268.7	348.3	79.7	39	16+525	310.7	272.6	309.5	37.0
87	SCCC 2210	310.5	271.6	353.6	82.0	40	17+75	305.1	243.2	295.3	52.1
97	Park 1800	300.1	264.9	342.5	77.6	41	17+300	280.1	237.2	281.3	44.2
96	Park 1500	306.5	268.9	339.1	70.1	42	17+525	288.1	257.5	303.5	46.0
95	Park 1200	299.6	266.2	333.5	67.3	43	18+75	283.2	243.0	284.7	41.7
94	Park 900	294.8	262.1	325.8	63.7	44	18+300	287.6	256.2	288.7	32.5
93	Park 600	268.7	241.4	302.3	60.9	45	18+525	312.0	279.0	308.8	29.8
92	Park 300	237.8	235.6	287.0	51.3	46	19+100	309.7	262.2	315.2	53.0
91	Park 0	256.2	206.4	287.2	80.8	47	19+525	332.4	291.5	337.1	45.6
1	1+75	266.8	211.3	275.1	63.8	48	19+955	275.8	273.7	313.3	39.6
2	1+300	257.9	213.3	283.4	70.1	49	20+100	257.0	237.0	268.9	31.9
3	1+525	250.1	221.8	305.7	83.9	50	20+350	267.8	248.3	276.5	28.3
4	2+75	258.6	208.6	319.9	111.3	51	20+600	278.3	270.4	303.8	33.5
5	2+300	244.6	216.2	299.7	83.5	52	21+75	285.7	266.6	298.6	32.0
6	2+525	239.9	211.7	275.5	63.8	53	21+265	287.7	272.7	306.9	34.2
7	3+75	242.8	190.9	255.4	64.5	54	21+430	300.2	287.9	320.7	32.8
8	3+300	233.7	209.3	265.1	55.8	55	22+75	289.3	281.7	324.9	43.2
9	3+525	242.1	212.4	259.2	46.8	56	22+268	296.3	286.6	326.3	39.8
10	4+75	243.8	194.3	247.9	53.5	57	22+460	298.6	296.1	326.4	30.3
11	4+300	260.8	198.9	253.4	54.5	58	23+100	294.6	279.2	324.1	44.9
12	4+525	258.8	225.6	270.3	44.7	59	23+220	299.0	281.1	321.6	40.5
13	5+75	261.1	205.9	270.7	64.8	60	24+100	266.7	262.4	309.2	46.8
14	5+300	266.5	216.0	278.9	62.9	61	24+190	258.4	259.6	303.4	43.8
15	5+525	267.6	222.3	292.1	69.8	62	25+100	241.5	238.6	289.3	50.7
16	6+75	263.9	200.0	279.9	80.0	63	25+200	238.6	236.4	277.5	41.0
17	6+300	278.6	215.9	294.7	78.8	64	26+115	222.4	194.8	251.8	57.0
18	6+525	272.3	231.9	309.6	77.7	65	26+235	233.8	199.8	247.2	47.4
19	7+75	269.1	211.4	304.8	93.3	66	27+78	262.4	214.7	259.6	44.9
20	7+300	256.1	208.9	289.5	80.6	67	27+290	322.6	278.1	302.3	24.2
21	7+525	270.3	249.9	322.0	72.1	68	28+130	394.2	396.2	426.5	30.3
22	8+75	279.7	224.2	300.4	76.2	69	28+277	436.3	383.3	431.1	47.7
23	8+300	268.8	227.3	299.4	72.2	70	29+75		370.5	402.4	31.9
24	8+525	279.8	266.7	336.2	69.5	71	29+340		345.3	362.1	16.8
25	9+75	300.4	262.0	328.2	66.2	72	2135	394.2	332.2	320.0	-12.2
26	9+300	281.6	256.7	304.8	48.1	73	30+85		300.6	297.2	-3.4
27	9+525	284.7	275.3	328.8	53.5	74	30+345		292.9	291.9	-1.0
28	10+75	273.9	262.7	321.9	59.2	75	2130B	169.0	144.8	136.1	-8.7
29	10+300	270.1	251.6	311.5	59.9	76	2130A	24.2	22.9	22.7	-0.2
30	10+525	264.3	248.3	298.9	50.6	77	2130	217.1	296.3	296.0	-0.4
31	11+75	279.5	246.0	307.9	61.9	78	2120	271.2	330.8	333.8	2.9
32	11+300	281.9	266.3	322.5	56.3	104			331.1	334.5	3.4
33	11+525	281.3	253.0	310.3	57.3	105	2115	293.3	325.6	315.3	-10.2
34	12+75	284.8	223.8	298.2	74.3	79	2113	301.6	303.3	304.5	1.2
35	12+300	285.4	232.9	293.5	60.6	106	2110	422.8	463.0	463.4	0.4
36	12+525	290.2	233.1	284.4	51.3	107			369.7	387.7	18.0
37	13+75	276.0	214.2	270.9	56.7	80			251.5	249.8	-1.7
38	13+300	277.7	231.0	283.9	52.9	81					0.0
39	13+525	267.2	227.9	277.3	49.3	82					0.0

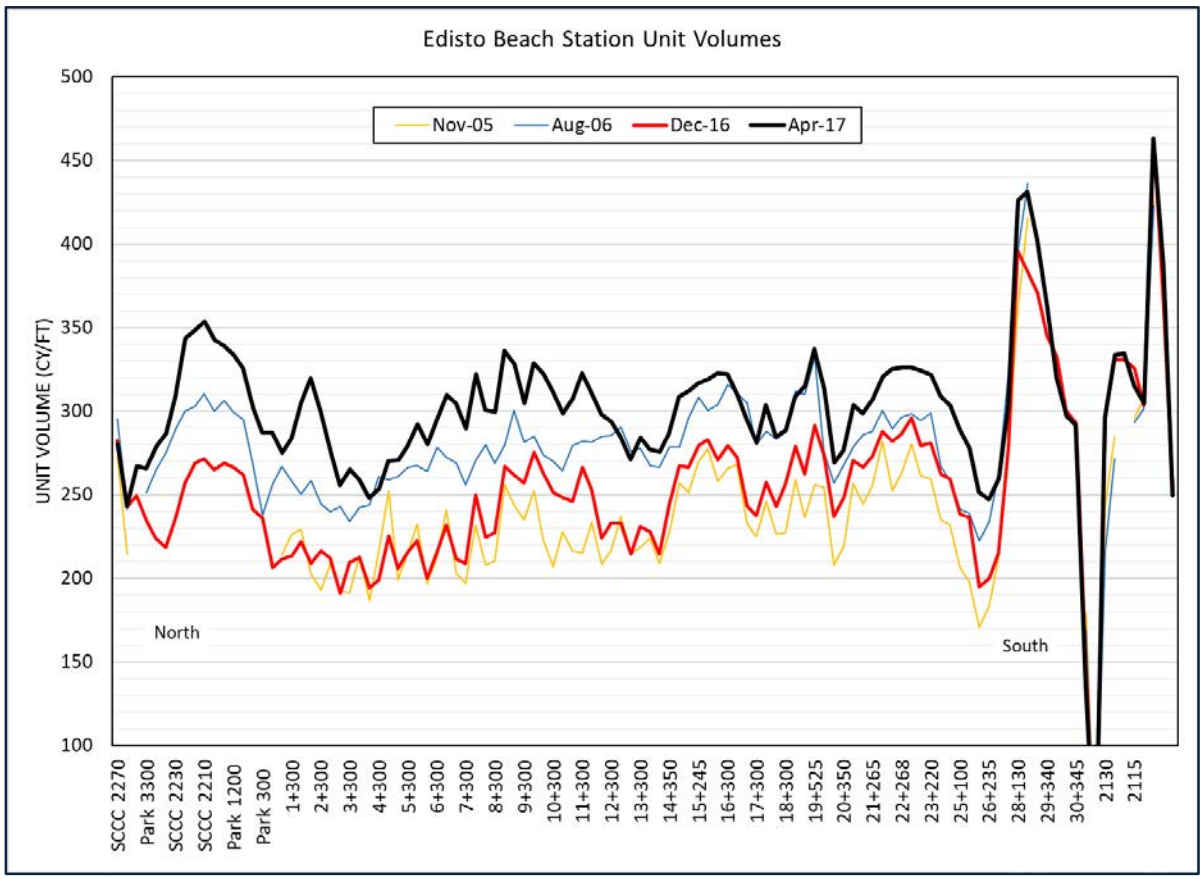

FIGURE 4.2. Beach unit volumes from before and after the 2006 and 2017 nourishment projects. Volumes are measured to −15 ft NAVD and are generally started at the structure line.

CSE has typically consolidated areas of the island into reaches to provide a more general assessment of beach condition over the island. Nourishment volumes by reach are shown in Figure 4.3. Measured fill volume in the project area ranged from 38 cy/ft to 71 cy/ft, increasing from south to north. Of note is that the post-project volume in 2017 was ~30–35 cy/ft higher in the state park and Reach 1 than after the 2006 project (Table 4.2). In Reaches 2 and 3, the volumes were ~14 cy/ft higher in 2017 than in 2006. Overall, the project added 54.8 cy/ft of sand within the project areas and 37.2 cy/ft of sand to the island as a whole.

4.2 Borrow Area Surveys

CSE completed surveys of the borrow area before the project and in June 2018. Surveys are used to confirm the excavation limits provided in the plans were not exceeded during the project and to monitor the rate of sediment infilling over time. The borrow area was positioned on the northern shoal of the South Edisto River Inlet channel. CSE anticipated the dredged needing to enter the borrow area from the channel side to have sufficient depth for operations.

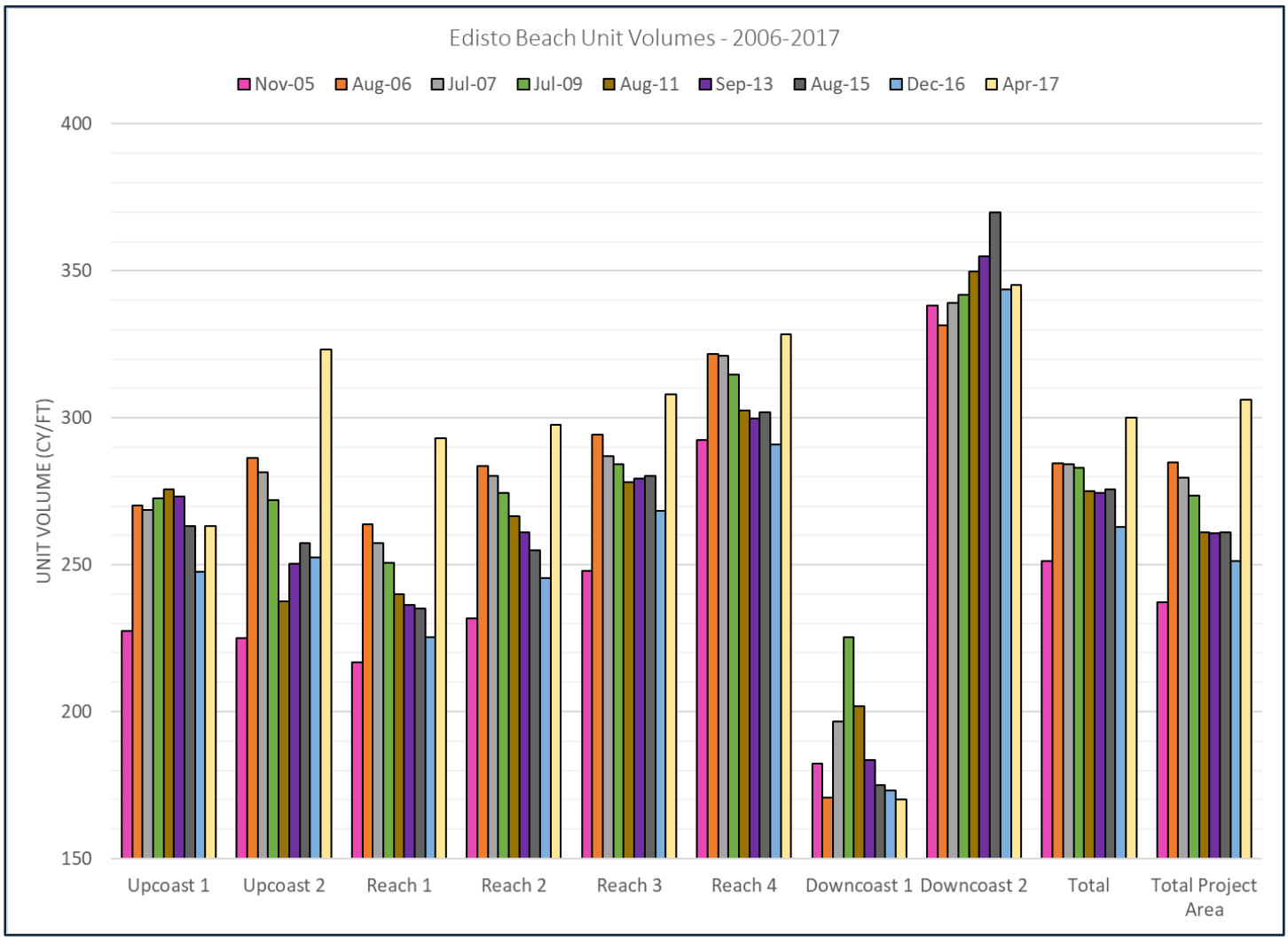

FIGURE 4.3. Reach unit volumes for selected surveys since 2005. Volumes are to −15 ft NAVD measured from the structure line.

TABLE 4.2. Reach unit volume values for the 2017 nourishment.

Reach	Length (ft)	Aug 2006 Unit Volume (cy/ft)	Dec 2016 Unit Volume (cy/ft)	April 2017 Unit Volume (cy/ft)	2017 Project Unit Volume Change (cy/ft)	Aug 2006 Total Volume (cy)	Dec 2016 Total Volume (cy)	April 2017 Total Volume (cy)	2017 Project Total Volume Change (cy)
Upcoast 1	3,145	270.1	247.7	263.2	15.5	849,462	779,083	827,790	48,707
Upcoast 2 (Park)	2,790	286.4	252.5	323.1	70.6	799,153	704,558	901,546	196,988
Reach 1	6,009	263.7	225.3	292.9	67.6	1,584,697	1,354,027	1,760,149	406,122
Reach 2	3,065	283.6	245.3	297.6	52.2	869,184	751,943	911,999	160,056
Reach 3	5,085	294.3	268.2	308.1	39.8	1,496,645	1,364,044	1,566,501	202,456
Reach 4	2,110	321.7	290.9	328.6	37.7	678,695	613,775	693,305	79,530
Downcoast 1	1,846	170.8	173.0	170.0	-3.0	315,236	319,398	313,878	-5,520
Downcoast 2	5,401	331.5	343.8	345.3	1.5	1,790,447	1,857,003	1,864,841	7,838
Total	29,451	284.7	262.9	300.2	37.2	8,383,519	7,743,832	8,840,008	1,096,176
Total Project Area	19,059	284.8	251.2	306.1	54.8	5,428,373	4,788,348	5,833,500	1,045,152

Marinex began excavations at the northwest corner of Borrow Area B and proceeded to the northeast along the inner margin of the borrow area. Marinex continued to work within Borrow Area B, using the majority of the area except for the southeastern portion. Marinex used the northern half of Borrow Area A, but did not work in the southern half. Figure 4.4 shows before-dredge (BD) and after-dredge (AD) surveys of the borrow area. The excavated areas are visible in the darker blue shades within the borrow area boundary.

CSE calculated the volume change between the surveys within the borrow area limits. As occurred following the 2006 project, significant infilling of sand is expected to occur over the next several years as sand moves in the shoal system. Between the 2016 and 2018 surveys, there was a measured loss of 1,100,885 cy of sand in the borrow area. This compares well to the volume measured in place on the beach, taking into consideration some infilling occurring in 2017 and losses occurring during the dredging project (typically, 10 percent handling losses are common in dredging projects, meaning more sand is excavated from the borrow area than is measured on the fill beach). CSE will continue to monitor the infilling of the borrow area over the next several years per permit conditions.

4.3 Groins

CSE completed surveys of the groin extensions following construction to verify placement elevations and extents. Survey data were obtained along the longitudinal axis of the groin (along the centerline) and around the accessible limit of the armor-stone apron. Cross-sectional profiles from the groins are provided in Appendix F. Figure 4.5 shows an example section from Groin 7. The post-construction condition is shown as the black line. Note that the survey includes the post-nourished beach sand, which is higher than the contructed extension in some cases. For example, at Groin 7, the old groin and the landward portion of the extension is buried at all distances landward of ~220 ft from the monument. The extension is seen as the horizontal portion near −1 ft NAVD elevation. The end of the cap at this groin is ~285 ft from the monument, and the armor-stone apron extends seaward.

Crowder recorded all material quantities for groin installation as shown in Table 4.3. Quantities include length of sheet pile, tons of armor stone, areas of marine mattress, and quantity of concrete. Overall, the project added 1,165 linear feet of sheet pile, 10,127 tons of stone, 37,800 square feet of mattress, and over 500 cy of concrete (cap and grout). Individual groins were lengthened up to 100 ft and required up to 850 tons of armor stone. Groin 5 required the most stone because the profile in that location was deeper than the other extensions. Figure 4.6 shows a plan view of a completed groin extension with elevations along the centerline and points located along the accessible limits of stone placement. The pre-project groin ended near the 0 ft NAVD elevation contour, and the extension is visible seaward of that point with the wider armor stone apron.

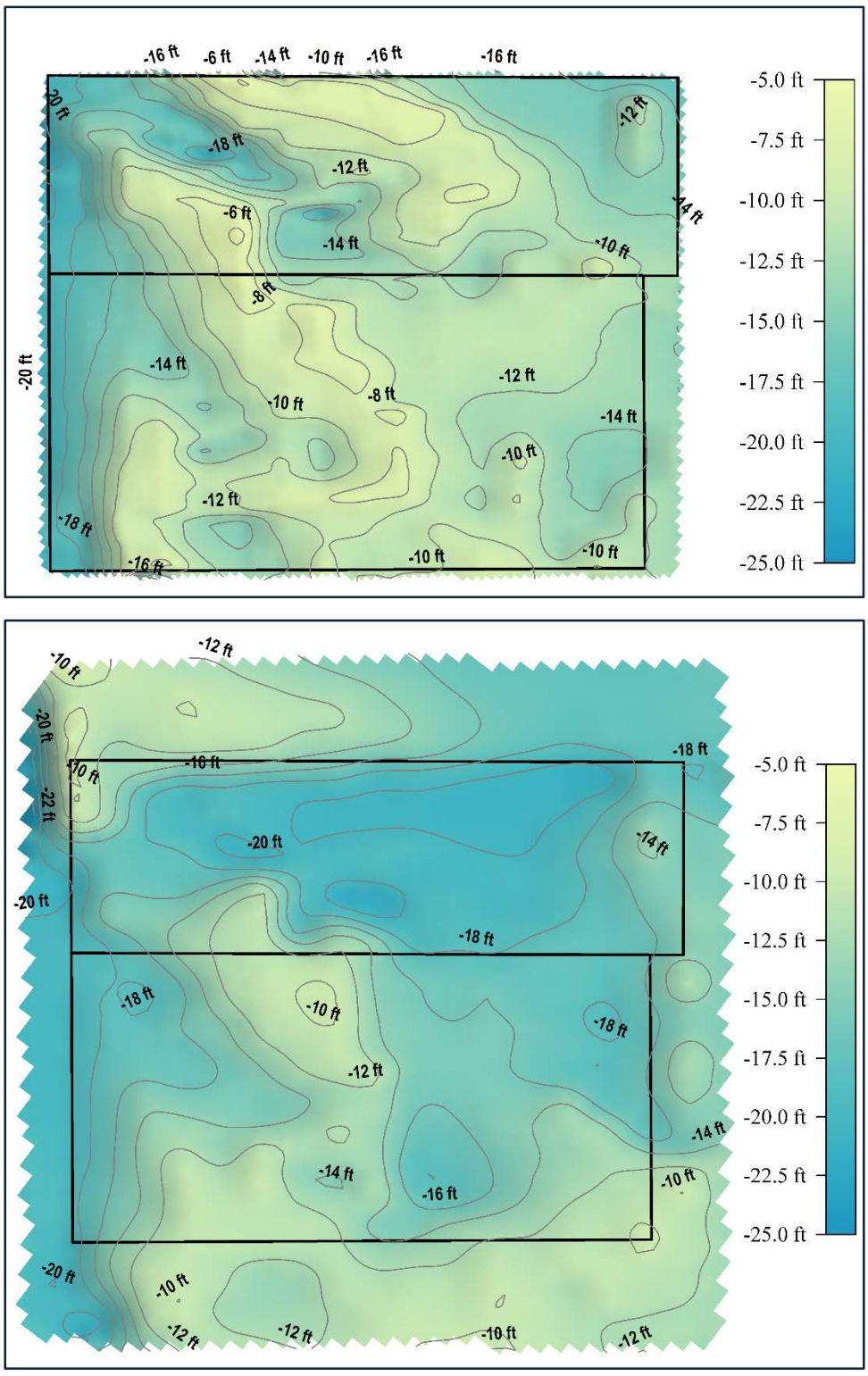

FIGURE 4.4. Before (August 2016) and after (June 2018) bathymetric models of the borrow area.

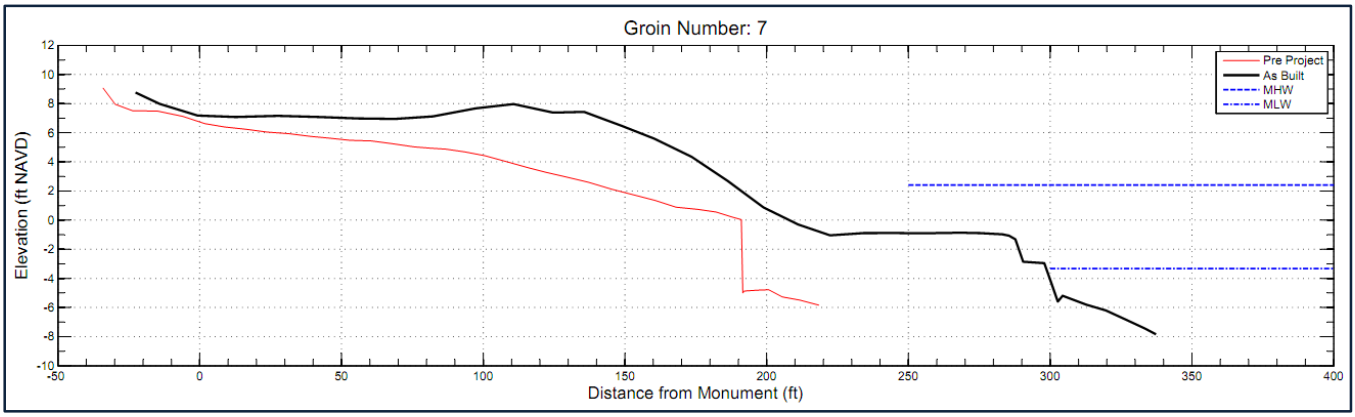

FIGURE 4.5. Before and after surveys at Groin 7 showing the extension cross-section. [See text on page 48 for details.]

TABLE 4.3. Groin extension quantity data.

Location	Length (lf)	Sheeting In Place (lf)	Class F Armor Stone (ton)	Mattresses In Place (Sq Ft)	Grout In Place (cy)	Est Cap Concrete (cy)
Groin 1	90	90	512	2,020	6	13
Groin 2	85	85	432	1,920	6	12
Groin 3	90	90	459	2,020	4	13
Groin 4	90	90	469	2,020	4	13
Groin 5	100	100	856	2,220	4	14
Groin 6	100	100	525	2,220	3	14
Groin 7	90	90	459	2,020	3	13
Groin 8	90	90	462	2,020	4	13
Groin 9	95	95	486	2,120	3	13
Groin 10	95	95	510	2,120	5	13
Groin 11	95	95	505	2,120	5	13
Groin 12	45		317	1,120	35	
Groin 13	80	80	425	1,820	5	11
Groin 14	65	65	440	1,520	5	9
Groin 15	40		286	1,020	28	
Groin 16	20		178	620	20	
Groin 17	20		180	620	20	
Groin 18	40		286	1,020	28	
Groin 19	0		0			
Groin 20	40		286	1,020	27	
Groin 21	31		236	820	23	
Groin 22	30		232	820	24	
Groin 23	30		232	820	23	
Groin 24	30		241	820	21	
Groin 25	40		286	1,020	25	
Groin 26	50		415	1,220	32	
Groin 27	50		412	1,220	33	
Groin 28	0		0		3	
Groin 29	0		0			
Total	**0**	**1,165**	**10,127**	**38,320**	**395**	**165**

FIGURE 4.6. Plan view of a typical groin extension using sheet pile and concrete cap. Elevations are labeled in white and the footprint of the accessible armor stone is shown in yellow. This extension began near the "0 ft NAVD" contour.

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5.0 SUMMARY OF SAND ANALYSIS

All excavations involved beach-quality sand similar in texture to the native beach. Edisto Beach has a much higher shell content than typical beaches in South Carolina. The majority of the shell is <2 millimeters (mm) (shell hash) and is similar in nature to coarse sand, although large shells are abundant. The project matched the character of the native beach by placing sand containing similar coarse sand and shell hash as presently exists on the beach.

Sand on the native beach prior to nourishment was sampled by CSE in April 2015. This established a native size distribution for purposes of compatibility analyses. The mean grain size of native beach sand samples (composite) was 0.487 mm with 5.4 percent of the material coarser than 2 mm. The beach samples (composite) tested as 24.8 percent (by weight) calcium carbonate ($CaCO_3$).

During construction, a representative from CSE visited the site several times per day (with the exception of periods when dredging operations were stopped because of weather or equipment maintenance). Additionally, whenever the dredge changed to a new borrow area, a CSE representative monitored the first few hours of discharge. Generally, twice per day, the observer made a visual inspection of the most recent sediment placed. These site visits were recorded in daily observation reports (Appendix G).

While on site, the observer also collected a composite grab sand sample from the last station completed. Each sample was analyzed to determine the grain-size characteristics and shell content as a means of monitoring the quality of the material placed on the beach. Results from analyses of all samples collected showing grain-size distributions and descriptions are attached in Appendix H. Grab sample analysis results are summarized in Table 5.1.

TABLE 5.1. Beach sand sample statistical results for each survey station along the project area.

	Mean	STD	Shell	Gravel
Sample	mm		%	%
SP 1+00	0.423	0.397	25.0	5.8
SP 4+00	0.769	0.464	36.6	9.8
SP 5+00	0.605	0.406	32.3	9.2
SP 7+00	0.327	0.423	27.9	3.3
SP 9+00	0.216	0.514	20.8	1.2
SP 10+00	0.302	0.392	23.0	5.1
SP 14+00	0.463	0.298	31.9	13.5
SP 17+00	0.691	0.310	43.2	18.4
SP 19+00	0.858	0.284	44.2	26.5
SP 24+00	0.383	0.345	30.0	8.6
SP 26+00	0.384	0.340	30.7	9.4
SP 28+00	0.380	0.421	25.0	7.3
Groin 1+100	0.486	0.384	31.5	8.4
Groin 2+100	0.218	0.486	11.7	2.0
Groin 3+00	0.398	0.358	23.7	7.6
Groin 3+100	0.611	0.352	32.2	12.4
Groin 3+300	0.580	0.392	31.5	8.0
Groin 3-100	0.554	0.386	30.3	8.0
Groin 4+00	0.620	0.423	36.0	7.6
Groin 5+00	0.519	0.446	30.2	5.4
Groin 5+200	0.672	0.425	33.7	9.4
Groin 6+00	0.519	0.399	36.6	7.4
Groin 6+300	0.534	0.446	35.7	6.4
Groin 7+00	0.489	0.359	28.1	9.8
Groin 7+300	0.739	0.376	41.3	14.8
Groin 8+00	0.382	0.363	30.3	7.6
Groin 8+300	0.448	0.381	33.2	7.9
Groin 9+000	0.603	0.394	35.9	9.7
Groin 9+300	0.574	0.358	33.7	11.3
Groin 10+300	0.663	0.347	38.7	11.8
Groin 10+300	0.430	0.486	27.1	5.0
Groin 11+300	0.538	0.473	43.6	6.4
Groin 12+300	0.502	0.392	37.0	9.4
Groin 13+300	0.525	0.426	44.8	7.6
Groin 14+300	0.550	0.498	33.5	6.0
Groin 15+00	0.697	0.312	28.4	14.9
Groin 15+300	0.386	0.524	26.3	2.8
Groin 16+00	0.435	0.515	31.8	5.7
Groin 16+300	0.445	0.518	25.0	4.0
Groin 17+00	0.516	0.403	31.0	8.5
Groin 17+300	0.402	0.551	18.8	2.9
Groin 19+100	0.484	0.391	34.7	8.4
Groin 19+300	0.580	0.406	30.7	8.9
Groin 20+00	0.634	0.361	28.7	13.8
Groin 21+00	0.632	0.365	43.1	13.2
Groin 2-100	0.629	0.371	35.0	11.4
Groin 22+00	0.652	0.358	35.7	14.2
Groin 23+00	0.788	0.317	49.8	21.3
Groin 24+00	0.622	0.343	32.0	14.9
Groin 25+00	0.589	0.340	26.2	14.3
Groin 26+00	0.575	0.285	29.7	15.1
Groin 27+00	0.535	0.319	27.1	10.7
Groin 28+00	0.487	0.386	25.2	7.9
Groin 29+00	0.394	0.478	25.1	4.6
ALL	0.508	0.372	31.8	9.4

Nourishment sand placed on the beach was found to be consistent with the borings obtained by CSE. The mean grain size of all samples collected during project construction by CSE was calculated to be 0.508 mm. The nourishment sand is slightly coarser than the native beach sand; however, the sand contained less large shell fragments. Post-project observations show the beach generally has a shallower slope than the pre-project condition, which is partially a result of sediment grain size.

FIGURE 5.1. Example of sediment character of the fill sand. As the dredge moved within the borrow area, sediment characteristics changed slightly. Over time, exposed sediment will become more uniform over the length of the beach.

6.0 REGULATORY COMPLIANCE

Standard protection measures common to similar projects were incorporated into the project design. Protection measures followed recommendations outlined by the USFWS in previous biological opinions (BO) issued for similar projects (Isle of Palms 2008, Folly Beach 2013). Also, the permit application for the beach restoration project included protection measures contained in the revised USFWS BO (2014) issued for the USACE-proposed Edisto Beach Coastal Storm Damage Reduction Civil Works Project (USACE 2014).

The USACE completed extensive work in support of a feasibility study for a beach nourishment and groin lengthening project to provide storm damage reduction for a 50-year project design life. Work accomplished by the USACE included a feasibility report and environmental assessment, coastal engineering, economic analysis, structural inventory, geotechnical engineering, impact analysis, a biological assessment (BA) and essential fish habitat (EFH) assessment, 404(b)1 evaluation, and a hard bottom and cultural resource survey. The USACE also corresponded with local, state, and federal resource and regulatory offices and completed formal Section 7 consultation with USFWS, receiving the BO referenced above on 14 March 2014. Documentation for the USACE project can be found at http://www.sac.usace.army.mil/Missions/CivilWorks/NEPA Documents.

In its permit application for the locally sponsored project, the USFWS allowed the Town of Edisto Beach to supplement the USACE BA and EFH prepared for the federal storm-damage reduction project. CSE prepared a supplement to the USACE EA, and USFWS issued a new BO for the local project, which is provided in Appendix I (USFWS, 21 January 2016). The project was intended to be constructed during the winter season (1 November to 30 April); however, due to impacts of Hurricane *Matthew*, CSE anticipated the project might need to extend into a portion of turtle nesting season. CSE requested a permit modification to allow the groin installation portion of the work to extend into nesting season under the condition that all terms and conditions of the BO and standard sea turtle protection measures included in the permits be included in the contractor's scope of work.

Each contractor was required to comply with all terms and conditions of the project permits (federal and state), as well as the conditions of the USFWS BO. In addition to the sediment sampling described in the previous section, additional compliance measures in the project included:

- Monitoring for escarpments during construction.
- Sediment compaction monitoring following nourishment.
- Daily sea turtle patrols beginning 1 May 2017.
- Equipment storage off of the beach to the extent possible.
- Fencing to prevent sea turtle entrapment around equipment or material storage areas.

- Filling of holes, track marks, or leveling of ridges each day to allow turtles to move freely.
- Incorporation of measures to prevent oil, fuel, and other pollutants from spilling or entering the waterway.

Marinex completed the nourishment portion of the project, including tilling of the beach and demobilization of equipment prior to turtle nesting season. Crowder needed additional time to complete the groin installation and coordinated with the local turtle patrol to identify areas where nesting activity may have occurred. Patrol members would locate and mark any nest (Fig 6.1), and inform Crowder of the location so that work activity would avoid the area. Crowder avoided areas near the dune and attempted to restrict equipment to the wet-sand beach as much as possible. Crowder did not work at night to avoid potential impacts of lighting. No incidents of impacts to turtles were reported by Crowder or the turtle team. All equipment was off of the beach by 12 June 2017.

FIGURE 6.1. Example of turtle nest located and marked on the already constructed berm. A completed groin extension is visible in the background.

8.0 MAINTENANCE AND MONITORING RECOMMENDATIONS

Beach nourishment projects typically involve varying levels of post-project monitoring, depending on the site and project complexity. Regular monitoring provides updated assessments of project performance, impacts, and storm losses, and allows for planning of future projects. The Town of Edisto Beach has monitoring responsibilities required by the state and federal permits (see Appendix A). Specific monitoring to be completed in the future includes the following.

Annual beach profile and hydrographic surveys of the project area for a minimum of five years. Surveys will extend from the back berm or dune to a minimum of -15 ft NAVD or a distance of 1,000 ft, whichever is reached first. Survey data will be used to determine project performance, calculate erosion rates, and determine potential downcoast impacts.

Semiannual monitoring of the same area for five years post-construction. These monitoring events will span the same limits as the annual monitoring, but are only required to extend to −6 ft NAVD (low-tide wading depth).

Hydrographic surveys of the borrow area in Years 1, 3 and 5 post-construction. Survey data will be used to monitor infilling of the area following dredging.

Aerial photography for five years following construction. High-resolution vertical photos georeferenced and covering the entire project area are required annually for five years following construction.

Compaction and escarpment monitoring for Years 1–3 post-construction. Compaction measurements are to be taken in the project area and compared to native areas. If compaction values are greater than the 500 psi threshold and exceed native values, the area will require tilling prior to 1 May following consultation with USFWS. Escarpments measuring greater than 100 linear feet and 18 inches high are required to be graded prior to 1 May.

Reports following each survey to be submitted to permitting and resource agencies as required by project permits. Reports will update the condition of the beach, and compare erosion rates to established thresholds to assist in determining potential downdrift impacts.

Data and information regarding the above-listed items must be submitted to SCDHEC–OCRM, USACE, USFWS, and SCDNR following each monitoring event.

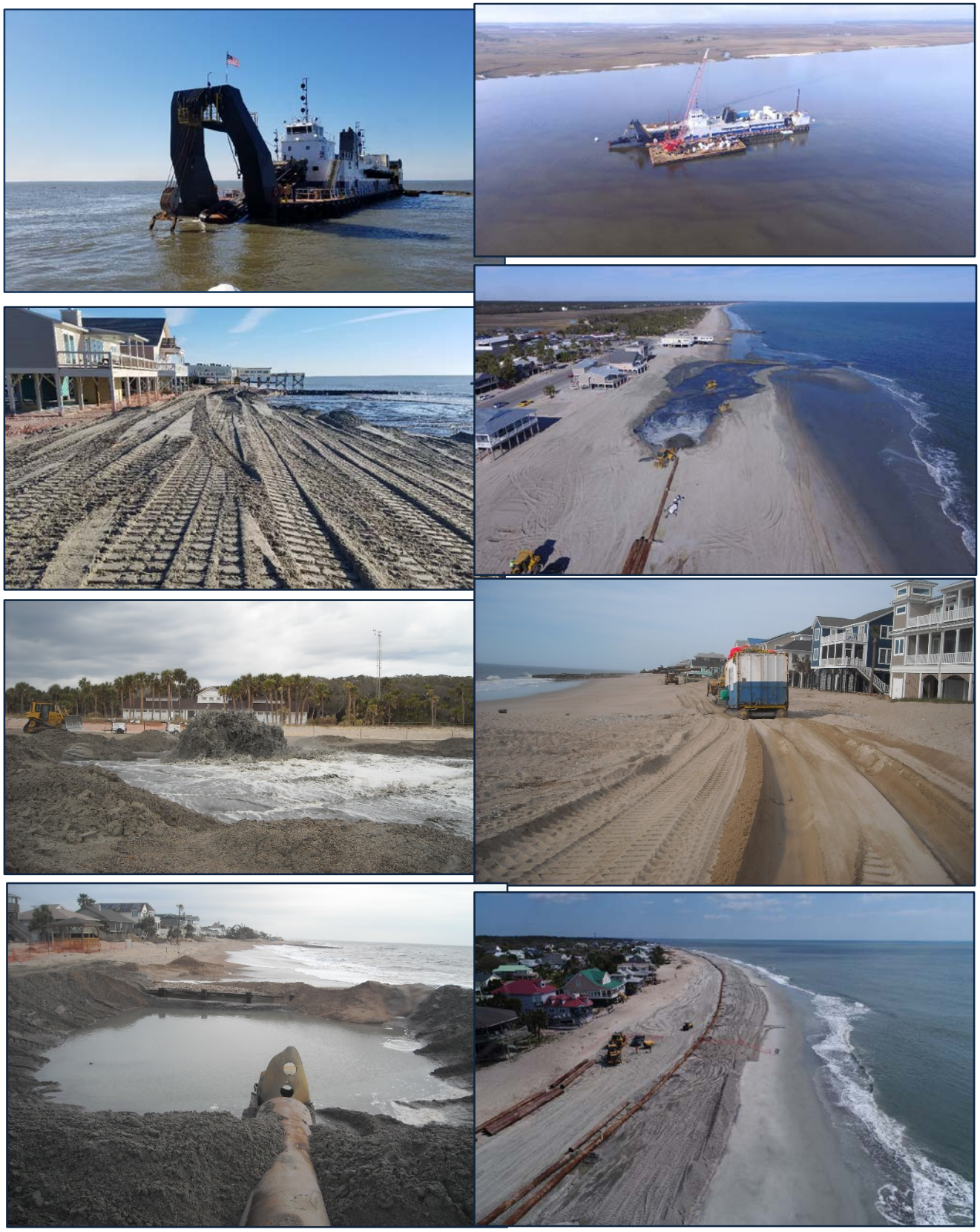
In the event of a future declared disaster, the Town would potentially be eligible for post-storm beach restoration funds from FEMA under a Community Assistance Grant—Category G— Improved Projects. This fund is available to cover the cost of renourishment such that sand losses due to a major storm are replaced. The Town received funds for Hurricane Joaquin and Matthew under this program. These funds were used to add additional sand to Edisto during the 2017 project. The key in each case was an ongoing monitoring and maintenance program along with post-storm surveys that documented losses due to these storms. This is an important program for sites that otherwise do not receive federal assistance for beach protection. FEMA continues to fund these grants in recognition that healthy beaches generally lower property damages in storms.

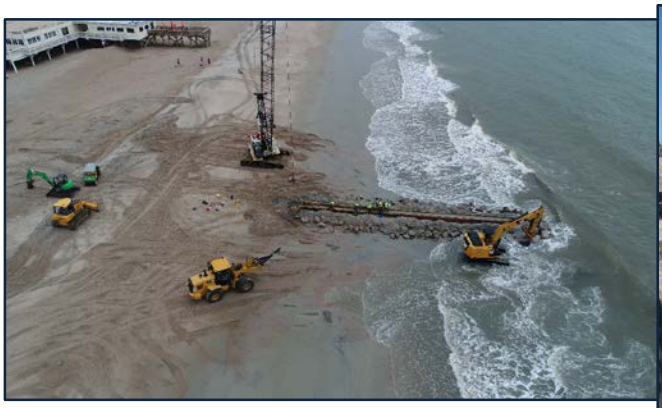
Turtle nesting is expected to be tracked in the future by the Edisto Beach Turtle Patrol. Should this program be terminated, CSE recommends the town seek ways to continue seasonal surveys and implement appropriate nest tracking and protection measures according to USFWS protocols.

The groins should be inspected yearly for evidence of displacement, corrosion, local scour, or loss of rock protection around the head. Visual inspections should be made frequently to note obvious damage to the cap, warning marker, or armor stone. The amount of exposure (height and length of groin section above sand level) should be documented when surveys are conducted. Other things to note when observing the groin condition are:

- Burial of the landward end—means the nourished berm/dry beach remains stable.
- Even reveal along the sloping section—means the nourished profile continues to follow a natural profile.
- Partial burial of rock above the low-tide beach and exposure of sheet piles near the head of the structure—may indicate toe protection is settling.
- Width of dry beach on the east and west side of the groin—measure of beach stability.

7.0 PROJECT PHOTOS



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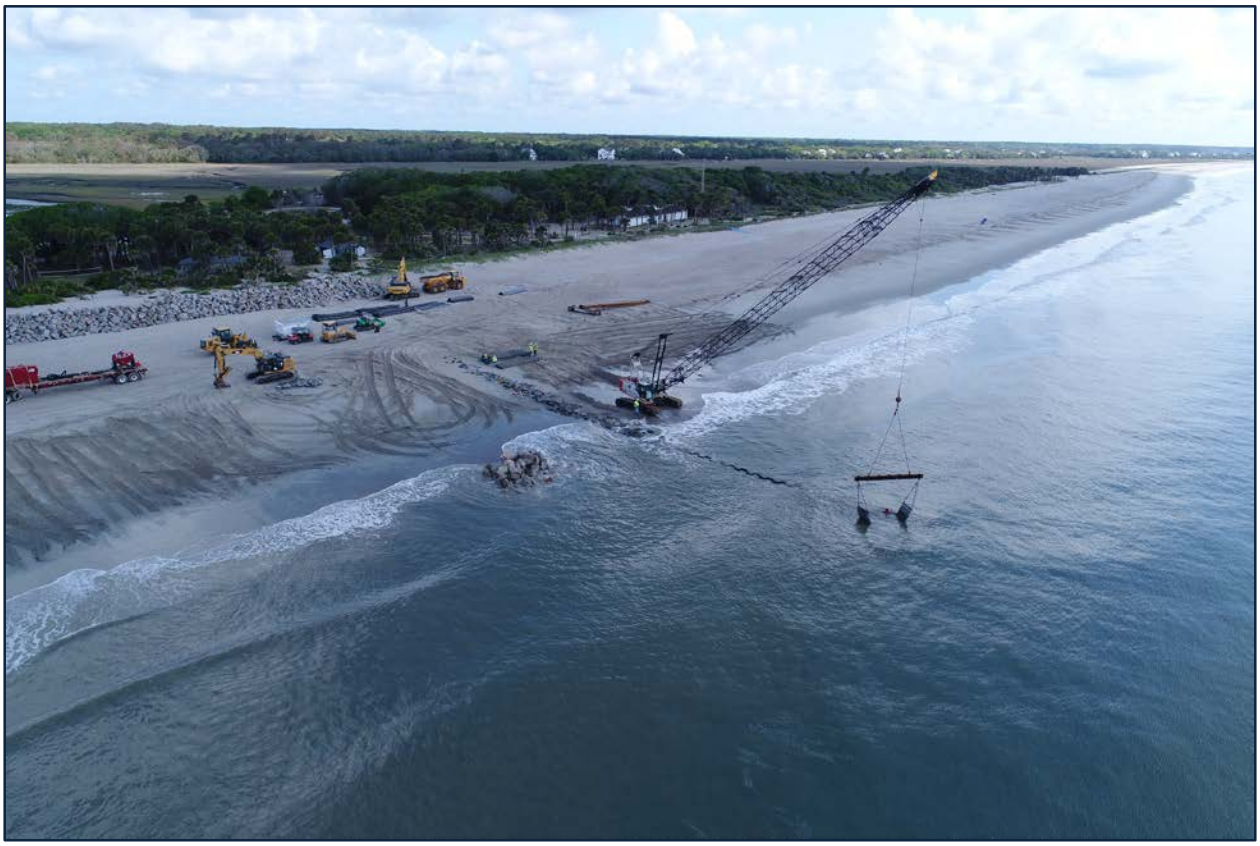

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