US Army Corps of Engineers®

Charleston District

CHARLESTON PENINSULA, SOUTH CAROLINA, A COASTAL FLOOD RISK MANAGEMENT STUDY

Charleston, South Carolina

ENVIRONMENTAL APPENDIX - F

September 2021

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NOTICE OF INTENT

COPY OF NOTICE OF INTENT TO PREPARE A DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT FOR THE CHARLESTON PENINSULA COASTAL FLOOD RISK MANAGEMENT STUDY, CHARLESTON COUNTY, SOUTH CAROLINA; ORIGINALLY PUBLISHED IN THE FEDERAL REGISTER ON MARCH 23, 2021

www.regulations.gov. Follow the instructions for submitting comments.

DoD Clearance Officer: Ms. Angela James. Requests for copies of the information collection proposal should be sent to Ms. James at *whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil.*

Jennifer D. Johnson,

Regulatory Control Officer, Defense Acquisition Regulations System.

[FR Doc. 2021–06010 Filed 3–22–21; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

Notice of Intent To Prepare a Draft Integrated Feasibility Report and Environmental Impact Statement for the Charleston Peninsula Coastal Flood Risk Management Study, Charleston County, South Carolina

AGENCY: Department of the Army, U.S. Army Corps of Engineers, Department of Defense (DoD).

ACTION: Notice of intent to prepare an Environmental Impact Statement.

SUMMARY: Pursuant to the requirements of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality Regulations, the U.S. Army Corps of Engineers (USACE), Charleston District, announces its intent to conduct public scoping and solicit public comments to gather information to prepare a draft Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS). In April 2020, USACE released a draft Integrated Feasibility Report/Environmental Assessment (IFR/EA) with a draft mitigated Finding of No Significant Impacts (FONSI) for the Charleston Peninsula Coastal Flood Risk Management Study. After further agency analysis, review of comments received on the Draft IFR/EA, and continued refinement of the study, USACE concluded that an IFR/EIS with a Record of Decision (ROD) would fulfill NEPA compliance for the study. Comments received during the draft IFR/EA public comment period will be considered as part of the scoping process for the IFR/EIS, and do not need be resubmitted.

DATES: USACE requests comments concerning the scope of the alternatives and identification of relevant information, studies, and analyses. All comments must be received by April 22, 2021. The draft IFR/EIS is scheduled to be released for a minimum 45-day public review in late summer of 2021. The final IFR/EIS is scheduled to be released in the summer of 2022. The ROD will be signed no sooner than 30 days after the release of the IFR/EIS.

ADDRESSES: Send written comments to U.S. Army Corps of Engineers Charleston District, ATTN: Planning and Environmental Branch, 69A Hagood Avenue, Charleston, SC 29403. Send comments via email to *Chs-Peninsula-Study@usace.army.mil.* Submit comments online at the website: *www.sac.usace.army.mil/charlestonpeninsulastudy.*

FOR FURTHER INFORMATION CONTACT: Nancy Parrish, U.S. Army Corps of Engineers, 69A Hagood Avenue, Charleston, SC 29403, (843) 329–8050, or *Chs-Peninsula-Study@usace.army.mil.*

SUPPLEMENTARY INFORMATION: USACE is issuing this notice pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA), as amended, 42 U.S.C. 4321 *et seq.;* and, the Council on Environmental Quality's (CEQ) regulations for implementing the procedural provisions of NEPA, 43 CFR parts 1500 through 1508. USACE is exercising its discretion to employ the 1978 CEQ NEPA regulations to this ongoing NEPA process pursuant to CEQ's Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, Final Rule, 85 FR 43304, at 43339–43340 (July 16, 2020).

Background: In April 2020, USACE released a draft IFR/EA with a draft mitigated FONSI for the Charleston Peninsula Coastal Flood Risk Management Study. After further agency analysis, review of comments received on the draft IFR/EA, and continued refinement of the study, USACE concluded that NEPA compliance for the study should instead be completed by transitioning to an EIS with a ROD. Portions of the draft EA which remain pertinent and current will be integrated into the draft IFR/EIS, as appropriate. The IFR/EIS culminating in a ROD will enable the agency to develop a more comprehensive and detailed analysis of the study alternatives, cultural, visual, and natural resource impacts (among others), and mitigation proposals, as well as provide enhanced and additional opportunity for resource agency and public input to the process.

Purpose and Need for the Proposed Action: The Charleston Peninsula, South Carolina, is a highly urbanized, relatively flat, low-lying coastal community. It is the historic core and urban center of the City of Charleston. The low elevation and tidal connections to the Charleston Harbor, and Ashley and Cooper Rivers, put the Charleston Peninsula at particular risk of flooding from coastal storms and render it more vulnerable to sea level rise and climate change. The purpose of this proposed action is to reduce risk to human health and safety and reduce economic damages resulting from coastal storm surge inundation on the Charleston Peninsula.

Preliminary Proposed Action and Alternatives: As described in the draft IFR/EA, multiple types of management measures (including structural, nonstructural, and natural or nature-based) were identified to achieve study objectives, take advantage of identified opportunities, and avoid constraints. Management measures were subjected to an initial evaluation assessment and combined into the initial range of alternatives. These were screened against the study's objectives and the four evaluation criteria of the *Economic and Environmental Principles and Guidelines for Water and Land Related Resources Implementation Studies,* resulting in two action alternatives, in addition to the No Action Alternative. Alternative 2 consists of construction of a storm surge wall along the perimeter or nearshore of the peninsula, and nonstructural measures in select areas of the peninsula. Alternative 3 included the measures in Alternative 2 as well as an additional structural measure, the wave attenuator. Since the public release of the draft IFR/EA, Alternative 3 was further refined using modeling and analysis to reduce uncertainty associated with the wave attenuator. This analysis showed that the wave attenuator does not produce additional (incremental) inundation reduction benefits beyond the measures in Alternative 2. Therefore, Alternative 3 is not being carried forward into the final array of alternatives for the IFR/EIS. The final array is expected to include the No Action Alternative and an optimized Alternative 2, now known as the proposed action.

Brief Summary of Expected Impacts: Under this proposed action, the storm surge wall would be strategically aligned to avoid and minimize impacts to existing wetland habitat and cultural resources (substantial avoidance and minimization of wetlands has already taken place as part of the refinement of the proposed action following release of the draft IFR/EA). The wall would be strategically located to allow for continued operation of all ports, marinas, and the Coast Guard Station. The wall would tie into high ground as appropriate, including the existing Battery Wall. Nonstructural measures

would be applied in areas of the peninsula where it is not feasible to construct the storm surge wall. In addition to the storm surge wall and associated access and flow gates, pump stations could be necessary to alleviate interior flooding induced by the wall. Where possible, designs would be modified to adhere to the visual aesthetic of the city.

The draft IFR/EIS will update and expand upon the effects analyzed in the draft IFR/EA which included, but were not limited to, positive and negative impacts to the cultural resources and historic properties, wetlands, visual aesthetics, aquatic and terrestrial resources, water quality, geology, air quality and noise, coastal hydrodynamics, hydrology and hydraulics, recreation, transportation, utilities, socioeconomics, and environmental justice.

Anticipated Permits, Authorizations, Consultations, or Coordination: USACE anticipates that the following will be required for this proposed action:

- Fish and Wildlife Coordination Act Report (already initiated).
- Consultation under Section 106 and Section 110(f) of the National Historic Preservation Act (already initiated).
- Consultations under Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act.
- Clean Water Act: Section 401 Water Quality Certification, Section 404(b)1 analysis.
- Coastal Zone Management Act consistency determination.

Public Scoping Process: During the development of the draft IFR/EA, USACE engaged Federal, State, and local agencies, stakeholders, and the public through various meetings and the NEPA public comment period. On January 31, 2019, a project information meeting was held where the public was informed on the results of the first two planning iterations and input was solicited both in person and via an online form. USACE also solicited public comments on the draft IFR/EA during the public review period, April 20–June 20, 2020. Comments relevant to scoping that were received in response to the draft IFR/EA public comment period will be considered as part of the scoping process for the IFR/EIS, and do not need to be resubmitted. However, all are welcome to submit to USACE updated, additional, or superseding comments relevant to scoping in response to this NOI.

Information regarding the upcoming public scoping meeting, including date and time, is published on the study's website at: *www.sac.usace.army.mil/charlestonpeninsulastudy.*

Request for Identification of Potential Alternatives, Information, and Analyses Relevant to the Proposed Action: USACE requests assistance with identifying any new potential alternatives to the Proposed Action to be considered. Complete submittals of proposed alternatives would include the purpose of the suggested alternative. USACE also requests assistance with identifying any new potential impacts of the Proposed Action, identifying the activity and the potential impact that should be analyzed. Information interested parties possess which would assist in the analysis of resources issues is also appreciated. As noted above, USACE will consider input received on the draft IFR/EA pertinent to the scoping of potential alternatives and impacts. This information will be used in the determination of the scope of issues for analysis in the EIS.

Special Assistance for Public Meeting. The scoping meeting will be virtual. People needing special assistance to attend and/or participate in the meeting should contact U.S. Army Corps of Engineers Charleston District, ATTN: Planning and Environmental Branch, 69A Hagood Avenue, Charleston, SC 29403 or via email to *Chs-Peninsula-Study@usace.army.mil.* To allow sufficient time to process special requests, please contact no later than one week before the public meeting.

Public Disclosure Statement. If you wish to comment, you may use the online form or mail or email your comments as indicated under the **ADDRESSES** section of this notice. Before including your address, phone number, email address, or any other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made available to the public at any time. While you can request in your comment for us to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Jason E. Kelly,

Project Management Professional.

[FR Doc. 2021–05929 Filed 3–22–21; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF EDUCATION

[Docket No.: ED–2020–SCC–0183]

Agency Information Collection Activities; Submission to the Office of Management and Budget for Review and Approval; Comment Request; Application for the U.S. Presidential Scholars Program

AGENCY: Office of Communication and Outreach (OCO), Department of Education (ED).

ACTION: Notice.

SUMMARY: In accordance with the Paperwork Reduction Act of 1995, ED is proposing an extension of a currently approved information collection.

DATES: Interested persons are invited to submit comments on or before April 22, 2021.

ADDRESSES: Written comments and recommendations for proposed information collection requests should be sent within 30 days of publication of this notice to *www.reginfo.gov/public/do/PRAMain.* Find this information collection request by selecting ''Department of Education'' under ''Currently Under Review,'' then check ''Only Show ICR for Public Comment'' checkbox. Comments may also be sent to *ICDocketmgr@ed.gov.*

FOR FURTHER INFORMATION CONTACT: For specific questions related to collection activities, please contact Simone Olson, 202–205–8719.

SUPPLEMENTARY INFORMATION: The Department of Education (ED), in accordance with the Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3506(c)(2)(A)), provides the general public and Federal agencies with an opportunity to comment on proposed, revised, and continuing collections of information. This helps the Department assess the impact of its information collection requirements and minimize the public's reporting burden. It also helps the public understand the Department's information collection requirements and provide the requested data in the desired format. ED is soliciting comments on the proposed information collection request (ICR) that is described below. The Department of Education is especially interested in public comment addressing the following issues: (1) Is this collection necessary to the proper functions of the Department; (2) will this information be processed and used in a timely manner; (3) is the estimate of burden accurate; (4) how might the Department enhance the quality, utility, and clarity of the information to be collected; and (5) how might the Department minimize the

FISH AND WILDLIFE COORDINATION ACT REPORT

Fish and Wildlife Coordination Act Report for the Charleston Peninsula Coastal Flood Risk Management Study Charleston, South Carolina

Charleston District

U.S. Army Corps of Engineers

Charleston Ecological Services Field Office

U.S. Fish & Wildlife Service

Habitat Conservation Division, Southeast Regional Office

NOAA National Marine Fisheries Service

July 2021

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1 Introduction

1.1 Study Purpose

The Charleston Peninsula in South Carolina is vulnerable and at risk to coastal storms as evidenced by past events. The impacts of coastal storms are expected to increase as a result of a combination of sea level rise and climate change over the 50-year study period. Without a plan to reduce damages from coastal storm surge inundation, the peninsula's vulnerability is expected to increase over time. The purpose of the Charleston Peninsula Coastal Flood Risk Management Feasibility Study is to investigate and recommend potential structural and nonstructural solutions to reduce damages and life/safety impacts from coastal storms.

1.2 Authorities

The Charleston Peninsula Coastal Flood Risk Management Feasibility Study is one of multiple Coastal Storm Risk Management (CSRM) studies currently in process throughout the Nation by the U.S. Army Corps of Engineers (USACE). The authority to study coastal South Carolina, including the Charleston Peninsula, was provided in the Rivers and Harbors Act of 1962, P.L. 87- 874, Section 110, and a subsequent Senate Committee Resolution. Section 110 reads in part:

"The Secretary of the Army is hereby authorized and directed to cause surveys to be made at the coastal areas of the United States and its possessions, including the shores of the Great Lakes, in the interest of beach erosion control, hurricane protection and related purposes."

On 22 April 1988, a Senate Environment and Public Works Committee Resolution authorized the Secretary of the Army to study the entire coast of South Carolina pursuant to Section 110.

The Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV, appropriates funding for the study at full Federal expense. As identified under this "Supplemental Appropriation" bill, the study is subject to additional reporting requirements and is to be completed within three years and for $3 million dollars.

1.3 Purpose and Scope of CAR

This Fish and Wildlife Coordination Act Report (CAR) is authorized by the Fish and Wildlife Coordination Act (FWCA) (16 U.S. Code Section 661 through 667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401). It provides for the U.S. Fish and Wildlife Service's (USFWS) involvement in evaluating potential impacts to fish and wildlife resources from proposed water resource development projects, to make recommendations for preventing their loss or damage, and to offer improved measures. The Charleston District of USACE prepared this CAR in collaboration with the USFWS and the NOAA National Marine Fisheries Service (NMFS).

During the early scoping phase of this study, the USFWS and NMFS issued a letter to USACE on January 31, 2019 indicating that a full FWCA investigation was not necessary. This was based on early understanding of the proposed measures being implemented in the urbanized, upland portions of the study area so that the USFWS and NMFS (here out referred to as the Services) suggested that the preliminary alternatives did not represent a significant threat to federally protected threatened or

endangered (T&E) species, Essential Fish Habitat (EFH), or federally managed fishery species. As study scoping continued, USACE determined that it would not be feasible to limit implementation of measures to only the uplands. As a result, the Draft Integrated Feasibility Report/Environmental Assessment (IFR/EA) released in February 2020 included alternatives, and a Tentatively Selected Plan, with proposed measures to be constructed in estuarine waters of the US. In their comments to USACE on the Draft IFR/EA on May 26, 2020, the Services found that a full FWCA investigation and report was now appropriate and recommended, due to the potential for significant impacts to estuarine habitat.

Since study objectives and alternatives have already been defined, and a Draft IFR/EA has already been prepared, USACE and the Services agreed to build upon that work. The primary focus of the CAR is further discovery of information about the types of impacts to fish and wildlife resources from the proposed measures, as well as potential strategies for minimization and mitigation. Since the time that the Draft IFR/EA was released, USACE has completed a period of "optimization," during which steps were taken to refine the alternative plans by reducing costs and impacts to the environment. This resulted in considerable adjustments to the measures that avoided impacts to natural resources where feasible. Measures and alternatives were presented to the Services on September 16, 2020. With avoidance actions for protection of fish and wildlife already considered, this CAR focuses on recommendations for minimizing and mitigating those potential impacts to fish and wildlife resources that remain for the "optimized" alternative plan.

Additionally, the CAR focuses primarily on potential impacts to aquatic and benthic resources, as the potential for adverse effects are most likely in these supporting habitats. Descriptions of upland habitats and terrestrial resources in the study area, and potential effects of the proposed measures on those resources, were included in the Draft IFR/EA. The CAR also focuses on potential permanent impacts to aquatic resources. Most of the temporary impacts expected from construction-related activities were addressed in the IFR/EA, which are expected to be minor with implementation of standard best management practices. However, noise-related impacts on aquatic resources are expanded on in the CAR.

2 Study Description and Tentatively Selected Plan

2.1 Study Objectives

As stated previously, the purpose of this feasibility study is to investigate and recommend potential structural and nonstructural solutions to reduce damages and life/safety impacts from coastal storms. The following objectives have been identified to help achieve the study goal:

- Reduce risk to human health and safety from coastal storm surge inundation on the Charleston Peninsula through the 50-year life of the project.
- Reduce economic damages resulting from coastal storm surge inundation on the Charleston Peninsula through the 50-year life of the project.

2.2 Study Area and Region of Influence

The Charleston Peninsula study area is approximately eight square miles, and is mostly urbanized. It is located between the Ashley and Cooper Rivers, which join off the southern end of the peninsula to form the Charleston Harbor before discharging into the Atlantic Ocean (Figure 1). The Charleston Harbor is a natural tidal estuary sheltered by barrier islands. The peninsula is relatively flat, with nearly all areas

below elevation 20 feet North American Vertical Datum of 1988 (NAVD88). The area has undergone dramatic shoreline changes since the first European settlers arrived in Charleston around 1670, predominantly by landfilling of the intertidal zone on the southern and western side of the peninsula. Tidal creeks that have not been filled and developed have all been altered to varying degrees. While most of the peninsula is developed, 2016 high-resolution landcover data (NOAA 2019) shows that approximately 555 acres of estuarine emergent wetlands, or salt marsh, remain in the study area.

Charleston played an important role in Colonial, Revolutionary, antebellum, and Civil War America. Today, the Charleston Peninsula is the historic core and urban center of the City of Charleston. It is a popular tourist destination and home to approximately 40,000 people, a medical district, multiple colleges, and a port.

The regions of influence (ROI) for assessing environmental impacts of the study were described in the Draft IFR/EA. The ROI for wetlands includes perimeter tidal wetlands, primarily on the Ashley River-side of the Peninsula, that will be directly filled, dredged, excavated or otherwise converted to another use as a result of construction, or indirectly affected through such factors as tidal flow, sedimentation, water chemistry, and erosion.

Tidal wetlands along shorelines directly across waterways from the Charleston Peninsula (Charleston Harbor, Ashley River, and Cooper River) are also in the ROI. To assess impacts to these areas requires additional modeling, which is being conducted as part of the feasibility study. Results are not available at the time of CAR preparation. If adverse effects are determined from the modeling, additional information discovery about impacts to fish and wildlife resources will be needed. If appropriate, potential mitigation measures will be proposed and incorporated into the feasibility study.

For aquatic and benthic resources, the ROI includes the estuarine tidal creeks and mudflats of the Charleston Peninsula, and the adjacent waterways of the Charleston Harbor, lower Ashley River, and lower Cooper River.

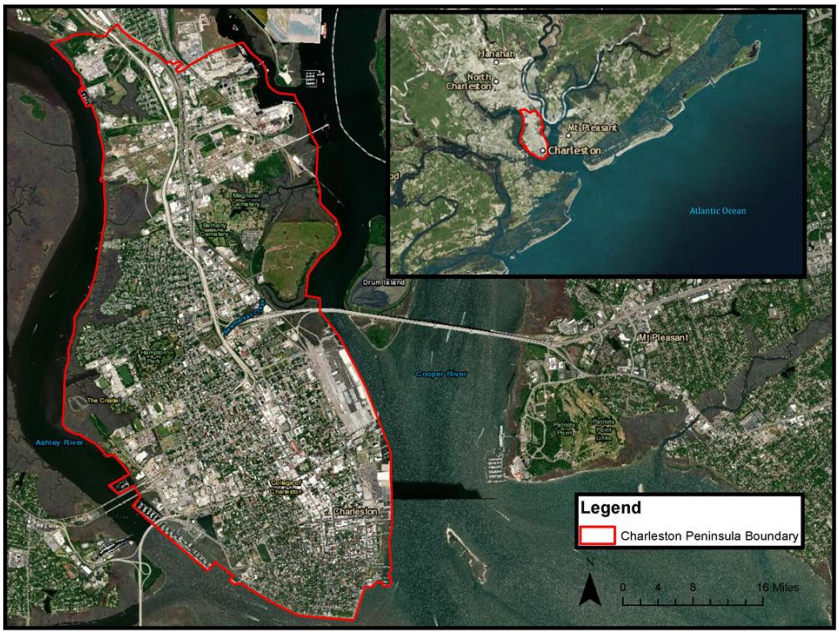

Figure 1. Charleston Peninsula study area, outlined in red.

2.3 Status of Planning Efforts to Date

The scoping phase for the feasibility study started in the fall of 2018. An Interagency Coordination Team was formed for the study, and a planning meeting was held with the City of Charleston, agencies, and stakeholders to get input on problem statements, opportunities, objectives and constraints. A public meeting was also held. A list of possible structural and nonstructural measures and natural or nature-based features was generated. An initial array of eight conceptual alternatives were formulated as a result of the meetings. Several of the alternatives were then screened due to their effectiveness in meeting study objectives, feasibility, cost, and other factors. The final array of alternatives included a no action alternative (or a Future Without Project alternative) and two action alternatives: a perimeter protection + nonstructural alternative, and a perimeter protection + nonstructural + wave attenuating structure alternative. A Draft Integrated Feasibility Study/Environmental Assessment (IFR/EA) was prepared that described the initial array of conceptual alternatives and the final array in detail. Initial costs, engineering, and the potential for adverse environmental impacts of final array of alternatives were evaluated as part of the Draft IFR/EA, which was released with a Draft Finding of No Significant Impact to the public and agencies for review in April of 2020.

Based on feedback from stakeholders and agencies, USACE further refined the action alternatives to optimize their cost effectiveness and reduce environmental impacts after the Draft IFR/EA was released. These were presented to the ICT in the fall of 2020. Also in response to feedback and additional analyses, USACE determined that significant adverse effects may result from the action alternatives, so a Draft Integrated Feasibility Report/Environmental Impact Statement (IFR/EIS) is now being prepared for the study in accordance with the National Environmental Policy Act.

2.4 Tentatively Selected Plan

At the time of preparation of this CAR, the Tentatively Selected Plan that is being carried forward in the Draft IFR/EIS is action alternative 2, which proposes construction of a storm surge wall of 12 ft elevation NAVD88 along portions of the perimeter of the peninsula, and nonstructural measures in the form of elevating and flood proofing for a limited number of structures. Approximately 7.1 non-continuous miles of the perimeter storm surge wall would be constructed on land; approximately 1.5 non-continuous miles would be constructed through saltmarsh wetlands. The wall would be constructed of concrete, and on land it would be a T-wall design and in the marsh it would be a combination design (these designs were described in the Draft IFR/EA and are being updated in the Draft IFR/EIS). For the combination wall, 12x12 ft prestressed concrete sheet piles are being proposed that would be battered at an inclination from vertical, typically at 5 to 30 degrees from vertical, using a hammer.

The optimized Tentatively Selected Plan is also being updated in the IFR/EIS to reflect the use of 5 permanent and 5 temporary pump stations of low to moderate size, ranging from 20 to 90 cfs; a series of upland access gates for pedestrians and transportation; and storm surge gates in the form of sluice gates to allow for tidal exchange at creeks and drainage channels in a few locations (several peninsula creeks do not fall within the footprint of the wall and will not be impacted). Five storm surge gates would be installed in the combination wall at Halsey Creek. Five storm surge gates would be installed at existing culverts where creeks or channels pass under roads. A walking path is also planned on top of portions of the storm surge wall where it is on land. This plan was determined to be the National Economic Development Plan (meaning it maximizes the storm risk reduction benefits for the cost) and

to have the least environmental impacts of the action alternatives in the Draft IFR/EA, but is still the tentative plan for the Draft IFR/EIS; USACE has not determined a Recommended Plan yet.

2.5 Summary of Proposed Mitigation

A Draft Mitigation Plan was prepared as part of the Draft IFR/EA for initial comment. It proposed a number of best management practices to reduce temporary environmental impacts during construction. With respect to aquatic resources, the Mitigation Plan also explained that the study will avoid and minimize placement of the storm surge wall in the aquatic environment to the maximum extent practicable, except where placement is necessary for effective storm risk management. This has been demonstrated through USACE's optimization efforts of the alternatives. Placement of hydraulic pumps in the aquatic environment will also be avoided except where determined necessary to minimize interior flooding induced by the storm surge wall.

The Mitigation Plan indicated that permanent, direct losses of saltmarsh wetlands (including intertidal flats) from the storm surge wall that cannot be avoided would be compensated. This included a buffer area on both sides of the combination wall. Additionally, losses in saltmarsh wetlands landward from the storm surge wall that cannot be practicably minimized will be compensated, as well as those wetlands functions lost after minimization.

To promote resilience to saltmarshes and minimize adverse impacts that may occur seaward of the storm surge wall, construction of living shorelines along the associated marsh shorelines has been proposed.

Additional minimization measures for adverse impacts to aquatic and benthic resources are being explored as part of the new IFR/EIS.

3 Current Fish and Wildlife Resources

3.1 Current Resources

Many species of aquatic and benthic resources including invertebrates, fish, and a few sea turtles and marine mammals can be found in the ROI, in varying proximity to the study area. There are also species of birds that depend on coastal habitats found in the study area. Some of these resources are listed as threatened or endangered species under the Endangered Species Act of 1973, as amended (16 USC §1531), for which the Services have jurisdiction. Table 1 shows the federally-listed aquatic and avian species that could be found in the ROI. There are also five species of whales listed as endangered, the endangered hawksbill sea turtle, the threatened giant manta ray, and the threatened oceanic white tip shark that can be found in offshore waters of South Carolina, but are not likely to be in the ROI for this study. Terrestrial wildlife in the ROI and potential impacts from the alternatives are presented in the Draft IFR/EA.

Table 1. Federally-listed Threatened and Endangered Species Under Jurisdiction of the Services in the Study's Region of Influence

Species Common Name	Scientific Name	Status
Atlantic sturgeon*	*Acipenser oxyrinchus*	E, CH
Shortnose sturgeon*	*Acipenser brevirostrum*	E
American wood stork**	*Mycteria americana*	T
Eastern black rail**	*Laterallus jamaicensis jamaicensis*	T
West Indian manatee	*Trichechus manatus*	E
Green sea turtle	*Chelonia mydas*	T
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Loggerhead sea turtle	*Caretta caretta*	T, CH

Key:

E - Endangered T - Threatened CH - Critical Habitat

* These species are under the sole jurisdiction of National Marine Fisheries Service

** These species are under the sole jurisdiction of US Fish and Wildlife Service

Sources: NOAA 2020; USFWS IPaC (n.d.)

3.1.1 Marine Benthic Macroinvertebrates

Marine benthic macroinvertebrates of the ROI are found living in or on the bottom of tidal creeks, tributaries and tidal flats. Marine benthic macroinvertebrates fall into two benthic communities. Epifaunal communities live attached to surfaces such as rocks, pilings, or on the surface of the bottom. Infauna communities burrow and live within benthic sediments. Macroinvertebrates sort within the tidal zones by habitat stressors such as benthic sediment size, soil salinity and wave energy (Sanger and Parker 2016).

Marine benthic macroinvertebrates are a primary food source for larger, economically important crustaceans and fish. Their size, abundance, and species diversity are valuable indicators of surrounding environmental conditions (Sanger and Parker 2016). Typical marine benthic macroinvertbrates that could be found in the ROI include mollusks, polycheates, oligochaetes, nematodes, and amphipods.

3.1.2 Invertebrates

Common aquatic invertebrates found in waterways and salt marshes in the ROI include penaeid shrimp, grass shrimp (*Palaemonetes vulgaris*), blue crabs (*Callinectes sapidus*), horseshoe crabs (*Limulus*

polyphemus), knobbed whelk (*Busycon carica*), eastern oysters (*Crassostrea virginica*), ribbed mussels (*Geukensia demissa*), hard clams (*Mercenaria mercenaria*), Eastern mud snails (*Ilyanassa obsolete*) and marsh periwinkles (*Littoraria irrorata*) (Sanger and Parker, 2016). Some of these organisms rely entirely on salt marsh-tidal creek systems, while others such as penaeid shrimp and blue crabs are transient and use them as nursery grounds. Many of these species are economically important in South Carolina. More information on habitat significance of salt marshes for invertebrates can be found in Section 3.2.

3.1.3 Fish

Common demersal fish that can be found in waters of the ROI include Atlantic croaker (*Micropogonias undulates*), bay anchovy (*Anchoa mitchilli*), mummichog (*Fundulus heteroclitus*), red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), silver perch (*Bairdiella chrysoura*), spot (*Leiostomus xanthurus*), spotted seatrout (*Cynoscion nebulosus*), Atlantic menhaden (*Brevoortia tyrannus*), blackcheek tonguefish (*Symphurus plagiusa*), and southern flounder (*Paralichthys lethostigma*) (Sanger and Parker, 2016). Several of these species, such as red and black drum, flounder, spot, and spotted sea trout have commercial and/or recreational value. Threats to many of these species include habitat loss, pollutants, and degraded water quality.

Two federally protected fish species also commonly occur in the Charleston Harbor and the Cooper River. As noted in Table 1, they include the shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*Acipenser oxyrhynchus*). Shortnose sturgeon spend most of their time as adults in fresh and brackish water but do venture into lower coastal reaches and the ocean on rare occasions. Atlantic sturgeon is a subtropical, anadromous species that typically migrates up rivers in the late summer to fall in this region to spawn. Both are bottom feeders. Historically, over-fishing affected sturgeon populations. Current prominent threats to these species include habitat loss or fragmentation, dredging, migration/passage barriers, decreased water quality, and entanglement in fishing gear, as well as vessel strikes for Atlantic sturgeon. Shortnose sturgeon are currently found in the Cooper River, and the Carolina Distinct Population of Atlantic sturgeon is found throughout the Charleston Harbor, with portions of the Cooper River designated at Critical Habitat for the Atlantic sturgeon (NOAA, n.d.). Both species have also been found in Ashley River. Tagging and tracking by the SCDNR of shortnose and Atlantic sturgeon confirm movement throughout the Charleston Harbor, and in the Cooper River with the highest usage of the Cooper River by shortnose sturgeon roughly between river km 30 and 45 where the freshwater-to-saltwater interface occurs. This is well upstream of the study area. Adult and sub-adult Atlantic sturgeon in the Cooper River are believed to be transient populations from other river systems.

Cartilaginous fishes, such as the Atlantic stingray (*Dasyatis sabina*) and the bonnethead shark (*Sphyrna tiburo*), can also be found in the ROI. Sharks move into estuaries in the spring, and then move offshore in the fall.

3.1.4 Marine Mammals

Marine mammals known in the ROI include bottlenose dolphin (*Tursiops truncates*) and West Indian manatee (*Trichechus manatus*). Both are afforded Federal protection under the Marine Mammal Protection Act (MMPA) of 1972, as amended (16USC 1461).

There are two recognized subspecies of the West Indian manatee; the Antillean manatee (*Trichechus manatus manatus*) and the Florida manatee (*Trichechus manatus latirostris*). The Florida manatee inhabits the Southeastern coast of the United States, however both subspecies are commonly referred to as the West Indian manatee. As noted in Table 1, the West Indian manatee is a federally-listed threatened species. Manatees can inhabit both salt and fresh waters and are found at shallow depths (5-20'). In the waters of the continental US, they and are most abundant in the warm waters of peninsular Florida. During the summer months manatees on the eastern coast of Florida have been reported to travel as far north as Cape Cod, Massachusetts (USFWS 2008). Manatees that inhabit and travel through South Carolina waters during the warmer months will feed on salt marsh grasses at high tide and submerged algae beds at low tide. Manatees have been sited near the Charleston Peninsula in the Cooper River, the Ashley River, the Atlantic Intracoastal Water Way, and Shem Creek; a tidally influenced saltwater creek that drains directly into Charleston Harbor before draining into the Atlantic Ocean.

While common bottlenose dolphins can be found in nearshore coastal waters and estuaries of the Atlantic Coast from New York to Florida, a resident single-stock of bottlenose dolphins inhabits the Charleston Harbor and main channels of the Ashley, Cooper, and Wando Rivers. The Charleston Estuarine System (CES) Stock spans the estuarine waters and tributaries from Price Inlet (near Capers Island) to the Stono River. The stock is threatened by entanglement with blue crab traps/pots and other fishing gear, disease, and urban pollution, especially in the tidal rivers more so than in the open waters of the Charleston Harbor (NOAA 2016). Bottlenose dolphins, who fall into the mid-frequency generalized hearing range for cetaceans of 150 Hz to 160 kHz, are susceptible to hearing impacts from underwater noise (NOAA, 2018). The size of the CES Stock is currently unknown, but it is considered to be a "strategic stock under the MMPA" (NOAA 2016).

3.1.5 Sea Turtles

There are four species of sea turtles known to occur in or near waters of Charleston, SC, all of which are federally-listed as threatened or endangered species (see Table 1): Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*) and green (*Chelonia mydas*). Leatherback sea turtles, found in offshore waters, and Kemp's ridley sea turtles, found in nearshore waters, could be but are less likely to be, in the ROI. Loggerhead and green sea turtles are the most common species in South Carolina waters, and their distribution at different life stages varies including offshore waters, bays, inlets, river mouths, salt marshes, creeks, ship channels, and sandy beaches for nesting. Subadult and adult loggerheads move into coastal waters, such as Charleston Harbor, to prey on mollusks, crustaceans, and fish (USFWS 2015). Studies done in Virginia and Delaware show loggerhead sea turtle eating preference to be horseshoe crab, then blue crab, then finfish. Ultimately, reduction of salt marsh acreage could lead to alteration of the loggerhead sea turtle food web (Boutin & Targett, 2013; Seney & Musick, 2007).

A trawling study conducted within the Charleston Harbor shipping channel between 2004-2007 showed that loggerhead sea turtles are present in the channel in increased numbers, and are of increased size, compared to the early 1990s (Arendt et al, 2012). Although loggerheads and greens could be found in the Cooper and Ashley Rivers, they are unlikely to wander into the shallow, altered tidal creeks of the peninsula.

Threats to sea turtles include vessel strikes, dredging, fishing by-catch and entanglement, degradation of foraging habitat, pollution, and disease. They are also threatened by various natural and anthropogenic impacts to their nesting habitat, such as beach erosion, beach armoring, artificial lighting, and nest predation. In the Charleston area, Critical Habitat for nesting loggerhead sea turtles has been federally-designated for Folly Beach and Morris Island, but these are well outside of the ROI.

3.1.6 Birds

Tidal marshes and flats harbor many species of birds including larger wading birds such as herons and egrets as well as smaller birds like redwing black birds and seaside sparrows. Marshes serve as nesting and foraging grounds for these and other birds. Foraging may occur at various tidal stages with birds seeking small fish and crabs, the marsh periwinkle (*Littorina spp*.), and other macroinvertebrates as described in 3.1.1. Of particular interest for this study are two species that are listed as threatened under the ESA (see Table 1): the American wood stork and eastern black rail (BLRA). The BLRA was officially listed in 2020.

The American wood stork is a long legged water bird species that uses freshwater and estuarine wetlands as feeding, nesting, and roosting sites. The stork constructs nests in trees, usually in gregarious colonies (called rookeries). Often the rookeries and roosting areas are in association with herons, egrets, and other species. Stork feeding behavior is typically along the marsh vegetation and open water interface seeking small fish and macroinvertebrates (USFWS, 1990). The existing tidal wetlands on the Peninsula could serve as potential foraging habitat for the wood stork, but there are no known roosting areas or rookeries.

While wood storks are habitat generalists, foraging and reproductive grounds are decreasing due to encroaching development. Additionally, storks are especially sensitive to environmental conditions at breeding sites and may fly relatively long distances either daily or between regions annually seeking adequate food resources (USFWS, 1990).

The BLRA is a wetland dependent bird found in a variety of salt, brackish, and freshwater wetland habitats that can be tidally or non-tidally influenced requiring dense overhead cover and soils that are moist to saturated (occasionally dry) and interspersed with or adjacent to very shallow water. The BLRA nests within dense clumps of vegetation over moist soil or shallow water to provide shelter from the elements and protection from predators. The primary threats to the eastern black rail included habitat degradation through marsh draining and ditching as well as fragmentation from conversion of habitat to agricultural lands or urban areas (USFWS, 2019). Presence of BLRA in the study area is questionable since the marsh habitat has varying tidal fluctuations, but the possibility remains for this recently-listed species (M. Caldwell, USFWS personal communication).

3.2 Supporting Habitats

3.2.1 Wetlands

Many of the species described above are supported by tidal wetlands found along the Lower Ashley and Lower Cooper Rivers. Habitats include emergent tidal marshes dominated by cordgrass (*Spartina alterniflora*) and black rush (*Juncus roemerianus*), as described in the Wetlands section of the IFR/EA.

While high marsh is limited in the study area, it typically includes sea oxeye (*Borrichia frutescens*), salt grass (*Distichlis spicata*) and salt meadow hay (*Spartina patens*), along with scrub shrub wetlands that support wax myrtle (*Myrica cerifera*), salt marsh elder (*Iva frutescens*) and groundsel tree (*Baccharis halimifolia*) (Sanger and Parker, 2016). The tidal creeks and tributaries in the study area, along with their adjacent saltmarshes and oyster reefs are designated Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) because they provide nursery habitat for juvenile development of penaeid shrimp, specifically white and brown shrimp. These habitats are also considered a Habitat Area of Particular Concern for fishes in the snapper-grouper complex. The snapper-grouper complex includes ten families of fishes containing 73 managed species. The Habitat Area of Particular Concern includes the areas of depth inshore of the 100-foot contour in Charleston Harbor. The habitat designation is specific to nearshore snapper-grouper species and target life stages that are estuarine dependent (NOAA 2020b).

3.2.2 Tidal Flats

Tidal flats are the foundation for coastal wetlands as they accumulate sediments on gently sloping beds in estuaries or other low energy marine environments. Tidal flats are important to intertidal chemistry as they recycle organic matter and nutrients from both terrestrial and marine sources. They are also areas of high primary productivity and can support an abundance of microorganisms, benthic organisms, fin fish, shellfish, and wading birds.

Tidal flats can be differentiated by tidal elevation zones. Supratidal flats are found in the supratidal elevation zone. This is the tidal zone above high tide. Intertidal flats are found in the intertidal elevation zone. This is the tidal zone between high and low tides. The Intertidal flats are non-vegetated, soft sediment habitats composed of fine-grained sediments (e.g. mud). Subtidal flats are found in the subtidal elevation zone. This is the tidal zone that is below low tide and is rarely exposed to the atmosphere. The subtidal flats are generally made up of larger grained sediments such as sand and are found lower in the tidal zone. The submerged ocean floor of Charleston Harbor is made up of unconsolidated sediments and is considered deep water habitat. Subtidal flats and the ocean floor in the ROI are considered EFH. These areas are designated EFH to protect marine benthic macroinvertebrates in support of economically important marine resources.

3.2.3 Water Column

The water columns of the Charleston Harbor, the lower Ashley River and the lower Cooper River are also considered EFH. They serve as the connecting water bodies between inshore estuarine nursery grounds and offshore marine habitats used for spawning and growth to maturity of several marine species.

4 Future Fish and Wildlife Resources

If current trends in land use and climate change continue into the future, aquatic resources in coastal South Carolina will continue to be affected. Over the past several decades, habitats within South Carolina have become increasingly fragmented. Habitat decline, increases in invasive species, shifting climate regimes and salinity profiles, increasing development in coastal areas, and rising sea levels represent constraints and barriers to dispersal and migration of fish, wildlife and plant species. Migratory corridors are essential for the ability of wildlife and fishes to find suitable habitat and for population maintenance. Habitat loss is the most important factor contributing to species decline (SCDNR, 2021).

4.1 Land Use

Increased development within coastal watersheds leads to increased salinity ranges, increased nutrient loading, bacteria and pathogens, and contaminants in tidal creeks that impair oyster health, reduce biological productivity, and alter the food web. The intertidal headwater areas of tidal creeks in small coastal watersheds are especially sensitive to changes in land use. When these small watersheds are characterized by 20-30% impervious surface, ecological processes in tidal creeks are impaired (Sanger, et al., 2015). All of the tidal creeks on the Charleston Peninsula would meet this classification. For example, New Market Creek drains only a 199 ha area that contains 70% impervious cover (Sanger, et al., 2015).

4.2 Climate Change

Estuaries and the species they support are at risk from climate change impacts such as changes in temperature, sea levels, salinity, dissolved oxygen levels, and ocean acidification. Table 2 summarizes some of the potential impacts and consequences of climate change.

4.2.1 Temperature

Current climate models predict continued warming across the southeast United States, with the predicted temperature increases in the summer months ranging between 4.5°F and 10.5°F. Higher temperatures create a higher risk of drought as rates of evapotranspiration increase leading to increased frequency, duration, and intensity of drought in the coming years. Warmer ocean temperatures can provide more energy to hurricanes creating conditions for more intense storms adding to flooding concerns. Though temperatures are trending upward, temperature days below freezing are slightly increasing in South Carolina. Temperature change is expected to shift species and their habitats in both time and space affecting species diversity and interactions at all trophic levels. Temperature has a direct effect on the physiology, maturation, and survivability of aquatic species whose metabolic rates fluctuate with environmental temperature. Temperature changes will likely affect the rate of energy transfer between the trophic levels as well. The timing and extent of species distributions and migration could also be affected by warming waters (SCDNR, 2021).

4.2.2 Sea Level Rise

It is anticipated that sea level rise will accelerate within the next 100 years. The Cooper River Entrance Tidal Gage (8665530), also known as the Charleston Harbor or Custom's House gage, is the most extensive and continuous record of tides for the City of Charleston. The Charleston Harbor tide gauge has been measuring sea level continuously since 1921. In that nearly 100-year time span, local sea level has risen 1.07 ft (NOAA, n.d.). One way to track local impacts from sea level rise is documenting "minor coastal flooding." Commonly called nuisance, sunny day, or high tide flooding, "minor coastal flooding" is a threshold from the National Weather Service that indicates when the tide has reached a certain height (7.0 ft. MLLW in the Charleston Harbor). At this height, low-lying areas on land begin to flood. For example, Lockwood Blvd begins to flood at 7.2 ft. MLLW (or 4.06 ft. NAVD88).

Potential impacts of rising sea level on total water levels along the South Carolina coastline include overtopping of waterside structures, increased shoreline erosion, and flooding of low lying areas. As sea levels rise, storm surge will extend farther inland and deeper. The predicted flood hazard will also increase and more areas will be flooded more often with high tides and King Tides.

Sea level rise will also affect coastal habitats such as estuaries, creeks, marshes, dunes and beaches by modifying patterns of sea water encroachment, flooding, erosion and deposition. It will also affect fish and wildlife species that depend on these habitats. As discussed in Section 3.2, estuarine flats, salt marshes and creeks are essential habitat for the juvenile stages of many marine species that are important fisheries. These habitats also sustain other small species that serve as prey for crabs and birds. Rising sea levels could contribute to a reduction in the area of intertidal marsh available, especially if coastal development impedes their inland expansion in response to inundation. This could also be limiting for shellfish beds if they cannot migrate landward, or they become destabilized through other habitat changes (SCDNR, 2021). Due to the urbanized nature of the Charleston Peninsula, there are already limited places were existing perimeter salt marsh and oyster reefs can migrate inland, if the sea level rise trends that NOAA predicts continue.

4.2.3 Salinity

Estuarine systems are at risk to impacts of climate change as a result of changes in sea level and variation in rainfall that may shift salinity profiles and changes in biotic composition. Rainfall and streamflow are tied directly to seasonal climatic conditions and shifts in salinity profiles in the estuarine system depend entirely upon freshwater input and rainfall. Changes in the location of the saltwater/freshwater interface will affect many freshwater and diadromous fish species. Saltwater will move further up the river systems as sea level rises. The success of species with low salt tolerances and diadromous fish will be limited by their ability to move upstream into better quality habitat due to habitat fragmentation (SCDNR, 2021).

In South Carolina, the past decade has been dominated by drought conditions accompanied by shifts in species distribution within estuaries. Changes in biotic composition and the prevalence of disease are expected to continue. Salinity profiles in estuaries are expected to change as a result of both sea level rise and changes in precipitation patterns. Sea level rise accompanied by drought will push salinity regimes up estuaries and landward compressing the available habitat. Coastal development will add to habitat compression resulting in reduction of saltmarsh habitat in the optimal salinity ranges. Estuarine species are able to tolerate salinity shifts over a tidal cycle, but they have optimal ranges and move in accordance with prevailing conditions. Sea level rise accompanied by drought would also lead to a reduction in abundance and reproduction of estuarine species that could affect all trophic levels. Extended drought leads to drying out and dieback of coastal marshes as a result of acidification of the estuary. Salt marsh dieback will reduce primary productivity and increase vulnerability to predators of juvenile fishes and invertebrates due to reduction in cover (SCDNR, 2021).

4.2.4 Dissolved Oxygen

Oxygen levels in coastal waters can also be affected by increasing temperatures and decreasing the solubility of oxygen, increasing primary productivity, and stratifying the water column. These factors can result in dead zones in coastal and estuarine waters. Hypoxia often is the result of increased nutrient run-off coupled with a stratified water column impacting benthic or demersal species that can result in losses to important fisheries. Numerous dead zone events have occurred in South Carolina during the last two decades, although most have occurred in small estuarine creeks for short durations. Only a few large events have been experienced. Increased occurrences of coastal hypoxia could result from climate-induced changes in ocean and wind circulation patterns (SCDNR, 2021).

4.2.5 Ocean Acidification

Increasing ocean acidification (decreasing pH) is related to increasing carbon dioxide levels in the Earth's atmosphere. Further deceases in pH can result from increasing acid rain and development within the coastal zone. The effects of low pH become greater as temperatures rise. In South Carolina, the concern is for the impact of ocean acidification on oysters, crustaceans, and primary producers. Decreased pH is known to impact a variety of physiological and immune functions in these aquatic organisms (SCDNR, 2021).

Table 2. Climate Change Impacts, and Consequences as Identified by the SCDNR Climate Change Technical Working Group (adapted from SCDNR, 2021).

Potential Impacts	Potential Consequences
• Changes in precipitation cycles increasing evapotranspiration (e.g. frequency and duration of droughts) • More problems with invasive species • Spatial changes in species' ranges • Changes in timing of aquatic organism migration and competition for available resources as food chains are altered • Increased coastal flooding • Increased coastal erosion • Rising water tables • Saltwater intrusion • Increased nonpoint source pollution • Increases in toxic substances flowing from upstream to coastal areas • Increases in numbers of threatened and endangered species	• Decline in water quality and quantity • Surface and sea-water pH changes • Decline in productivity and availability of fish and other aquatic species • Economic losses directed toward business associated with natural resource management in coastal zones • Loss of beaches • Increased storm surge flooding • Impacts to coastal infrastructure • Salt marsh conversion to open water • Freshwater marsh conversion to salt marsh • Loss of important recreational and commercial fishing and shell fishing habitats • Extinction of threatened and endangered species

5 Potential Impacts of the Tentatively Selected Plan on Fish and Wildlife Resources

The goals of coastal storm risk management projects are to improve life safety and reduce property damages resulting from storms. Historically, beach nourishments and traditional coastal defense structures such as groins, seawalls, revetments, breakwaters and jetties have been used to reduce wave action and erosion along ocean-facing shorelines. The impacts of implementing these measures have been studied over time and their impacts on fish and wildlife resources are generally understood.

Coastal risk management projects are, increasingly, considering the use of traditional riverine flood control structures, such as levees and flood walls, to address storm surge along coastal shorelines. Hardened structures in these situations may be placed in the estuarine environment where the resulting impacts on estuarine fish and wildlife resources are not as well understood.

What is known about hardened structures, such as bulkheads, in estuaries is that they can cause damage to natural landforms. Hardened structures can interfere with the natural transport of sediments. They can lead to loss of wetlands. They can be visually undesirable, and they can restrict recreational access (Rangel-Buitrago et al., 2017). Numerous studies show that placing structures in tidal creek-salt marsh networks alter the food web by reducing biological productivity, changing species composition, abundances, and diversity. Hardened structures can directly affect sessile biota and indirectly shape amphipod assemblages causing cascading effects (Sedano et al., 2020; Sanger et.al., 2015).

5.1 Storm Surge Wall

While the perimeter storm surge wall proposed in the TSP is not designed the same as a seawall on a beach, nor for the same purposes as a bulkhead, its interactions with the estuarine environment may be similar. Seawalls and bulkheads are artificial coastal defense structures that fortify soft-shore coastlines into static, hard structures for the primary function of preventing shoreline erosion. The introduced hard surface associated with such structures is less dynamic than the substrate they replace. They can lead to intertidal habitat change and habitat loss as the area normally flooded by the tide is limited by the structure. This can cause a shift in the benthic community resulting in a significant decline in the abundance, biomass and size of organisms, including macroinvertebrates, in the tidal zone where the structure is located (see more below). Working up the food web, these alterations can affect the species richness and abundance of shorebirds as they rely on near shore habitat for food and rearing young (Schoonees, et al., 2019).

The design profile of a seawall can also artificially create steeper slopes in the environment. These steeper slopes find organisms that used to live in different vertical zones to be in much closer proximity to one another. This change in proximity causes change in ecological interactions as they are, now, competing for resources in an altered stress environment. This competition typically results in alterations in the food web by altering species composition and abundance (Schoonees et al., 2019).

Seawalls reflect wave energy seaward. The reflection can create turbulence, capable of suspending sediments, leading to increased erosion, or scour, at the foot of the wall (Bush et al 2001; Walton and Sensabaugh, 1979). The scouring can impact the tidal mudflat habitat and reduce water clarity. The impact on the outer edge of the marsh may be even greater. A 2018 thesis study looked at the long-term effects of bulkheads on salt marsh loss in North Carolina, including the role of wave energy on marsh loss (Burdick, 2018). Rates of outer edge marsh loss were observed to be higher when adjacent to bulkhead sites than to natural shorelines. The rates were not significantly different under different wave energy regimes (high, medium, low).

The storm surge wall and gates, as proposed in the TSP, could also have similar environmental effects in the aquatic environment as roads and culverts do. Road networks, including culverts, are the primary mechanism for changing the volume and timing of peak flows in a watershed. Roads and ditches transport water through systems more quickly concentrating flow, and culverts and dikes constrict the

flow. The result is increased stream power that erodes channel beds and banks. Incising or aggrading of the channel can occur around the culverts (Castro, 2003). Culverts impact aquatic (and terrestrial) species by disrupting the longitudinal continuity, or connectedness, of the channel. They can be passage barriers for aquatic resources due to high velocities, shallow depths, reduced lengths of resting areas, or excessive height (Castro, 2003). In tidal creek-salt marsh systems, culverts could mean limited access to nursery habitat for fish, shrimp and crabs.

5.2 Storm Surge Gates and Tidal Exchange

This section reviews the few studies that could be found that examine the changes in tidal flow from water control structures or flow gates in estuaries, and their indirect impacts on vegetation, fish and wildlife resources, and water quality.

5.2.1 Changes in Tidal Inundation on Vegetation

The vertical distribution of tidal zone species has been attributed to species preference to environmental stressors such as soil salinity and tidal chemistry. These stressors are strongly determined by the elevation of the tidal zone in which the species occur. De Leeuw et al. (1994) studied the effects of a sluice gate installation on tidal zone vegetation at the mouth of the Oosterschelde Estuary, The Netherlands, where the tidal range is 11-12 ft (double the tidal range found in the Charleston Harbor). The sluice gate reduced the width of the mouth of the estuary and decreased the inundation frequencies. They reported that extreme reduction in tidal inundation can reduce the salinity of the soils and alter tidal zone vegetation composition. They found that infrequently inundated intertidal zone sediments displayed a lower salinity in the seasons when rainfall exceeded evapotranspiration. In their study, rainfall exceeded evapotranspiration 3 of the 4 seasons. They found that habitat upland of the sluice gate was more suitable for annual vegetation establishment than it was for perennial vegetation establishment. The authors speculated that seeds of annual species were able to germinate at a faster rate under low salinity conditions than perennial species. When tidal flats were once again inundated with tide waters, the salinity favored perennial species and they were able to reestablish (De Leeuw et al., 1994).

5.2.2 Changes in Tidal Inundation on Marine Organisms

(All the information in this section comes from Ritter et al., 2008.)

Ritter et.al. (2008) compared estuarine habitats with unrestricted and artificially restricted tidal flows due to employment of water control structures in Elkhorn Slough, Central California, USA. It should be noted that while the tidal range in this estuary is similar to the Charleston Harbor, Elkhorn Slough experiences mixed diurnal tides and Charleston Harbor has a semi-diurnal tide exchange. In Central California, there are also distinct wet and dry seasons.

Water control structures can permit a tidal flow gradient that extends from substantial tidal influence to minimal tidal influence. The investigators sampled a broad variety of marine organisms and water quality parameters then compared community composition patterns and responses to the varying gradients of tidal restrictions within this single estuary. To compare organism responses, they placed organisms into three different habitat categories and three different tidal exchange categories: estuarine /brackish, marine/coastal, or terrestrial/freshwater habitats and “full”, “muted” or moderately restricted, or “minimal” tidal exchange categories, respectively. The muted tidal exchange would be

similarly classified for the proposed storm surge wall and sluice gates in the Charleston Peninsula Coastal Flood Risk Management Study.

Community Composition

Ritter et.al. (2008) found that there were differences between community composition in the three tidal exchange categories. In the algal community, there were significant differences (95% confidence interval) between the algal community composition in the minimal tidal exchange and the full and muted tidal exchange. In the invertebrate community there were significant differences between the invertebrate community composition in the minimal tidal exchange and the full and muted tidal exchange. There were marginal differences (90% confidence interval) in the invertebrate community composition between the full tidal exchange and the muted tidal exchange. In the fish and crab community there were significant differences between the minimal tidal exchange and the full and muted tidal exchange. There were no significant differences between the fish and crab community composition in the full tidal exchange and the muted tidal exchange.

In the plant community, at the marsh-upland ecotone, there were marginal differences between the plant community composition in the muted tidal exchange and the minimal and full tidal exchange. There were no significant differences between the plant community composition at the marsh-upland ecotone in the minimal tidal exchange and the full tidal exchange. There were marginal differences between the community composition of organisms found on artificial surfaces in the full tidal exchange and the muted tidal exchanges (no minimal tidal exchange sites were assessed). There were significant differences between the bird community composition in the minimal tidal exchange and the full and muted tidal exchanges. There were significant differences between the shorebird community composition in the full tidal exchange and the minimal tidal exchange, but no differences between the shorebird community composition in the muted tidal exchange and the minimal and full tidal exchange. There were significant differences between the mammal community composition in the minimal tidal exchange and the full and muted tidal exchanges.

Ritter, et.al. (2008) also found that large culverts, which were present at some of the sites, created muted tidal exchanges that allowed for colonization of muted habitats by muted aquatic organisms. At minimal tidal exchange sites, they found that biotic communities were different from communities in the full and muted tidal exchange sites, possibly due to differing environmental conditions resulting from structural barriers. They also concluded that birds and upland plant movement is not restricted by water control structures as their dispersal mechanisms are able to clear the barriers.

Community Structure

Community structure is the number of species present and their relative abundance. Certain species emerged as significant in explaining differences between community structure in the three tidal exchange categories in the Ritter, et.al. (2008) study. Western/least sandpipers, sanderlings, Olympic oysters, salt grass, alkali heath, three-spine sticklebacks, long-jaw mudsuckers, and poison hemlock were the significant species contributing to differences in community structure between the full and muted tidal exchange categories. Gulls, long-billed curlews, Japanese mud snails, amethyst gem clams, European shore crabs, yellow shore crabs, water boatmen, fleshy jaumea, California brackish snails, and poison hemlock were the significant species contributing to differences in community structure between full and minimal tidal exchange categories. Long-billed curlew, staghorn sculpins, Japanese mud snails,

European shore crabs, yellow shore crabs, water boatmen, soft chess, salt grass, alkali heath, and curly dock were the significant species contributing to differences in community structure between muted and minimal tidal exchange categories.

For plant community structure, they found marginal differences between the plant community structure in the muted tidal exchange and the minimal and full tidal exchanges. There were no differences between the plant community structure in the minimal tidal exchange sites and the full tidal exchange sites.

Ritter, et.al. (2008) concluded that tidal restrictions accentuate the natural sea-to-land gradient of key physical factors. These restrictive structures affect environmental conditions leading to differences in habitat structure and water quality. Restricted sites in this study had far less area of intertidal mudflats than did the full tidal exchange sites. This may explain the lower frequency of most shorebird species in restricted tidal exchange sites (both minimal and muted exchange) versus the full tidal exchange sites.

Midge larvae and sinistral snails were found, only, in minimal exchange sites. Most of the marine algae and invertebrates were found in the minimal exchange, as well.

Species Richness

Species richness is the number of different species present in a community. Ritter, et.al. (2008) found that a mosaic of tidal exchange categories maximizes estuary-wide species richness. They also found that species richness was greatest in the full tidal exchange, then muted tidal exchange, and lowest at the minimal tidal exchange. Primary producers and invertebrates were more common across all tidal exchange categories than fish or birds. Primary producer species were greater in the full and minimal tidal exchanges and lower in the muted tidal exchange. Invertebrate species were greatest in the full tidal exchange, then in the muted tidal exchange, and lowest in the minimal tidal exchange. Bird species were greatest in the muted tidal exchange than they were in the full and minimal tidal exchanges. Fish species were greater in the full and muted tidal exchanges than in the minimal tidal exchange.

Species Richness Patterns by Habitat and Tidal Exchange Categories:

Species richness for terrestrial and freshwater species was greatest in the minimal tidal exchange, then the full tidal exchange, and lowest in the muted tidal exchange.

Species richness for estuarine species was greatest in the full tidal exchange, then the muted tidal exchange, and lowest in the minimal tidal exchange. Species richness for estuarine primary producers were greater in the full and minimal tidal exchange than in the muted tidal exchange. Species richness for estuarine invertebrate species were greater in the full and muted tidal exchanges than in the minimal tidal exchange. Estuarine fish species richness was greatest in the minimal tidal exchange.

Seventy-nine marine species were identified in the study area. Marine species richness was greater in the full tidal exchange than in the muted tidal exchange, and lowest in the minimal tidal exchange. Most of the fish species, half of the invertebrate and bird species, and a third of primary producers identified in the study were marine species. Marine invertebrates and fish were noticeably scarce at the minimal tidal exchange sites.

Fifty-six non-native species were identified in the study area. Non-native species richness was similar and greater at the full and muted tidal exchange sites that at the minimal tidal exchange sites. Most

non-native species and the majority of primary producers across all tidal exchange categories identified in this study were upland plant species. There were many non-native invertebrates identified. The majority were estuarine species found in the full and muted tidal exchanges. There was 1 non-native fish and no non-native birds identified.

5.2.3 Water Quality

Water quality varied between tidal exchange categories in the Ritter, et.al. (2008) study, and the different water quality parameters helped to define the categories.

The water quality parameters most important in defining differences between full tidal exchange and minimal tidal exchange were tidal range, rainy season salinity, and phosphate (greater in minimal). The water quality parameters most important in defining differences between muted tidal exchange and minimal tidal exchange were rainy season salinity, phosphate, ammonia, and turbidity (greater in minimal). Phosphate and pH were important in defining the minimal tidal exchange category. The minimal tidal exchange category was most distinct, where water quality in the full and muted tidal exchange categories were somewhat similar. The water quality parameters most important in defining differences between full tidal exchange and muted tidal exchange were tidal range, temperature, pH, DO, and dry season salinity.

Water quality upstream of the estuarine water control structures often showed lower salinity, higher temperature, higher nutrient concentrations and higher suspended heavy metal concentrations. The minimal tidal exchange sites in the study, on average, had far less salinity than the muted or full tidal exchange sites. This, in part, was due to the water control structures serving as partial freshwater impoundments. Salinity is a key determinate of biotic community composition.

Water in the muted tidal exchange underwent extreme, diel, biogeochemical cycling. Temperature, salinity, and DO recorded in the muted tidal exchange showed considerable daily variation relative to full tidal exchange. This extreme, diel, biogeochemical cycling includes cycling between supersaturated oxygen and hypoxic conditions. Hypoxia is known to affect estuarine communities particularly invertebrates and fishes.

5.3 Hydraulic Pumps

Studies show that hydraulic pumps may impact aquatic resources through potential exposure to hydraulic fluid used in the pumps, and through exposure to noise generated by the pumps. They can also expose aquatic resources to concentrated water quality as a point source of stormwater effluent. Additionally, if pumps are placed in an aquatic environment, there could be the potential for organisms to become entrapped in the pumps; however, no studies were located that reported on this effect.

5.3.1 Hydraulic Fluid Toxicity

Most "environmentally friendly" hydraulic fluid is largely made up of vegetable oil. It is considered "environmentally friendly" because it has a favorable LD50 for trout in a tank, not in-situ. The effects of vegetable oil on in the marine environment or on the marine food web are not considered in toxicity testing (High Performance environmentally Acceptable Hydraulic Fluid Patent-online). However, a hydraulic fluid spill might interrupt the food web beginning with diatoms and possibly affecting other marine species. Vegetable oil is a polyunsaturated fatty acid that can induce oxylipin production in

diatoms. Diatoms are primary producers found in all ecosystems and are represented by thousands of species. They are a preferred food source of copepods, who are an important food source for many other marine organisms, but oxylipins interfere with copepod reproduction. (Russo et.al., 2018).

5.3.2 Pump Noise

There are many marine organisms at various trophic levels that use sound for communication or predation (Tyack, 2008). Sound travels three times faster in water than it does through the air. If the frequency of a sound source is outside of the hearing range of a species then the likelihood of hearing loss caused by that sound source is low (NMFS 2018). A small marine pump operates at 50/60 Hz; hydraulic pumps at other frequencies could interfere with the health of aquatic resources, such as bottlenose dolphin who have a hearing range of about 75 Hz- 150 kHz.

5.3.3 Pumps and Water Quality

When operating, hydraulic pumps can become a source of point discharge of the water they move, such as rainfall and stormwater runoff. Bottlenose dolphins are sensitive to significant/abrupt shifts in salinity and may be harmed if long duration or frequent pumping of freshwater into tidal waters lowers salinity levels. If the extent and duration of pumped stormwater effluent were to reach the Cooper River, it could affect sturgeon and Atlantic sturgeon Critical Habitat (Andrew Herndon, NOAA Fisheries, personal communication, April 2021).

Nutrients and pollutants in storm water effluent can also cause algal blooms, which can be harmful to aquatic resources such as bottlenose dolphins, particularly if they produce toxins, by increasing mortality, reducing prey availability, and increasing likelihood of entanglement or ingestion of fishing gear. Algal blooms may also lower dissolved oxygen concentrations to levels that are harmful to sturgeon (Andrew Herndon, NOAA Fisheries, personal communication, April 2021). It should be noted that algal blooms are very rare in the Charleston Harbor estuary with respect to current pumping and stormwater discharges from the Charleston Peninsula and other surrounding communities.

5.4 Storm Surge Wall Construction

While a range of temporary impacts from construction related activities for the TSP are covered in the Draft IFR/EA, noise from installing the concrete battered piles for the storm surge wall in the tidal creek-salt marsh environment was not well covered for its effect on aquatic resources.

Sound propagation in shallow waters is complicated by multiple reflections, refractions, and by sound wave scattering, but studies that assess impacts of multi-pulse sound associated with pile installation using hydraulic impact hammers show mostly negative effects on mammals and birds. Marine mammals near pile driving have been found to suffer temporary hearing loss, increased stress levels, and whole populations have developed avoidance behavior that has led to habitat loss. The extent of the damage to these mammals depends on noise frequency, duration, and auditory characteristics of the species (Middel & Verones, 2017 and Tsouvalas, 2020).

NOAA also reports that marine mammal hearing can be impacted through acoustic exposure from impulsive underwater sound (NMFS 2018). The cumulative weighted temporary onset acoustic threshold shift for mid-frequency cetaceans, which includes bottlenose dolphins like those found in the

Charleston Estuarine System Stock, is 178 dB SEL (takes into account both received level and duration of exposure) (NMFS 2018).

The type and intensity of underwater sound associated with pile driving depends on the type and size of the pile, the firmness of the substrate and water depth, and the type and size of the pile-driving hammer and material. The pressure waves generated from wood or concrete driving are generally considered less harmful than driving steel piles. For reference, vibratory driving of a 30-inch battered steel pile during a ferry dock construction resulted in an underwater average Root Mean Square of 168 dB, and sound exposure level (SEL) of 210 dB (Washington State DOT, 2012). This occurred at a 37-foot depth.

5.5 Nonstructural Measures and Recreational Features

Nonstructural measures of elevating and floodproofing existing structures do not typically result in direct impacts to aquatic resources if they do not take place in the aquatic environment. There could be the potential for indirect impacts to aquatic resources if pollutants or soil particles from ground disturbance are released during construction of the nonstructural measures and become concentrated in runoff that reaches local waterways. This could temporarily alter water quality conditions that aquatic resources depend on.

It is not uncommon for traditional coastal storm risk management projects, such as beach renourishment projects, to include recreational features that increase access or use of coastal resources and could in turn impact aquatic resources. In the proposed plan, a walking path for pedestrians and recreational transportation (i.e., bicycles) along portions of the storm surge wall is being proposed (primarily where sidewalks will be lost due to construction of the wall), but only for segments of the wall that are on land, not in the salt marsh.

5.6 Summary and Potential for Cumulative Effects

In summary, hardened structures in tidal creek-salt marsh networks can result in direct and indirect impacts to aquatic resources. If multiple adverse effects result in a location, there is the potential for them to have a compound or additive effect on fish and wildlife in that tidal creek-salt marsh network. If multiple tidal creek-salt marsh networks are significantly affected, then there is the potential for the effects to be cumulative.

Traditional coastal defense structures can limit access to habitat, lead to loss of habitat, alter habitat, and alter food webs. Similar impacts could occur from a flood wall constructed in tidal creek-salt marsh networks such as the storm surge wall proposed for the TSP. Water control structures with gates in an estuary will influence tidal exchange and inundation of vegetation, soils, and organisms behind the control structure. Severity of effects on water quality, community composition and structure, and species richness depend on the degree of tidal flow control/restriction, with the greatest impacts expected under minimal tidal exchange compared to full or muted exchange. Muted (moderate) tidal exchange is most similar to what could be expected from the storm surge wall and open sluice gates that are proposed in the TSP. The storm surge wall and associated gates could also contribute to localized scouring and channel incising.

Use of hydraulic pumps during storm surge events, as proposed in the TSP, could impact aquatic resources if the duration and frequency changes the water quality that aquatic resources are exposed to from this point source.

Temporary construction activities could impact the hearing of aquatic resources if the noise travels underwater and levels fall within ranges of sensitive species. Runoff from constructing structural and nonstructural measures could also result in impacts, if standard best management practices are not implemented.

6 Potential Conservation Measures for Fish and Wildlife Resources

While not all conservation measures may be applicable to the environmental conditions of the Charleston area nor to the specific measure proposed in the TSP, several studies provide ideas for avoiding or minimizing impacts to aquatic resources from building traditional coastal defense structures in estuarine environments. Some of these are already planned for the study (see Section 2.5).

6.1 Measures to Avoid Impacts

Direct impacts to aquatic resources can be avoided by not building coastal defense structures in the estuarine environment. However, even land-based structures can have indirect impacts by changing the physical landscape that contributes to estuaries. Impacts from upland construction of defense structures could also have indirect impacts. So while most direct impacts could be avoided, minimization measures are likely need to reduce indirect impacts. Some impacts to aquatic resources could be avoided by considering non-structural measures to achieve coastal defense if they don't involve construction, such as policy changes or outreach and education.

6.2 Measures to Minimize Impacts

6.2.1 Seawall

Consider ecological engineering tactics that may encourage colonization and survivability of intertidal species to offset some of the impacts of sea walls or other traditional coastal defense structures. For example, the underwater portion of a seawall could be built using riprap or fine-scale surface textures to facilitate early colonization and support biodiversity (Rangel-Buitrago et al., 2017; Coombes et al., 2015). Place seawalls as low in the intertidal zone as possible to promote habitat variety and diversity. Modify or lower certain stretches along the seawall to restore sediment movement and ecological connectivity if possible. Seawalls can be constructed of steps or with cavities left between the seawall blocks or rocks (Schoonees et al., 2019). Seawall surfaces should be heterogeneous, rough and have large irregularities for a greater variety of habitat and to promote higher biodiversity. This can be achieved by incorporating tiles, different textures and microhabitats. Rock structures should have both soft and hard rock (i.e. carbonate and igneous rock). Rock sizes should be mixed. If the structure can be porous, valuable habitats can form within the internal compartments. This will support greater species richness and diversity (Schoonees et al., 2019). Roughening the structures by adding holes and grooves will improve habitat and increase the potential for increasing biotic diversity and abundance (Hall et al., 2018). Make simple adjustments to the traditional engineering design by including modified structures that enhance habitat complexity to mitigate the ecological impact of the construction (Borsje et al., 2011).

Use models to predict the shoreline response to help to optimize design for mitigating physical changes on the adjacent coast from seawalls (Schoonees, et al., 2019). Monitor the structure throughout its lifetime to identify unintended morphologic and hydrodynamic changes. Hard structure adaptations for ecological enrichment should be considered early in the design phase and be designed in close collaboration with ecologists (Schoonees et al., 2019).

6.2.2 Tide Gates

Keep tide gates open as much as possible. Connectivity between marine, estuarine and freshwater/terrestrial communities is critical to biodiversity in the estuarine ecosystem (Ritter, et.al., 2008). Keep gates in good working order to ensure they are open when not in use.

6.2.3 Hydraulic Pumps

Avoid placement in the aquatic environment. Have a fluid containment structure around hydraulic pumps in case of spill or malfunction. To reduce potential impacts of hydraulic spills on the localized environment, a containment system around each pump should be employed. Hydraulic spills should be cleaned up as soon as possible so fluid doesn't escape containment area.

Pumps should be used in a manner that meet state water quality standards, including treating stormwater if needed.

6.2.4 Pile Driving

Consider another device than a hammer and use sound reduction techniques if necessary (Tsouvalas, 2020). Different pile driving procedures can be used to alter the noise and reduce noise emission at the pile driving location (e.g. modify force exerted by the impact hammer or switch to other methods such as vibratory, BLUE, or Gentle Driving of piles). Along with this, an anti-noise barrier can be created around the pile (e.g. air bubble curtain, use casings to form air-column around pile, resonator-based noise mitigation system (sound dampers) or a combination of mitigation techniques). Noise reduction techniques are optimal at frequencies above 200 Hz, and no technique can reduce noise levels below 20 Hz. Only a combination of techniques reduces noise levels >20 dB for frequencies between 125 Hz to 8 kHz (Klusek et al., 2014 and Tsouvalas, 2020).

Use noise attenuation and minimization measure during pile driving such as these best management practices offered by NOAA and the Federal Highway Administration (NMFS and FHWA, 2017):

- Surround piles with an air bubble curtain system, turbidity curtain isolation casing, or dewatered cofferdam
- Drive piles in the day or during low water conditions for intertidal areas
- Use vibratory hammers and/or construction phasing to minimize acoustic impacts
- Minimize number and size of temporary and permanent piles
- Limit daily window for pile driving activities to no more than approximately 12 hours wherever feasible
- Provide a 12-hour quiet (recovery) period between pile driving days wherever feasible
- Use a "soft start" or "ramping up" pile driving (e.g., driving does not begin at 100% energy)
- For load-bearing piles, driving piles as deep as possible with a vibratory hammer prior to using an impact hammer wherever feasible
- Using cushion blocks when using an impact hammer wherever feasible
- Using drilled shafts for permanent construction instead of hammered piles where appropriate and feasible

6.2.5 Wave attenuation and Sediment Dynamics

Oysters and mussels filter algae, silt, and organic particles from the water column and their beds provide shelter and nesting areas for fish and crustacean species. Use oyster beds, mussel beds and vegetation to trap and stabilize sediment. Soil accretes and elevations rise, helping to attenuate waves. Oyster beds are more effective in wave attenuation than mussel beds, but both can help stabilize the intertidal sediment in front of coastal defense structures. Oyster beds serve the same function as groins or revetments on a macro-scale and influence ecology on a micro-scale (Borsje et al., 2011).

7 Recommendations and Position of Services

The Service's finds that the proposed peninsula surge wall, while intended as a measure to protect against severe storm damage, is likely to result in the loss of natural resources surrounding the peninsula of Charleston. Natural resource communities surrounding The City of Charleston have been historically eliminated through fill and development as the City grows and expands. The addition of a storm surge wall represents a continuation of this expansion. While the project does not propose fill to be placed landward of the wall the salt marsh between the surge wall and uplands will be gradually lost through restriction of tidal sheet flow hindering native vegetative growth vital to many fauna dependent upon the salt marsh system. The walled salt marsh will also entrap storm debris as well as human produced litter and trash further degrading the marsh and negatively affecting scenic vistas.

The Service recommends the USACE and the City of Charleston consider the following measures to minimize, or preferably avoid, impacts to the salt marsh habitat.

- Relocating the storm surge wall to high-ground wherever possible. Alternatively, reduce the height and width of the surge wall and locate it closer to the marsh/upland interface.
- The USACE and the City of Charleston should continue to seek additional opportunities to raise vulnerable structures within the peninsular limits.
- A maintenance and operations plan for the pumps and storm gate operation should be developed. The plan should encompass contingencies in the event of gate or pump failure.
- Compensation for impacts to marsh should include direct and indirect losses as well as consider the loss of marsh over time. It is preferred that a Permittee Responsible Mitigation plan be developed within the local watershed.

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ENDANGERED SPECIES ACT COMPLIANCE WITH U.S. FISH & WILDLIFE SERVICE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

August 12, 2021

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

Attn: Nancy Parrish

Re: Threatened and Endangered Species Evaluation, Charleston Peninsula Coastal Flood Risk Management Study, Charleston, South Carolina, FWS Log# 2021-I-0973

Dear Colonel Johannes:

The U.S. Fish and Wildlife Service (Service) has reviewed the above-referenced evaluation submitted on August 6, 2021. The Department of the Army (Department) is undertaking a Coastal Flood Risk Study for the City of Charleston Peninsula, Charleston County, South Carolina. The City of Charleston requested this study and is the non-Federal sponsor. Pursuant to section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531-1543) (ESA) the Department is seeking concurrence from this office on its determination of affects the action may have upon federally threatened or endangered species within the project area. This response is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the ESA.

The purpose of the Charleston Peninsula Coastal Flood Risk Management Feasibility Study is to investigate and recommend potential structural and nonstructural solutions to reduce damages and life and safety impacts from coastal storms. The proposed Federal action to meet the study objectives includes construction of a storm surge wall along portions of the perimeter of the Charleston Peninsula, and nonstructural measures in the form of elevating and flood proofing for a limited number of structures. Approximately seven non-continuous miles of the perimeter storm surge wall would be constructed on land; approximately one and one-half non-continuous miles would be constructed through saltmarsh wetlands. The study area covers approximately eight square miles of the lower Charleston Peninsula wholly within the City of Charleston's jurisdiction.

A determination of *no effect* for the following listed species was made by the Department: the frosted flatwoods salamander, Bachman's warbler, piping plover, red knot, red cockaded woodpecker, northern long-eared bat, American chaffseed, Canby's dropwort, pondberry, and seabeach amaranth. These species do not occur in the study area as there is no suitable habitat

present. Consultation under section 7 on the ESA is not required for *no effect* determinations. No further action is required for these species at this time.

The Department determined that the proposed Federal action *may affect, but is not likely to adversely affect* the West Indian manatee, the American wood stork, and eastern black rail due to the presence of potentially suitable habitat for each of these species. The planned storm surge wall in the marsh would permanently impact approximately 35 acres of salt marsh wetlands, limiting potential foraging habitat for wood storks and eastern black rails. There are no known American wood stork roosting areas or rookeries on the peninsula, and utilization of marshes on the peninsula by the eastern black rail is questionable. West Indian manatees inhabit and travel through South Carolina waters during the warmer months of the year feeding on salt marsh grasses and other aquatic vegetation. West Indian manatees have been sited throughout the coastal waters of South Carolina including the Charleston Peninsula.

Due to the known presence suitable habitat for the American wood stork, eastern black rail, and West Indian manatee within the project area, the Department determined that the proposed project *may affect, but is not likely to adversely affect* these species. The Service concurs with your determination. Please note that obligations under section 7 of the ESA must be reconsidered if (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner which was not considered in this assessment, or (3) a new species is listed or critical habitat is determined that may be affected by the identified action.

The Service appreciates the opportunity to review and provide comments on the submitted permit. If you should need further assistance, please contact Mark Caldwell at (843) 300-0426, or by email; mark_caldwell@fws.gov and reference FWS Log# 2020-I-0973.

Sincerely,

Thomas D. McCoy

Thomas D. McCoy
Field Supervisor

TDM/MAC

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

06 August 2021

Planning and Environmental Branch

Mr. Tom McCoy
Ecological Services, South Carolina Field Office
U.S. Fish and Wildlife Service, Region 2
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

Dear Mr. McCoy:

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531), and 50 CFR 402.13 (Informal consultation), the U.S. Army Corps of Engineers, Charleston District (USACE) is providing the following letter regarding the potential for effects to threatened and endangered species with respect to the federal action proposed in the Charleston Peninsula Coastal Flood Risk Management Study. USACE has determined that the federal action will have either no effect, or may affect but is not likely adversely affect, threatened and endangered species, nor will it adversely modify designated Critical Habitat, for which U.S. Fish and Wildlife Service (USFWS) has jurisdiction. In light of its conclusions regarding the ESA, USACE also believes that further action under the Marine Mammals Protection Act of 1972 (16 USC 1371, et seq) is not required.

This letter has been revised from the August 3, 2021 informal consultation request letter submitted by USACE to reflect a not likely to adversely affect determination for the American wood stork and Eastern black rail, rather than the no effect determination made in the first letter. This revision is informed by conversations held between Mark Caldwell of USFWS and Bethney Ward of USACE on August 3, 2021 as part of the Section 7 informal consultation process. Therefore, USACE seeks USFWS' concurrence on the determinations for all listed species in this letter, dated August 6, 2021. More information on the federal action, listed species, and effect determinations are provided below.

Description of Federal Action

The purpose of the Charleston Peninsula Coastal Flood Risk Management Feasibility Study is to investigate and recommend potential structural and nonstructural solutions to reduce damages and life and safety impacts from coastal storms. The authority to study coastal South Carolina, including the Charleston Peninsula, was provided in the Rivers and Harbors Act of 1962, P.L. 87- 874, Section 110, and a subsequent Senate Committee Resolution dated 22 April 1988. Funding for the study

was appropriated by the Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV. The City of Charleston requested this study and is the non-Federal sponsor. The study area covers approximately 8 square miles of the lower Charleston Peninsula that is within the City's jurisdiction. The following objectives have been identified in the study:

- Reduce risk to human health and safety from coastal storm surge inundation on the Charleston Peninsula through the 50-year life of the project, estimated to be 2032 to 2082.
- Reduce economic damages resulting from coastal storm surge inundation on the Charleston Peninsula through the 50-year life of the project, estimated to be 2032 to 2082

After several iterations of scoping, the proposed federal action to meet the study objectives includes construction of a storm surge wall of 12 ft elevation NADV88 along portions of the perimeter of the Charleston Peninsula, and nonstructural measures in the form of elevating and flood proofing for a limited number of structures. Approximately 7.1 non-continuous miles of the perimeter storm surge wall would be constructed on land; approximately 1.5 non-continuous miles would be constructed through saltmarsh wetlands. The wall would be constructed of concrete, and on land it would be a T-wall design and in the marsh, it would be a combination design (these designs are described in previous reports provided to USFWS). For the combination wall, 12x12 ft prestressed concrete sheet piles are proposed that would be battered at an inclination from vertical, using a hammer.

Other features of the proposed plan include the installation of 5 permanent and 5 temporary pump stations of low to moderate size, ranging from 20 to 90 cfs; a series of access gates for pedestrians and transportation; and storm gates in the form of sluice gates to allow for tidal exchange at creeks that intersect with the proposed wall. Five storm gates would be installed in the combination wall at Halsey Creek. Five storm gates would be installed at existing culverts that intersect several altered creeks or channels. A walking path is also planned on top of portions of the storm surge wall where it is on land. Finally, natural and nature-based features in the form of approximately 9,3000 linear feet of oyster reef-based living shorelines are also planned.

The location of the action or region of influence (ROI) for effects from the proposed federal action for terrestrial species has been defined as the Charleston Peninsula study area (approximately 8 square miles of the lower Charleston Peninsula within the City's jurisdiction, see Figure 1). For fish, marine mammals, and other aquatic species, the location of the action or ROI covers the estuarine tidal creeks of the Charleston Peninsula and the adjacent waterways including the Charleston Harbor, lower Ashley River, and lower Cooper River.

Figure 1. Map of the Charleston Peninsula Coastal Flood Risk Management Study Area

Consultation History

USACE is currently preparing a Draft Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) for the Charleston Peninsula Coastal Flood Risk Management Study. The USFWS Charleston Field Office has provided technical assistance throughout the study process. USACE has engaged USFWS through the study's Interagency Coordination Team, as a Cooperating Agency for the EIS, and under the Fish and Wildlife Coordination Act.

The USFWS provided initial comments during the scoping phase of the study in a letter dated January 31, 2019. At that time, minimal impacts to fish and wildlife resources were anticipated. In April of 2020, USACE issued a Draft Integrated Feasibility Report/Environmental Assessment (Report) and a mitigated Draft Finding of No Significant Impact for the study, prior to preparing the current Draft IFR/EIS. The Report did not include an ESA determination at that time. USFWS provided comments on the Draft Report on May 26, 2020, requesting that a Fish and Wildlife Coordination Act Report be prepared due to the potential for adverse impacts to fish and wildlife

resources. In direct response to USFWS' comments, a Coordination Act Report has been drafted and is currently being finalized.

ESA-Listed Species and Critical Habitat

The following threatened and endangered species under the jurisdiction of the USFWS can be found in Charleston County (IPaC Tool, accessed June 17, 2021):

Species Common Name	Scientific Name	Status
Frosted flatwoods salamander	*Ambystoma cingulatum*	T, CH
Bachman's warbler	*Vermivora bachmanii*	E
Eastern black rail	*Laterallus jamaisensis ssp. jamaicensis*	T
Piping plover	*Charadrius melodus*	T, CH
Red knot	*Calidris canutus rufa*	T
Red-cockaded woodpecker	*Picoides borealis*	E
American wood stork	*Mycteria americana*	T
West Indian manatee	*Trichechus manatus*	E
Northern long-eared bat	*Myotis septentrionalis*	T
American chaffseed	*Schwalbea americana*	E
Canby's dropwort	*Oxypolis canbyi*	E
Pondberry	*Lindera melissifolia*	E
Seabeach amaranth	*Amaranthus pumilus*	T

NOTES:

E - Federally Endangered T - Federally Threatened CH - Critical Habitat

Additionally, Critical Habitat for the threatened loggerhead sea turtle (*Caretta caretta*) has been designated for some nesting areas in Charleston County. Nesting loggerheads are under shared jurisdiction between the USFWS and NOAA Fisheries.

Most of the federally-listed species above, and the habitat they depend on, are not known to occur within the ROI. The January 31, 2019 letter from USFWS confirmed there are no known populations of listed wildlife or plant species in the terrestrial ROI. According to USFWS, the existing tidal wetlands on the Peninsula could serve as potential foraging habitat for the wood stork, but there are no known roosting areas or

rookeries. The presence of eastern black rails in the study area is questionable since the marsh habitat has varying tidal fluctuations, but the possibility remains. For marine species, the West Indian manatee is found within the aquatic ROI. There is no designated Critical Habitat for any of these species in either ROI.

There are a number of At-Risk-Species (ARS) in Charleston County, which are also State-listed species, but the terrestrial ROI does not support suitable habitats for most of them. Two that could be found on the Peninsula include the salt marsh sparrow (*Ammospiza caudacuta*) and the monarch butterfly (*Danaus plexippus*). At-Risk-Species are not afforded any Federal protections and therefore are not discussed in this letter, but are considered in the Draft IFR/EIS.

Species Assessment and Effect Determination

USACE has determined that the proposed federal action will have no effect for the following listed species, nor for designated Critical Habitat associated with any of them: frosted flatwoods salamander, Bachman's warbler, piping plover, red knot, red cockaded woodpecker, northern long-eared bat, American chaffseed, Canby's dropwort, pondberry and seabeach amaranth. These species do not occur in the study area or ROI nor does suitable habitat to support them. Therefore, there is no route of exposure to effects from the proposed federal action.

USACE has determined that the proposed federal action may affect, but is not likely to adversely affect, the American wood stork and Eastern black rail. The American wood stork is a long legged water bird species that uses freshwater and estuarine wetlands as feeding, nesting, and roosting sites. The stork constructs nests in trees, usually in gregarious colonies (called rookeries). Often the rookeries and roosting areas are in association with herons, egrets, and other species. Stork feeding behavior is typically along the marsh vegetation and open water interface seeking small fish and macroinvertebrates. The Eastern black rail is a wetland dependent bird found in a variety of salt, brackish, and freshwater wetland habitats that can be tidally or non-tidally influenced, requiring dense overhead cover and soils that are moist to saturated (occasionally dry) and interspersed with or adjacent to very shallow water. The black rail nests within dense clumps of vegetation over moist soil or shallow water to provide shelter from the elements and protection from predators. The planned storm surge wall in the marsh would permanently impact approximately 35 acres of salt marsh wetlands, limiting potential foraging habitat for wood storks and eastern black rails. As stated above, there are no known wood stork roosting areas or rookeries on the peninsula, and utilization of marshes on the peninsula by the eastern black rail is questionable. These species would be able to migrate to other areas to forage. Therefore, the effect of the proposed federal action on these species is deemed insignificant and discountable.

USACE has determined that the proposed federal action may affect, but is not likely to adversely affect, the West Indian Manatee. There are two recognized

subspecies of the West Indian manatee; the Antillean manatee (*Trichechus manatus manatus*) and the Florida manatee (*Trichechus manatus latirostris*). The Florida manatee inhabits the Southeastern coast of the United States, however both subspecies are commonly referred to as the West Indian manatee. Manatees can inhabit both salt and fresh waters and are found at shallow depths (5-20'). In the waters of the continental US, they and are most abundant in the warm waters of peninsular Florida. During the summer months manatees on the eastern coast of Florida have been reported to travel as far north as Cape Cod, Massachusetts. Manatees that inhabit and travel through South Carolina waters during the warmer months will feed on salt marsh grasses at high tide and submerged algae beds at low tide. Manatees have been sited near the Charleston Peninsula in the Cooper River, the Ashley River, the Atlantic Intracoastal Waterway, and Shem Creek.

There is the potential for construction activities of the combination wall in the salt marsh to have temporary effects on manatees. Effects could include underwater sound impacts from pile driving, increased sedimentation and total suspended solids around the location of construction, and the potential for vessel strikes from movement of waterborne construction equipment. Construction impacts would be minimized through implementation of the Standard Manatee Conditions for In-Water Work published by the Florida Fish and Wildlife Commission which has been adopted by USFWS (see enclosure), with updated information on reporting manatee collisions or injuries to the South Carolina Department of Natural Resources wildlife hotline and the USFWS South Carolina Ecological Services office. Noise associated with pile driving is primarily a concern for marine mammals when the sound travels through water. The majority of pile driving for the combination wall would occur in the marsh where water depths range from a few inches to a few feet across the tidal cycle, which limits noise exposure for marine mammals. In areas where pile driving will occur along the nearshore of the Charleston Harbor, pile driving would be limited to low tide, when water depths will likely be a few feet. This will primarily apply to construction of the combination wall by the current U.S. Coast Guard Station on Tradd Street. Nearshore topobathy data will be used to help define a low-tide construction window prior to construction. Additionally, construction impacts in saltmarsh wetlands will be minimized through the use of a worksite trestle, similar to that currently being used by the City of Charleston for their construction of the Spring/Fishburne St. pump station. The trestle will extend out over the mash to facilitate construction operations from the land so that no heavy equipment operates on the marsh surface. This temporary structure is described in more detail in the IFR/EIS. Once the trestle is removed, any minor marsh disturbance from the trestle will be restored.

Pumps that will be temporarily used as part of the proposed plan are not expected to have adverse effects on manatees. Direct interference with the pumps will not occur since the pumps will be located either on land or in shallow wetland areas behind the storm surge wall where manatees would not be present. Rain and storm

water discharged from temporary pumping operations during occasional storm surge events would be expected to meet state water quality standards.

The proposed action may have some permanent effects on potential manatee habitat, but these are deemed to be insignificant and discountable. As described for the wood stork and black rail, the storm surge wall in the marsh would permanently impact approximately 35 acres of salt marsh wetlands. While this would limit to some degree potential manatee habitat and food sources, it is noted that South Carolina is at the northern edge of the manatees' range and most of the salt marsh wetlands in question regularly lack sufficient depth to provide for manatee access. Finally, while it is possible for manatees to be injured or killed during closure of one of the five water control structures (sluice gates) currently planned in the combination wall at Halsey Creek, this is not anticipated to occur. At this location, water depths range from a few inches to a few feet, so the presence of manatees is unlikely. In addition, since closure of the gates will be limited to occasions of storm surge events, and since the gates will be manually closed on those occasions only after visual observations for clearance of any marine mammals by the gate operators (to be included in the Operations and Maintenance Manual for the project), the likelihood of injury will be further reduced to a discountable level.

Summary

USACE has determined that the proposed federal action for the Charleston Peninsula Coastal Flood Risk Management Study may affect, but is not likely to adversely affect, the American wood stork, Eastern black rail, and West Indian manatee. The proposed federal action will have no effect on the frosted flatwoods salamander, Bachman's warbler, piping plover, red knot, red cockaded woodpecker, northern long-eared bat, American chaffseed, Canby's dropwort, pondberry and seabeach amaranth.

USACE requests concurrence from USFWS on these determinations. We look forward to your response to this letter within 60 days of receipt of this letter.

Sincerely,

Nancy Parrish

Nancy Parrish
Chief, Planning and Environmental Branch

ENDANGERED SPECIES ACT COMPLIANCE WITH NOAA FISHERIES

CONSULTATION IS ONGOING; ALL DOCUMENTATION WILL BE ADDED HERE FOR THE FINAL REPORT

ESSENTIAL FISH HABITAT ASSESSMENT

ESSENTIAL FISH HABITAT ASSESSMENT BEING PREPARED; WILL GO HERE WITH CONSERVATION RECOMMENDATIONS FROM NOAA WHEN COMPLETE

COASTAL ZONE MANAGEMENT ACT - FEDERAL CONSISTENCY REVIEW

Coastal Zone Consistency (Federal Consistency) Review for USACE's Charleston Peninsula Coastal Flood Risk Management Study, Charleston, South Carolina September 2021

Background

The South Carolina Coastal Management Program was authorized in the South Carolina Coastal Tidelands and Wetlands Act of 1977 (Statutory Code Ann. Section 48-39-10 et seq.). The South Carolina Department of Health and Environmental Control Division of Ocean and Coastal Resource Management (SCDHEC OCRM) is responsible for the implementation of the state's program. The goals of the South Carolina Coastal Management Program are attained by enforcement of the policies of the State as codified within the South Carolina Code of Regulations (SC Code of Regulations Chapter 30).

The national Coastal Zone Management Act of 1972, as amended, requires that each Federal agency activity performed within or outside the coastal zone that affects land or water use, or natural resources of the coastal zone, be carried out in a manner which is consistent to the maximum extent practicable, i.e. fully consistent, with the enforceable policies of approved state management programs.

The U.S. Army Corps of Engineers, Charleston District (USACE) is currently conducting the Charleston Peninsula Coastal Flood Risk Management Study to investigate and recommend potential structural, nonstructural, and natural or nature-based solutions to reduce damages and life safety impacts from coastal storms. The authority to study coastal South Carolina, including the Charleston Peninsula, was provided in the Rivers and Harbors Act of 1962, P.L. 87- 874, Section 110, and a subsequent Senate Committee Resolution dated 22 April 1988. Funding for the study was appropriated by the Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV. The City of Charleston requested this study and is the non-Federal sponsor. As a result of the study, USACE has identified a Tentatively Selected Plan, also considered the proposed Federal action. This Tentatively Selected Plan was determined to be the National Economic Development Plan (meaning it maximizes the storm risk reduction benefits for the cost) and to have the least environmental impacts of the action alternatives considered. In compliance with the National Environmental Policy Act (NEPA), a draft integrated Feasibility Report/Environmental Impact Statement (FR/EIS) has been prepared for the study and accompanies this Federal Consistency review. It is available on USACE's website at: https://www.sac.usace.army.mil/Missions/Civil-Works/Supplemental-Funding/Charleston-Peninsula-Study/.

According to 15 CFR 930.37, a Federal agency may use its NEPA documents as a vehicle for its consistency determination with the Coastal Zone Management Act. Therefore, in compliance with the Coastal Zone Management Act of 1972, USACE has reviewed the proposed Federal action for consistency with the enforceable policies of the 1979 South Carolina Coastal Zone Management Program of SCDHEC OCRM, and prepared this consistency determination, supported by detailed information within the draft FR/EIS. Below is a summary of the proposed Federal action, the Federal Consistency review, and USACE's conclusion. The draft FR/EIS should be referred to for more information.

Description of Federal Action

The location of the proposed Federal action is the Charleston Peninsula study area (approximately 8 square miles of the lower Charleston Peninsula within the City's jurisdiction, see Figure 1). The region of influence for environmental effects includes the study area and the adjacent waterways of the Charleston Harbor, lower Ashley River, and lower Cooper River, as well as communities and historical resources outside of the study area that align those waterways. Notable areas that are not in the region of influence of the proposed Federal action are the Atlantic Intracoastal Waterway and barrier islands flanking the Charleston Harbor.

The following objectives have been identified for the Charleston Peninsula Coastal Flood Risk Management Study:

- Reduce risk to human health, safety, and emergency access from coastal storm surge inundation on the Charleston Peninsula through the 50-year life of the project, estimated to be 2032 to 2082.
- Reduce economic damages resulting from, and increase resilience to, coastal storm surge inundation on the Charleston Peninsula through the 50-year life of the project, estimated to be 2032 to 2082

The proposed Federal action to meet the study objectives includes construction of a storm surge wall of 12 ft elevation NAVD88 along portions of the perimeter of the Charleston Peninsula, nonstructural measures in the form of elevating and flood proofing for a limited number of structures, and natural and nature-based features in the form of large-scale oyster reef-based living shoreline sills. The approximate locations of these measures are shown in Figure 1 and are described in much more detail in the draft FR/EIS. Conceptual drawing and examples of the structural measures can be found in the Engineering Appendix. A summary of some key features of the measures are provided here.

Figure 1. Map showing the study area and approximate locations of the measures in the proposed Federal action.

Approximately 7.1 non-continuous miles of the perimeter storm surge wall would be constructed on land; approximately 1.5 non-continuous miles would be constructed through saltmarsh wetlands. The wall would be constructed of concrete, and on land it would be a T-wall design and in the marsh, it would be a combination design. For the combination wall, 12x12 ft prestressed concrete sheet piles would be battered at an inclination from vertical, using a hammer. The actual height of the wall at any given location will vary depending on the existing ground elevation, so that in total the height of the land and the wall reaches 12 ft NAVD88 to reduce the impacts of storm surges up to this height.

In relation to the storm surge wall, a number of features are being proposed. A series of gates would be needed in the wall to allow for daily access by pedestrians and transportation where the wall would intersect with existing infrastructure. The preliminary number and conceptual locations of the upland gates are discussed in the draft FR/EIS. Storm gates in the form of sluice gates are also needed to allow for daily tidal exchange in areas that intersect with the proposed wall. Five storm gates would be installed in the combination wall at Halsey Creek, and five storm gates would be installed at existing culverts that traverse several creeks or channels. These are also described in more detail in the draft FR/EIS. Gates would be closed during a storm surge event, and otherwise remain open.

A walking path for pedestrian transportation is planned on top of portions of the storm surge wall where it is located on land in the place of current sidewalks, similar to the promenade on the current Battery seawalls. The wall would also include aesthetic design features that are consistent with the current character of the Charleston Peninsula, which will be determined in a later design phase, if the project is authorized for funding.

Five permanent and five temporary pump stations of low to moderate size, ranging from 20 to 90 cubic feet per second (cfs), would be installed. The purpose of the hydraulic pumps is to mitigate for rainfall flooding that may occur in the interior of the proposed wall. These pumps would be consistent in size with the smaller pumps currently permitted and operated by the City of Charleston. The pumps are described in the draft FR/EIS, including their preliminary locations. The final number and locations of the hydraulic pumps will be verified in a later phase of the project, if it is authorized for funding. However, they are not expected to change considerably.

For nonstructural measures, elevating and floodproofing of structures have been proposed in residential areas where construction of the storm surge wall would not be practicable due to topography and other constructability constraints. For example, dry

floodproofing measures would be applied to the Bridgeview Village neighborhood and elevation measures would be applied to the Rosemont neighborhood due to the nature of the construction materials and techniques used in these communities. Wet floodproofing measures, such as elevating utilities, would be applied in the Lowndes Point neighborhood because residential structures are already elevated above 12 feet NAVD88.

Finally, in association with the storm surge wall, approximately 9,3000 linear feet of oyster reef-based living shoreline sills would be constructed in strategic locations to reduce coastal storm impacts to natural shorelines and other resources seaward of the wall. The living shoreline sills would reduce erosion of existing wetland marsh, while reducing scour at the base of the proposed storm surge wall. The living shorelines would also provide other environmental benefits, such as habitat for fish and wildlife. The exact locations would be verified in a later phase of the project, if it is funded, but they have been proposed in areas where small scale living shoreline projects have already shown success.

Coastal Zone Consistency Review

USACE reviewed the policy groups of the South Carolina Coastal Zone Management Program to determine Federal Consistency, based on their relevancy or applicability to the proposed Federal action. The policy groups that were considered for determining if the proposed Federal action is consistent with the enforceable policies of the South Carolina Coastal Zone Management Program included: Fish and Wildlife Management, Geographic Areas of Particular Concern, Areas of Special Resource Significance, Erosion Control, Shoreline Access, and Stormwater Management.

Additionally, the proposed Federal action would take place in "Critical Areas." Impacts on Critical Areas were taken into consideration while reviewing the policy groups. All of the tidelands and coastal waters in the study area and region of influence are within Critical Areas. Policies related to Areas of Special Resource Significance are focused on Navigation Channels and Public Open Spaces for consistency, and not tidelands because all of the tideland impacts are within Critical Areas. For clarification, there are no barrier islands or beach/dune systems in the study area nor the study's region of influence so policies related to these resources were not considered.

Action information and its consistency with the relevant policy groups is summarized here. Any policy groups not listed here were considered not applicable.

a) Wildlife and Fisheries Management – Consistent

i. Management

The proposed Federal action has the potential to affect approximately 35 acres of salt marsh wetland habitat and approximately 0.5 acres of sandy, intertidal flat habitat. This would result from approximately 1.5 miles of the proposed storm surge wall being constructed in seven different coastal wetland locations, including two associated with coastal waters around the perimeter of the Charleston Peninsula. USACE attempted to avoid impacts to wetlands by locating the proposed wall on land wherever possible. The majority of the storm surge wall (86%) would be constructed on land, but in some locations it would not be feasible due to the close proximity of existing built infrastructure and private property along shorelines of the study area.

One of the seven locations of the storm surge wall would intersect a salt marsh tidal creek system on the Charleston Peninsula, Halsey Creek off of the Ashley River. As described in more detail in the Draft Integrated FR/EIS, tidal flow in this tidal creek system is already restricted by two 24 inch diameter culverts which runs under 10th Street. The Creek is currently impaired by the surrounding dense residential development of the Wagener Terrace neighborhood. Under the proposed Federal action, ~0.1 mile of the storm surge wall would be constructed through Halsey Creek and its salt marsh system. To avoid fully impounding the area of creek and marsh behind the wall, which would result in a total loss of salt marsh tidal creek functions including habitat for fish and wildlife, USACE would install gates in the wall to allow for daily tidal flow. Approximately five gates of 15 ft-wide each (for a total opening of 75 feet in this part of the wall) are planned. While not fully restricted, tidal flow would still be altered because of the wall and gates. This in turn has the potential to degrade water quality and habitat value for aquatic resources that could commonly be found in Halsey Creek, such as white shrimp (*Litopenaeus setiferus*). Using a habitat suitability index model for white shrimp, USACE concluded that 90% of the habitat function could be lost in Halsey Creek as a result of the wall, even with the gates. This modeling is described in detail in Appendix F of the draft FR/EIS.

To mitigate for the adverse effects on salt marsh wetlands and coastal waters and the indirect effects on water quality and aquatic resources, USACE would compensate for ~0.6 acres of direct loss of salt marsh wetlands (in the footprint of the wall, which includes a 25 ft buffer on both sides of the wall) and ~7.1 acres of salt marsh wetlands behind the wall. This would be accomplished either through purchasing salt marsh wetland credits from an approved wetland mitigation bank or through Permittee Responsible Mitigation. The mitigation planning process is being closely coordinated with resource agencies and is currently ongoing. The process is described in more detail in the Draft Mitigation Plan for the study in Appendix F of the draft FR/EIS.

The gates would be open at all times except during a storm surge event, which is necessary to reduce storm surge flooding impacts to property and life safety. There is the potential for water quality to be dramatically altered in Halsey Creek during these occasional and temporary gate closures, which would have an adverse effect on aquatic resources behind the gates. This effect would be minimized by establishing gate protocol actions such as closing the gates during low tide when fewer aquatic resources would be present and by reducing the time that the gates are closed to the greatest extent that is practicable. Gate closure protocols will be finalized in a later phase of the project, if it is authorized for funding.

The proposed Federal action also has the potential to enhance habitat for fish and wildlife through the construction of reef-based living shoreline sills. Over 9,000 linear feet of living shorelines would be constructed. Since the primary purpose of the living shoreline sills would be to reduce erosion and wave attack related to coastal storms, this activity is described in more detail in the policy section related to Erosion Control. While the habitat value of the living shorelines has not been quantified for this study, it is widely recognized that reef-based living shorelines provide ecosystem services that benefit fish and wildlife including habitat for foraging and protection, improving water quality, and expansion of marsh vegetation.

ii. Impoundments

Five of the locations that would be adversely affected by the storm surge wall are areas of fringing salt marsh along the perimeter of the Charleston Peninsula. In these locations, tidal flow would become restricted between the wall and the upland shoreline, resulting in permanent impoundment of the salt marsh. Over time, water quality conditions would change and salt marsh functions, including salt marsh habitat for fish and wildlife, would be lost. Access by aquatic resources into these areas would also be lost.

The locations and acreage of the salt marsh wetland habitat lost would be:

- Along the Ashley River, roughly from north of Halsey Creek to Lowndes Point (~6.5 acres)
- Along the Ashley River, roughly from south of Halsey Creek to north of the Citadel boat channel (~4.5 acres)
- Citadel marsh behind Joe Riley Baseball Stadium (~11.5 acres)
- US Coast Guard marsh and coastal waters by Lockwood Blvd. and Tradd Street (3.5 acres)
- Along the interior shoreline of Diesel Creek (~1 acre)

Approximately 0.5 acres of sandy intertidal flat and coastal waters would also be impounded by the proposed storm surge wall at an area near the existing high Battery seawall and the Charleston Yacht Club, known locally as "Battery Beach." Due to dense infrastructure along the shoreline near this location, it was not feasible to construct the wall on land.

To minimize the extent of fringing marsh impounded, the storm surge wall would be located as close to the upland shoreline as possible, which is approximately 35 feet in most locations.

To further mitigate for this loss of the salt marsh wetlands and intertidal flat, USACE would compensate for the ~27 acres of salt marsh wetlands permanently lost or impounded (including a 25 ft buffer) at a 1:1 ratio, and the ~0.5 acre tidal flat impounded (and buffer) at the same ratio. This is consistent with mitigation requirements of the South Carolina Coastal Zone Management Program that indicate mitigation shall be performed at a ratio of 1:1 wetland created to wetland altered, for projects deemed in the public interest. The compensatory wetland mitigation would be accomplished either through purchasing salt marsh wetland credits from an approved wetland mitigation bank or through Permittee Responsible Mitigation of like habitat. The mitigation planning process is being closely coordinated with resource agencies and is currently ongoing. This process is described in more detail in the Draft Mitigation Plan in Appendix F of the draft FR/EIS.

b) Activities in Geographic Areas of Particular Concern – Consistent

i. Areas of Unique Natural Resource Value

There are no Heritage Trust Program Sites, State Wildlife Preserves, State Parks, or Marine and Estuarine Sanctuaries in the study area.

While a 24-mile stretch of the Ashley River from near Summerville to the Mark Clark Expressway (I-526 bridge) in North Charleston has been designated as a state Scenic River, this is out of the region of influence of the proposed Federal action.

Shellfish harvesting is already restricted in waters in and surrounding the study area.

The study area does fall within the Trident Capacity Use Area for groundwater; however, the proposed Federal action would not withdraw or use groundwater. The action would also not produce any waste that would be disposed of and impact groundwater.

There is no designated critical habitat for federally-listed threatened and endangered terrestrial wildlife species in the study area. There is designated critical habitat for Atlantic sturgeon within the region of influence of the Federal action, but the Federal action does not involve any in-water work near this area and any water quality changes are not expected to adversely modify their critical habitat.

Salt marsh-tidal creek habitat that is in the study area, while not designated critical habitat, could be used by listed species including manatees, wood storks, eastern black rails, sea turtles, and sturgeon. While it's possible for any of these species to be present in salt marsh areas potentially impacted by the Federal action, conditions are not ideal nor well documented so USACE is making a determination under Section 7 of the Endangered Species Act that these species "may be affected but are not likely to be adversely affected" by the proposed Federal action. This includes construction-related activities since USACE would employ best management practices to reduce temporary adverse water quality and noise impacts on protected species. The US Fish and Wildlife Service has already concurred with this determination; consultation with the National Marine Fisheries Service is ongoing. A similar conclusion is reasonably being made for state-listed species.

While the Federal action is proposed along coastal shorelines because this is where it is needed to be effective, it is not dependent on coastal shorelines for using or extracting any coastal resources.

ii. Areas of Special Historic, Archeological, or Cultural Significance

According to the South Carolina Department of Archives and History and the South Carolina Institute of Archaeology and Anthropology, who inventory data from the state's archaeological and built heritage, there are currently 373 known cultural resources within the study area. Of the 373 cultural resources identified within the study area, 79 are individually listed in the National Register of Historic Places, including 32 which are also designated as National Historic Landmarks. The largest concentration of historic properties is found in the Charleston Old and Historic District which spans the southern portion of the Peninsula and is also designated a National Historic Landmark. While USACE is taking steps to avoid impacts to these resources, this will not be feasible everywhere.

There is the potential for many of these resources, and resources yet to be identified, to be adversely affected by the Federal action. USACE is currently working with the South Carolina State Historic Preservation Office, the National Park Service, the Advisory Council on Historic Preservation, the City of Charleston, the Catawba Indian Nation, Historic Charleston Foundation, and the Preservation Society of Charleston to develop

a Programmatic Agreement (PA) pursuant to 36 CFR § 800.4(b)(2). The PA is a legally binding document that defines the surveys and other research needed during the design phase of the project, should it be funded, to fully identify cultural/historical resources that could be adversely affected, and proposes and ensures implementation of mitigation to reduce effects on cultural and historic resources to the greatest extent practicable. In accordance with the PA, the future project design would be modified where possible to avoid adverse effects to historic properties. A copy of the PA can be found in the draft FR/EIS.

c) Activities in Areas of Special Resource Significance – Consistent

i. Navigation

The majority of the proposed Federal action would occur on land. The activity will not harmfully obstruct the natural flow of navigable water at the expense of commercial navigation, shipping, or port development. Where it would be located in coastal waters or salt marsh wetlands, it would not be in close proximity to Federal navigation channels to restrict or adversely affect navigation, shipping, or port development. The wall in the marsh would not intersect with any established roads or bridges. It would intersect with the US Coast Guard Station's dock off Tradd Street; however an access gate would be included and is being closely coordinated with the U.S. Coast Guard to ensure continued operations and security of their facilities.

Effects on existing marine commerce operations or transportation from the proposed wall at Columbus Street Terminal and Union Pier have been minimized by placing the proposed wall on land rather than waterside, and in strategic locations with gates away from critical port operations. The proposed wall is also being closely coordinated with the South Carolina Ports Authority and the specific alignment within their property boundaries may be modified during a future phase of the project.

ii. Public Open Space

The proposed storm surge wall would align some known recreation areas/parks within the study area, most notably Waterfront Park and Brittlebank Park. While the wall may alter pedestrian or traffic flow into and out of the parks, public access to all parks and their associated recreational features such as public fishing piers, would not be restricted (except when gates are closed during a storm surge event). USACE has attempted to avoid intersecting parks by defaulting to aligning parks near roadways instead. Regardless, any landscaping, including trees, and other recreational features such as benches, trails, and playgrounds that may be in the footprint of the proposed wall would be redesigned and replaced in an alternate yet suitable location in the parks, if necessary.

Because the storm surge wall would be visible in public open spaces, the aesthetics of these spaces have the potential to be adversely affected, depending on the location and other factors. Adverse effects on aesthetics and the viewshed would be minimized through design elements of the storm surge wall and other engineering features in a later phase of the study if the proposed Federal action is selected for funding. Since this is a feasibility study, detailed design and engineering decisions that could inform mitigation for degraded aesthetics and viewshed effects cannot be made at this time. USACE has drafted a Memorandum of Understanding (MOU) with the City of Charleston that outlines a process for identifying and implementing practicable mitigation measures for potential adverse effects to visual resources. A copy of the MOU can be found in Appendix A of the draft FR/EIS.

d) Erosion Control – Consistent

The proposed Federal action includes installation of approximately 9,300 linear feet of reef-based living shoreline sills to be constructed in strategic locations of the study area to reduce wave attack and erosion from coastal storms. This natural or nature-based feature provides more benefits than hardened measures for shoreline stabilization. Site suitability surveys would be conducted in a later phase of the project if it is funded, but tentative locations are shown in Figure 1, which include areas along the Charleston Peninsula shoreline of the Ashley River near Lockwood Blvd, Brittlebank Park, and the Wagener Terrace neighborhood. These locations correspond with sites where other small scale living shorelines have already been constructed and shown success.

The specific design/technique of the reef-based living shoreline sills would also be determined in a later phase of the project if funded, but would be constructed with similar methods as those already used in South Carolina and that meet the definition and project standards for living shorelines in new sections R.30-1.D(31) and R.30-12.Q of S.C. Code Sections 48-39-10 et seq.

The Federal action, particularly the storm surge wall that would be constructed in portions of fringing salt marsh wetlands, have the potential to produce scouring of the marsh at the base of the wall. In these locations, it would not be feasible to construct the storm surge wall on land due to existing built infrastructure. The erosional impact to marshes in the immediate area would be offset through compensatory wetland mitigation that is planned for the larger action. In addition, the living shoreline sills would be placed in areas seaward of the storm surge wall to help reduce wave energy and trap sediments that would help minimize the scouring effect.

Modeling of wave action conducted by USACE supports that reflection and refraction of waves encountering the proposed wall on the Charleston Peninsula would have a nominal effect on shorelines outside of the study area. Under normal conditions, wave heights vary around the Charleston Peninsula depending on location, such as sheltered vs. exposed areas. Aside from these variations, the results did not show a difference in wave height in the surrounding areas with the wall present, when compared to without the wall. This is consistent with the understanding that local wind waves within the surrounding rivers and Charleston Harbor nearshore area would be limited in wave height and period during a storm surge event by the limited fetches. Waves would be dissipated by marshes and shallow foreshore areas before encountering the wall which would scatter the remaining waves, causing them to dissipate within a few wavelengths. Scattering would be due to directional/frequency spread of the short-period waves, irregularities in the wall, near-wall bathymetry, adverse wind (wind from the coastal storm blowing against the reflected waves), and complex bathymetry of the far-field (river channels/nearshore). Details and results of the modeling can be found in Appendix B, Coastal Sub-Appendix of the draft FR/EIS.

e) Beach and Shore Access – Consistent

To reduce impacts from storm surge on structures and life safety, the storm surge wall proposed in the Federal action, by design, creates a physical barrier between the upland and coastal waters. To the extent practicable, USACE has avoided implementation of this measure, including in areas that are already at a higher elevation or where nonstructural measures were more practicable. Several square miles of the upper Charleston Peninsula will not be affected by the storm surge wall.

In places where the storm surge wall would be constructed and there is currently designated access between the land and water, such as docks or marinas, gates would be installed in the wall to allow for continuous access. The gates would remain open except during a storm surge event.

In some places around the Charleston Peninsula, the storm surge wall would be constructed in public right-of-ways near the shoreline, where sidewalks for pedestrian transportation currently exist (e.g., along Lockwood Blvd). The loss of the sidewalk on the ground level would be offset with a walking path on top of the storm surge wall, similar to the current promenade on the Battery seawalls. The walkway, and access to it, would be compliant with the American Disabilities Act.

The function of the ~0.5 acre sandy intertidal flat near the current high Battery sea wall that is locally known as “Battery Beach” would be permanently affected by the proposed

Federal action. Once the proposed wall is built, tidal flow will no longer reach this area, and over time the tidal flat would no longer function (ecologically) as an intertidal flat. This impact is described in the Wildlife and Fisheries Management section above. With respect to public access, the existing high Battery seawall and cady-corner sea wall that runs along the yacht club serve as current barriers between the land and water interface here. There is currently no designated public access to the area known as "Battery Beach," although the public has been known to access it anyway. Although the proposed Federal Action may change the nature of the area, it would have no effect on the current lack of public access to the area.

f) Stormwater Management – Consistent

Construction activities related to the proposed nonstructural measures and the storm surge wall have the potential to disturb soils and sediments or create debris that could run off with stormwater into local waterways. This could result in increased turbidity and suspended solids in shallow waters that could degrade water quality, including temporary changes in salinity, pH and dissolved oxygen levels. To minimize these effects, typical construction best management practices (BMPs) would be used to reduce and contain the movement of soils and sediments. For example, silt curtains, settling basins, cofferdams, and other operational modifications would be applied.

The hydraulic pumps that are proposed as part of the Federal action would operate temporarily during a storm surge event for the purpose of minimizing rainfall and stormwater flooding impacts on the interior of the wall. The five proposed temporary pump stations would collect street-level stormwater that "ponds" because of the wall and exceeds the capacity of the current drainage system during a storm surge event, discharging it to the other side of the wall, as it would have with overland flow. The five permanent pump stations are intended to collect rainfall and stormwater runoff that is not collected by the subsurface drainage system as it naturally flows over land to low-lying marshes. The runoff would be pumped over/through the wall before water levels elevate to a level of inducing flooding to nearby structures. The pumps would not redirect the runoff; they would move the water where it would have drained without the wall.

When operating, the pumps would be a point source of stormwater discharge. The proposed pumps would be similar to the small- and medium-sized pumps that the City of Charleston already operates on a regular basis on the Charleston Peninsula, but would only be operated occasionally and temporarily. The proposed pumps would be expected to be compliant with state water quality standards. To minimize effects of the

pumped storm water on water quality, small manufactured treatment devices or sediment settling basins could be installed at the permanent pump stations if necessary.

Coastal Consistency Review Concluding Determination

The potential beneficial and adverse effects of the proposed Federal action on the human environment have been evaluated and documented in the draft FR/EIS. Based on the review provided here, USACE has determined that the proposed Federal action and the avoidance, minimization, and compensatory mitigation measures as proposed in the Charleston Peninsula Coastal Flood Risk Management Study, would be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the South Carolina Coastal Zone Management Program.

CLEAN WATER ACT SECTION 401 CERTIFICATION

CWA SECTION 401 CERTIFICATION LETTER WILL BE ADDED HERE

CLEAN WATER ACT SECTION 404(b)(1) EVALUATION

CWA 404 EVALUATION WILL GO HERE WHEN COMPLETED

STATE BASELINE ENVIRONMENTAL CONDTIONS DATA

EXISTING DATA ON ENVIRONMENTAL CONDITIONS PRODUCED BY THE SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES ARE BEING COMPILED FOR ESTUARINE SITES IN THE ROI AND WILL BE ADDED HERE

DRAFT MITIGATION PLAN

DRAFT MITIGATION PLAN

Charleston Peninsula Coastal Flood Risk Management Study

Draft Mitigation Plan

September 2021

This document describes the USACE and City of Charleston's strategy for mitigating adverse environmental effects that may result from implementation of the Tentatively Selected Plan (TSP) of the Charleston Peninsula Coastal Flood Risk Management Study (see more on the TSP in Section 2.0). This document will be updated during the remainder of the feasibility study with the Non-Federal Sponsor, and in coordination with environmental regulatory agencies, for the Final Feasibility Report/Environmental Impact Statement. It may also be revised during the Preconstruction, Engineering, and Design (PED) Phase of the project when the final engineering designs are provided and final jurisdictional determinations are made.

Previous coordination includes formation of an Interagency Coordination Team (ICT) made up of Federal, State, and local agencies who provided early input during the scoping phase of the study and on the initial array of alternatives. Once the TSP was identified and optimization was underway, USACE began meeting regularly with subsets of the ICT to discuss specific measures and features of the TSP and how they could affect environmental resources for which they have jurisdiction or interest. The natural resources agencies have been primarily engaged in conversations with USACE about compensatory wetland mitigation requirements for this study and provided feedback on the habitat functional analysis performed (described later in Section 4). Coordination with respect to alternatives for meeting the wetland mitigation requirement is currently underway. Similar meetings with a subset of the cultural resources agencies on the ICT have also occurred, with a focus on defining the extent of effects and the activities that would take place in PED to identify, minimize, and mitigate effects on cultural/historical resources.

1.0 Mitigation Framework

For natural resources, the Water Resources Development Act (WRDA) of 1986 (Section 906), as amended in WRDA 2007 (Section 2036), and WRDA 2016 (Section 1163), the Water Resources Reform and Development Act (WRRDA) of 2014 (Section 1040), the National Environmental Policy Act (NEPA), and USACE Engineering Regulation (ER) 1105-2-100, Appendix C establish the mitigation framework for this Draft Mitigation Plan. They require that adverse impacts to ecological resources from Federal actions are avoided or minimized to the extent practicable, and that remaining, unavoidable impacts are compensated for to the extent justified. For adverse impacts to wetlands which cannot be avoided or minimized, options include compensatory mitigation in the form of restoration, establishment, enhancement, and/or preservation South Carolina state regulations, specifically the Coastal Tidelands and Wetland Act of 1977 (Statutory Code Ann. Section 48-39-10 et seq.), must also considered in the mitigation framework for this study. Section 4.1 of this Plan provides more information on compensatory mitigation regulations specifically for wetlands.

For historic and cultural resources, the Advisory Council on Historic Preservation's Part 800 regulations provide the framework for this Draft Mitigation Plan. Specifically, 36 CFR 800.6(a) provides for continued consultation "to develop and evaluate alternatives or modifications to the undertaking that could avoid, minimize, or mitigate adverse effects on historic properties." As part of that continued consultation, the parties will enter into a Programmatic Agreement (PA) to provide for additional avoidance and minimization as more detailed project designs are developed and appropriate compensatory mitigation once project features are verified.

This Draft Mitigation Plan identifies avoidance and minimization measures that would be employed to lessen impacts to natural resources from the TSP. These are described in Section 3.0 below. While the primary focus of this Draft Mitigation Plan is on natural resources, given the parallel process for addressing mitigation to historic and cultural resources under the PA, this Plan also includes reference to mitigation for historic and cultural resources where specifically noted (e.g., under Avoidance and Minimization Measures, below). Among the natural resources, the most significant of unavoidable adverse impacts expected are direct and indirect impacts to saltmarsh wetland systems. The framework for compensatory mitigation for these and other natural resources, and how it will be applied is described in Section 4.0. Impacts to historic and cultural resources have the potential to be significant, but will be addressed in the parallel process under the PA.

2.0 Summary of TSP and Impacts

The TSP for the Charleston Peninsula Coastal Flood Risk Management Study is Alternative 2, which is also the National Economic Development plan. It includes structural and nonstructural measures, and Natural and Nature Based Features (NNBF) (see Figure 1).

Structural measures of Alternative 2 would consist of an 8.6-mile storm surge wall of 12 ft NAVD88 elevation along the perimeter of portions of the Charleston Peninsula. Most of the storm surge wall (~7.1 miles) would be on land in the form of a T-wall design, while ~1.5 miles would be in salt marsh wetlands in form of a combination wall design. The width of the combination wall that will be in the marsh is estimated to be 10 ft, with an additional 25 ft on the landward side where piles would be battered at an angle. These structural designs and dimensions are described in more detail and with graphics in the draft integrated Feasibility Report/Environmental Impact Statement (FR/EIS) in Appendix B Engineering, Structural Sub-Appendix.

The storm surge wall would also include gates in select locations for pedestrians and traffic flow (auto and rail), and for tidal flow in marshes, referred to as storm gates. The number and size of upland gates will be determined in the PED phase. For storm gates, these would be in the form of sluice gates and 10 are planned. In addition, 5 permanent and 5 temporary pump stations would be used to mitigate for interior flooding that may be induced by the wall during a storm surge event. The permanent pumps would be housed in a structure of 60 ft x 50 ft that would be located on high ground. The gates and pumps are also described in more detail and with graphics in the Structural Sub-Appendix of the FR/EIS.

Alternative 2 would also include implementation of nonstructural measures in two primary locations, the Rosemont and the Bridgeview neighborhoods of the Charleston Peninsula. The types of non-structural measures planned are home raising and flood proofing. Finally, for NNBF, roughly 9,300 linear feet of reef-based living shoreline sills would be created in association with the storm surge wall.

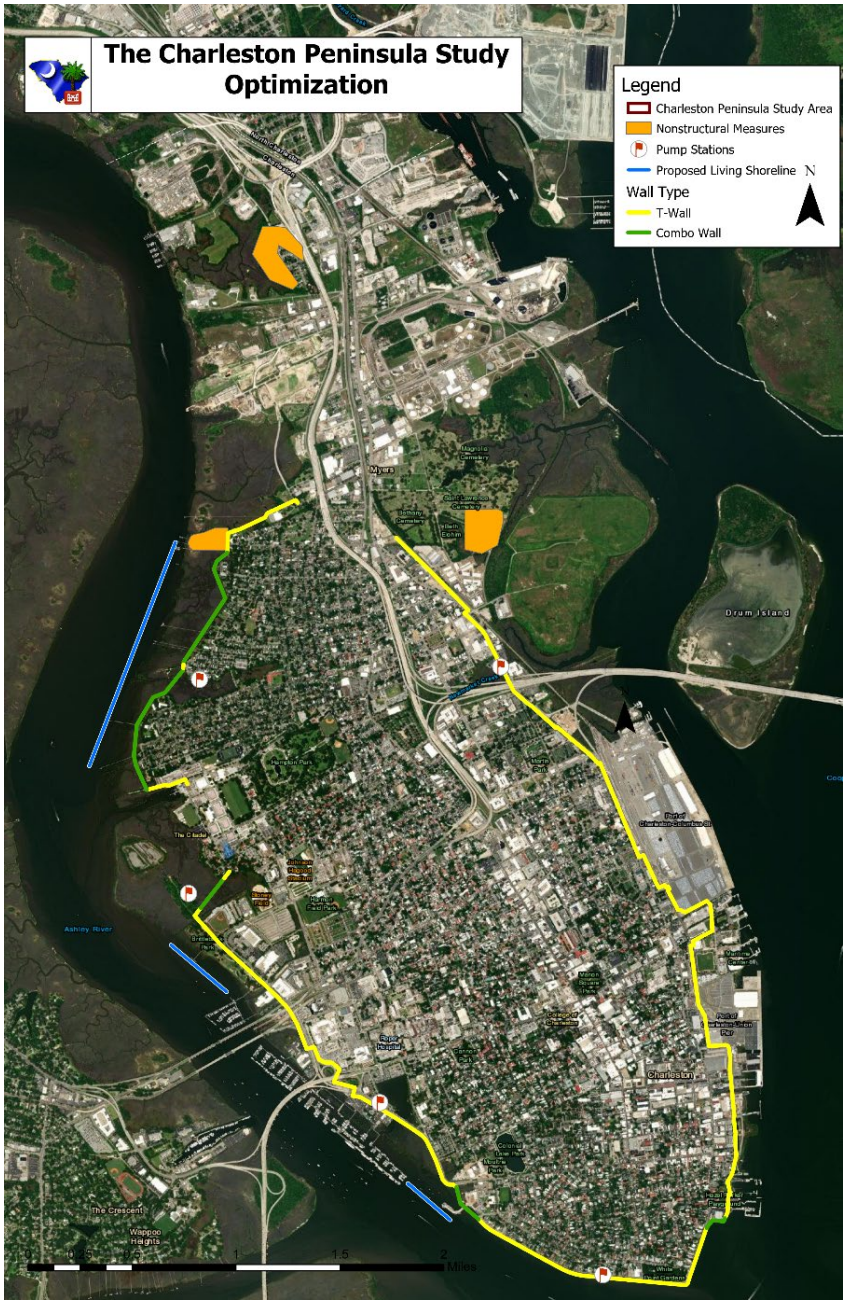

Figure 1. Map showing the structural and nonstructural measures, NNBF, and other potential features (e.g., pumps) in Alternative 2 of the Charleston Peninsula Coastal Flood Risk Management Study. This alternative is the Tentatively Selected Plan. (Source: USACE)

The direct and indirect effects from the TSP on environmental resources are described in detail in the FR/EIS. The National Environmental Policy Act defines direct effects as those which are caused by the action and occur at the same time and place. Indirect effects are defined as those which are caused by the action and are later in time or farther removed but still reasonably foreseeable. Many beneficial effects on the human environment would result through a reduction in storm surge flooding including for floodplain management, life safety, compound flooding, historical/cultural resources, transportation and some land uses. The living shoreline sills would, in addition to stabilizing natural shorelines from coastal storms, potentially benefit aquatic, benthic, and wildlife resources, and water quality.

Adverse effects are expected across of a number of environmental resources but most would be temporary, such as from construction activities, and are considered to be minor.

For natural resources, no significant adverse effects would occur to threatened and endangered species. Water quality and aquatic resources are expected to be adversely affected as a result of the occasional and temporary closure of the storm gates during a storm surge event. There is the potential for permanent adverse effects to wetlands. After optimizing the TSP (see below), there remains the potential for up to 40 acres of salt marsh wetlands to be adversely affected if the TSP is selected. The process for identifying the number of wetland acres that would be compensated for through mitigation and how they would be compensated for are described in the remaining sections of this document. Most of the losses would be to fringing salt marsh along the Ashley River in the footprint of the wall and a buffer area around the wall that USACE is assuming would be permanently adversely affected, and areas of marsh between the wall and the shoreline that would be permanently impounded, or blocked from tidal flow. Portions of the salt marsh tidal creek system at Halsey Creek, the only tidal creek on the peninsula that the wall directly intersects, would not be impounded through the use of gates, but would potentially be degraded. A small area of sandy tidal flat (less than one acre) near the current Battery seawall would also be lost as a result of the TSP.

Historic and cultural resources, as well as visual resources, also have the potential to be adversely affected by the structural and nonstructural measures of the TSP. The significance of such impacts to these resources will vary by location and depends upon final designs in the PED phase of the project. These resource areas are also addressed in separate appendices to the FR/EIS.

3.0 Avoidance and Minimization Measures

The first step in mitigation planning involves efforts to avoid and minimize adverse effects on environmental resources. Resource agencies have been engaged in discussion about the measures in the TSP through technical meetings and site visits. Primary concerns were centered around cultural and historic resources, including viewshed impacts to historical sites from the storm surge wall, and on placement of the storm surge wall in saltmarsh wetlands. USACE has taken the following planning actions to avoid and/or minimize effects of the TSP, and proposes additional steps that can be taken during the PED phase to further reduce adverse effects.

Alignment of storm surge wall. During optimization of the TSP, USACE assessed the feasibility of moving portions of the storm surge wall from salt marsh wetlands to the land to avoid impacts to

wetlands, as required by the "Wetland Mitigation Rule." This would avoid impacts to aquatic and benthic resources in those locations, and to localized water quality. Due to limited construction space in the urbanized landscape of the peninsula, this was not feasible everywhere. The following modifications were made to the earlier conceptualization of the storm surge wall:

- moved storm surge wall from marsh along Ashley River on to (alongside of) Lockwood Blvd, from US Coast Guard Station to Brittlebank Park
- reduced length of storm surge wall through the Citadel marsh by tying into high ground along most of the Citadel shoreline

The change in alignment resulted in a considerable reduction of roughly 71 acres of wetlands potentially impacted from the previous conceptualization of the TSP in the draft FR/EA of April 2020 to the current TSP in the FR/EIS (from 111 acres to 40 acres). The wetland effects were then further reduced to only 35 acres of lost wetland habitat function through minimization measures (described below). With the modified alignment, though, the number of upland gates that would be needed for traffic and pedestrian flow increased. USACE will continue to identify opportunities to minimize effects on transportation.

Design of storm surge wall. USACE and City of Charleston assessed whether the addition of a walking path, similar to the promenade on the current Battery wall, would be a justified feature of the TSP to offset some effects on transportation, visual resources and cultural/historic resources (but not as a recreation feature). A walking path on portions of the wall where it is on land has been added to the optimized TSP. During the PED phase, USACE and City of Charleston will also consider design features for the storm surge wall that would maximize consistency with the history and culture of the peninsula to minimize adverse effects on historic and cultural resources and aesthetics.

Elimination of breakwater. A large water-attenuation structure, or breakwater, was originally considered as a cost-effective way to reduce damages from coastal storm surge inundation. In the draft FR/EA released in April 2020, this measure was included in one of the final array of alternatives under consideration. However, because the economics of the breakwater did not justify its continued inclusion, it was eliminated from further consideration in the FR/EIS. While this decision was economically-driven up front, it had the positive effect of avoiding direct impacts on aquatic and benthic resources in waters of the Charleston Harbor, as well as viewshed and other effects, and is illustrative of the continued effort to refine the TSP to the optimal storm surge risk reduction while limiting the extent of structural measures.

Gate modifications. The miter gate that was originally proposed at the Citadel boat channel has been removed from the TSP. This minimizes effects on aquatic resources and recreation. During the PED phase, USACE and the City of Charleston will continue to look for opportunities to reduce the number of upland gates and their effects on transportation. Also during the PED phase, the gate closure protocol will be refined in a manner that provides storm surge and life safety protection while minimizing effects to transportation, interior drainage, water quality, salt marsh wetlands, and aquatic resources to the greatest degree feasible. The Charleston Weather Forecast Office of NOAA will be consulted on how storm surge forecasts and local meteorological information can be used to make the best-informed decisions about opening and closing gates. For the storm gates, it has been

proposed that the gates close on the last low tide prior to the onset of storm impacts forecasted by NOAA. The gate protocol will be included in the Operations and Maintenance Plan that will be part of the legally-binding Project Partnership Agreement between USACE and City of Charleston. Regular maintenance would also be performed on the gates to minimize the risk of failure, which would be detailed in the Operations and Maintenance Plan.

Hydraulic Pumps. Permanent and temporary pump stations are proposed in the TSP to minimize impacts of damaging flooding that would be induced by the storm surge wall when the gates are closed during a storm surge events. Adverse effects the pumps may have on water quality would be minimized by reducing the time the gates need to be closed and pumps are active to the greatest degree practicable. Pumps would be expected to meet state water quality standards. Small manufactured treatment devices or sediment settling bases could be added in some locations if necessary. During the PED phase, refined modeling of the interior hydrology will be performed and USACE will look for opportunities to reduce the number and size of pumps to reduce potential water quality impacts while still addressing flooding mitigation needs. Pumps that would be near salt marsh wetlands would be placed in low lying areas but not in marshes or creeks.

Construction Best Management Practices. The FR/EIS has helped to identify when adverse effects may result from construction of the TSP, and where minimization measures could be applied. USACE would require that various construction best management practices (BMPs) be included in contractor construction plans. These may include use of erosion blankets, silt fences, settling basins, and cofferdams to minimize erosion, sedimentation, and turbidity impacts on water quality and aquatic resources. Best management practices for noise abatement would include considering the days and times of days when construction would occur, and use of noise control techniques on equipment, such as mufflers and intake silencers. Pile driving in shallow open water areas would be limited to low tide to reduce the potential for underwater sound impacts on marine mammals and fish. The "Standard Manatee Construction Conditions" recommended by the U.S. Fish and Wildlife Service would be required to reduce potential construction-related impacts to the manatee to discountable and insignificant levels (FWC, 2011). These recommendations will also help to reduce the potential for adverse effects on other aquatic resources. Down-shielding of nighttime lighting would reduce effects on migratory birds. A special minimization feature that would be used is a workload trestle for keeping heavy equipment off the marsh during construction of the combination wall. It would be similar to a trestle currently being used by the City of Charleston for another construction projects to reduce impacts to the marsh and the need for construction equipment to be brought in or stored in the water.

4.0 Compensatory Wetland Mitigation

4.1 Wetland Mitigation Guidance

Section 2036(a) of the Water Resources Development Act (WRDA) of 2007 required, among other things, that USACE Civil Works mitigation plans meet the applicable mitigation standards and policies of the Regulatory programs administered by the Secretary of the Army. On April 10, 2008, USACE and U.S. Environmental Protection Agency (USEPA) published regulations entitled, "Compensatory Mitigation for Losses of Aquatic Resources" ("Mitigation Rule"). The primary goal of these regulations was to improve the quality and

success of compensatory mitigation plans that are designed and implemented to offset impacts to aquatic resources authorized by Department of the Army regulatory permits. Subsequent guidance issued 31 August 2009 by USACE (CECW-PC Memorandum, Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 07) - Mitigation for Fish and Wildlife and Wetlands Losses) concluded that Civil Works guidance on mitigation planning is consistent with the applicable standards and policies of the Corps Regulatory Program for wetlands mitigation.

The Mitigation Rule emphasizes the strategic selection of mitigation sites on a watershed basis and established equivalent standards for all types of compensatory mitigation (mitigation banks, in-lieu fee programs, and permittee-responsible mitigation plans). Per regulations 33 CFR Parts 325 and 332, compensatory mitigation means the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of wetlands for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. The three mechanisms for providing compensatory mitigation listed in order of preference as stated in the Mitigation Rule are the following: mitigation banks, in-lieu fee programs, and permittee-responsible mitigation. Compensatory mitigation is necessary to offset these unavoidable impacts to aquatic resource functions and services and to meet the programmatic goal of "no overall net loss" of aquatic resource functions and services.

Likewise, the South Carolina Coastal Tidelands and Wetland Act of 1977 requires that impacts to wetland be mitigated. It states that avoidance is preferable to mitigation. and that mitigation shall be performed at a ratio of 1:1 wetland created to wetland altered, for projects deemed in the public interest.

While the focus of this section is on Wetland Compensatory Mitigation, it is noted that the Mitigation Rule being applied is itself titled, "Compensatory Mitigation for Losses of Aquatic Resources." Thus, the mitigation considered here would also address effects of the TSP on related aquatic resources occupying or using the impacted wetland areas, including the habitat of commercially and recreationally important species.

4.2 Mitigation Planning Objective

USACE and City of Charleston intend to compensate for significant adverse effects on salt marsh wetlands through in-kind mitigation to the extent incrementally justified, and employing a watershed approach. The preliminary mitigation planning objective is to replace non-negligible direct loss, and indirect losses in habitat function and quality, of salt marsh wetlands (measured in habitat units) as a result of the TSP as is required by USACE policy. The action to be taken to achieve the mitigation objective for wetland losses is anticipated to be either the purchase of credits from an approved Mitigation Bank and/or a Permittee-Responsible Mitigation alternative (to be determined).

Since only one Federal action alternative was carried forward in the final array of alternatives in the FR/EIS, a cost comparison per habitat functional unit between action

alternatives was not needed. An incremental cost effective analysis to compare and select from the different mitigation alternatives (Mitigation Bank or Permittee-Responsible Mitigation) is needed.

4.3 Areas of Potential Impact

Consistent with USACE policy and at this stage in the planning process, this Draft Mitigation Plan considers the wetland losses reasonably expected to occur from the conceptual measures in the TSP. Careful consideration has already been taken during optimization of the TSP to avoid impacts to wetlands where feasible, reducing the number of wetlands potentially impacted in an earlier conceptualization of the alternative from approximately 111 acres to 40 acres. As such, USACE does not expect the potential impact areas to change considerably. During the PED phase, when the conceptual measures will be finalized, there may be opportunities to further minimize wetland impacts, resulting in a reduction of wetland impacts. If that happens, jurisdictional agencies will be consulted and this Mitigation Plan will be updated accordingly. Also during the PED phase, wetland delineations will be performed by USACE at each of the wetland impact areas to verify the actual acreage, but are not expected to be considerably different from what has been estimated during the feasibility phase.

For this study, potential areas of wetland impact were identified based on a visual assessment of geospatial data, site reconnaissance, and local understanding of the sites. The marshes and tidal creek systems that would be impacted are relatively small. Because the wetland areas are small, they were hand-digitized (leaving some room for inaccuracy) using current imagery, and spot-checked with 2017 NOAA Coastal Change Analysis Program (C-CAP) data. USFWS National Wetland Inventory (NWI) data was only used as a general guide since it is the least current of the data sets. However, NWI data confirmed, for estimation purposes, that only one wetland type according to the Cowardin et al (1979) system is present at the potential impact locations: estuarine emergent wetlands. The potential impact acreage was calculated based upon the intersection of the conceptual footprint of the storm surge wall and buffer with the digitized wetlands, including the wetland areas landward (behind) the wall. The impact areas are predominantly on the Ashley River-side of the Charleston Peninsula. Since the storm surge wall would not be continuous in the marsh (i.e., coming onto land in some areas), the wetlands impacted are also not continuous and can be isolated by location. Figure 2 shows the locations and labels of saltmarsh wetland areas potentially affected by the TSP.

Figure 2. Potential wetlands impact areas from the TSP. (Source: USACE)

The total area of wetlands that may be affected by the TSP, prior to accounting for minimization measures and the wetland functional analysis, is 40.3 acres. The acreage per impact site is shown in Table 1.

Table 1. Estimated saltmarsh/mudflat/water quality (all EFH) impact locations.

MARSH LOCATION	ESTIMATED IMPACT AREA (acres)
Ashley River along Wagener Terrace – North end	6.4
Halsey Creek	13.2
Ashley River along Wagener Terrace – South end	4.6
Citadel Marsh (behind Joe Riley Stadium)	11.5
Diesel Creek	1.2
USCG Marsh	3.4
TOTAL	**40.3**

4.4 Wetland Functional Analysis

USACE Engineering Regulation (ER) 1105-2-100 states that "habitat-based evaluation methodologies shall be used to the extent possible to describe and evaluate ecological resources and impacts associated with alternative plans." In order to comply with this and to meet the mitigation planning objective, the lost function and quality of the wetlands were considered, not just the acreage. USACE identified the Habitat Suitability Index (HSI) Model for white shrimp (Turner and Brody, 1983) to estimate the functional loss of wetlands, and for the associated mitigation alternatives and quantities that would occur with implementation of the TSP. This model was selected because all of the salt marshes in the study area are designated as Essential Fish Habitat (EFH) for white shrimp (*Litopenaeus setiferus*) in the post-larvae to juvenile stage, as defined by the South Atlantic Fisheries Management Council in accordance with Magnuson-Stevens Act. This HSI Model is among the models approved for use by the USACE ECO-PCX; however, since the model was developed for the Gulf of Mexico region, single-use approval has been granted by the USACE ECO-PCX to apply it in South Carolina estuaries for this study. NOAA Fisheries and other jurisdictional agencies have agreed with the appropriateness and use of the White Shrimp HSI for determining functional losses of wetland habitat of this feasibility study.

The output of the shrimp HSI model is an index between 0.0 and 1.0, which reflects total shrimp production or carry capacity for an area. The authors suggest that "generalized statements about habitat requirements cannot be applied equally to all populations," and "each variable in the model should be evaluated and modified as necessary for best results in a local situation." There are four habitat variables: V1 - percentage of marsh cover; V2 - substrate composition (soft, muddy, course); V3 - salinity (summertime mean); and V4 - Temperature (summertime mean). The first two variables relate to postlarvae and juvenile

white shrimp life requisites for food and cover, and the last two relate to water quality life requisites. The suitability index values are derived from graphical relationships with values for each habitat variable, and then are combined for the food/cover requisite component and for the water quality requisite component, respectively. The HSI is equivalent to the lowest value of either of the two life requisite values. The HSI also gives special consideration to physical structures, such as levees or roads, when evaluating habitat suitability for shrimp, which would apply to the storm surge wall in the TSP. If a physical structure would close off the hydrologic connection between estuarine shrimp habitat and the offshore habitat, a modifier is applied to the HSI calculation. The modifier states that if the hydrologic connection is ≤10% of the length of the confining boundary when considering the unconfined outline of the natural hydrologic unit, the site is assumed to be unsuitable for white shrimp habitat requirements, and the HSI score defaults to zero.

For this habitat functional analysis, each of the potential wetland impact areas was evaluated with respect to its suitability to provide habitat for white shrimp, both with the storm surge wall present, and without the wall (which represents the current habitat conditions). An HSI value, or score, was computed for each impact area using the White Shrimp HSI. The HSI score that resulted when computed with the wall present, was subtracted from the current condition HSI score, then multiplied by the number of acres at each impacted area. The output was the number of acres of habitat function lost, not the size of the impact area. The outputs of the white shrimp HSI functional analysis are shown in the last column in Table 2.

Table 2. Estimated Essential Fish Habitat Function lost at each wetland impact area.

MARSH LOCATION	ESTIMATED IMPACT AREA (acres)	ESTIMATED FUNCTIONAL LOSS (acres)
Ashley River along Wagener Terrace – North end	6.4	5.1
Halsey Creek	13.2	8.7
Ashley River along Wagener Terrace – South end	4.6	3.5
Citadel Marsh (behind Joe Riley Stadium)	11.5	5.8
Diesel Creek	1.2	0.8
USCG Marsh	3.4	2.4
TOTAL	**40.3**	**26.3**

4.5 Determination of Required Mitigation

In order to determine the required amount of wetland mitigation, Federal and state regulations and USACE policy must be considered. South Carolina coastal zone regulations as defined in the Coastal Tidelands and Wetlands Act (S.C. Code § 48–39–10 et seq) would require that wetland mitigation be compensated at a 1:1 ratio for TSP, if it were to be selected. This regulation does not take into account the habitat function of the impacted wetlands. The regulation states "*Mitigation shall take the form of wetland creation and/or*

wetland enhancement and restoration. Wetland creation shall be performed at a ratio of 2:1, wetland created to wetland altered, for private projects and 1:1, wetland created to wetland altered, for projects deemed in the public interest." As such, the mitigation requirement for this study should not be determined by using the white shrimp HSI alone, because the amount of mitigation calculated by habitat function is less than what is currently accepted for wetland mitigation by the State. USACE would be expected to mitigate for the wetland acreage lost, not function, in order to be in compliance with the Coastal Zone Management Act state regulations and to obtain Section 401 Water Quality Certification for estuarine emergent wetlands.

However, USACE believes the results of the functional analysis should be used for calculating the wetland mitigation requirement at Halsey Creek where most of the marsh is indirectly affected by the wall, not directly. Because storm gates would be installed in the wall at Halsey Creek as a minimization measure that allows for tidal exchange rather than creating a full restriction, the salt mash wetlands in Halsey Creek would not be completely lost, but some functions would be degraded over time. Therefore, the HSI calculation for functional acres lost would be used to define the mitigation requirement here. The HSI and associated modifier was also used to determine the number of sluice gates that would be needed to maintain suitable habitat for white shrimp in Halsey Creek.

After considering all applicable regulations and policies, the feasibility-level estimation of wetland acres required to be offset through compensatory mitigation is 34.8 acres (see Table 3).

Table 3. Required Compensatory Wetland Mitigation for Impacted Wetlands

MARSH LOCATION	ESTIMATED REQUIRED MITIGATION (acres)
Ashley River along Wagener Terrace – North end	6.4
Halsey Creek	7.7*
Ashley River along Wagener Terrace – South end	4.6
Citadel Marsh (behind Joe Riley Stadium)	11.5
Diesel Creek	1.2
USCG Marsh	3.4
TOTAL	**34.8**

*Includes estimation of habitat function lost, not total acreage impacted

4.6 Mitigation Alternatives

For the Draft Mitigation Plan, two basic mitigation alternatives are under consideration – a Mitigation Banking Alternative and a Permittee-Responsible Mitigation Alternative. USACE and the City of Charleston are in the process of identifying potential opportunities for salt marsh restoration that could be suitable for the Permittee-Responsible Mitigation

Alternative. Selection of an appropriate permittee-responsible mitigation site would be based on selection criteria that are consistent with policies and regulations and with input from natural resource agencies.

Securing credits from an approved saltwater mitigation bank would mean that many of the prerequisites for an acceptable mitigation plan have already been addressed. Permittee-Responsible Mitigation would require acquisition of appropriate real estate interests and financial assurances for the mitigation site. If Permittee-Responsible Mitigation becomes the selected mitigation alternative, then USACE and City of Charleston would work with local agencies to identify needed surveys and develop a mitigation work plan, maintenance plan, performance standards, monitoring requirements, long-term management plan, and adaptive management plan, all in accordance with mitigation regulations. These would be added to this Mitigation Plan if this alternative is selected.

To determine if a Permittee-Responsible Mitigation site meets the required mitigation need, it would also need to be evaluated for its potential to provide suitable habitat for white shrimp. The potential degraded site would be evaluated with the White Shrimp HSI to determine its current condition, and then it would be evaluated again with the HSI assuming restoration is achieved. The difference in white shrimp habitat function between the two conditions, or the ecological life requirements, would need to be equivalent to 35 acres or more.

There are currently three approved (permitted) saltwater mitigation banks in South Carolina – Clydesdale Mitigation Bank, Murray Hill Mitigation Bank, and Point Farm Mitigation Bank. There are a few other mitigation banks currently going through the permitting approval process so additional banks could be available prior to the Draft Mitigation Plan being finalized.

The Clydesdale Mitigation Bank was approved in June 2013, and includes 487.6 acres of tidal restoration and 202.66 acres of tidal preservation. The bank is located west of Highway 17 in Jasper County, South Carolina, approximately two miles north of Savannah, Georgia.

The Murray Hill Mitigation bank was approved in May 2018, and includes 452.9 acres of tidal preservation, 353.6 acres of tidal restoration, and 32 acres of upland preservation. The bank is located north of the Savannah River, west of Highway 17, and adjacent to the Clydesdale Mitigation Bank, in Jasper County, South Carolina.

The Point Farm Mitigation bank was recently approved and permitted in June 2021 but is not authorized to release credits yet. This bank will include 35.31 acres of tidal restoration, 22.9 acres of tidal enhancement, and 1,107.57 acres of tidal preservation. The bank is located on the western end of Wadmalaw Island, approximately 22 miles west-southwest of Charleston, in Charleston County, South Carolina.

4.7 Mitigation Costs

A rough order of magnitude (ROM) cost for Permittee-Responsible Mitigation cannot be developed until a potential site (or sites) is identified. However, ROM mitigation costs can be estimated for the wetland mitigation banks, based on present day values, which is appropriate for this feasibility-level study (See Tables 4a, 4b, and 4c.)

The ROM cost for mitigating significant adverse effects to wetland from the TSP, using wetland mitigation banking as the mitigation alternative, would be $7,600,000 - $9,400,000.

4.8 Selecting a Mitigation Alternative

Once a Permittee-Responsible Mitigation site(s) is identified and evaluated with the white shrimp HSI to determine that it would meet the mitigation requirement for the TSP, a ROM cost for the Permittee-Responsible Mitigation site(s) can be developed.

USACE policy is to compare different mitigation alternatives and select the "best-buy" mitigation plan. To do this, a cost effective/incremental cost analysis (CE/ICA) would be performed, as described in USACE ER 1105-2-100. The CE/ICA would identify the least cost mitigation alternative that provides full mitigation of losses identified in the mitigation plan, and that is unconstrained except for required legal and technical constraints. The average annual habitat units and the cost for each potential mitigation site would are used in the CE/ICA. The data used and methods for this analysis would be displayed here when the Draft Mitigation Plan is updated.

4.9 Consistency with the Mitigation Rule

Once a mitigation alternative is selected as described above, this section will be updated to document how it conforms with the Mitigation Rule and other relevant policy and regulations.

Table 4a.

Proposed Mitigation Using Murray Hill Mitigation Bank			
Wetland Impact Site	Required Acres	Murray Hill Mitigation Bank Required Credits	Murray Hill Mitigation Bank Credit Cost
Ashley River North	6.4	21.76	$1,414,400.00
Ashley River South	4.2	14.28	$928,200.00
USCG	3.4	11.56	$751,400.00
Diesel Creek	1.2	4.08	$265,200.00
Halsey Creek	7.7	26.18	$1,701,700.00
Citadel Marsh	11.5	39.1	$2,541,500.00
Totals	34.4	116.96	$7,602,400.00

Table 4b.

Proposed Mitigation Using Point Farm Mitigation Bank			
Wetland Impact Site	Required Acres	Point Farm Mitigation Bank Required Credits	Point Farm Mitigation Bank Credit Cost
Ashley River North	6.4	30.464	$1,827,840.00
Ashley River South	4.2	19.992	$1,199,520.00
USCG	3.4	14.178	$850,680.00
Diesel Creek	1.2	5.712	$342,720.00
Halsey Creek	7.7	31.57	$1,894,200.00
Citadel Marsh	11.5	49.22	$2,953,200.00
Totals	34.4	151.136	$9,068,160.00

Table 4c.

Proposed Mitigation Using Clydesdale Mitigation Bank			
Wetland Impact Site	Required Acres	Clydesdale Mitigation Bank Required Credits	Clydesdale Mitigation Bank Credit Cost
Ashley River North	6.4	26.88	$1,747,200.00
Ashley River South	4.2	17.64	$1,146,600.00
USCG	3.4	14.28	$928,200.00
Diesel Creek	1.2	5.04	$327,600.00
Halsey Creek	7.7	32.34	$2,102,100.00
Citadel Marsh	11.5	48.3	$3,139,500.00
Totals	34.4	144.48	$9,391,200.00

5.0 Monitoring and Adaptive Management

If mitigation banking is selected as the mitigation alternative, the approved mitigation bank would assume monitoring and adaptive management (and long term management which would normally be included as an Operation & Maintenance cost) of the compensatory site in accordance with their bank approval requirements. USACE and City of Charleston will have met their mitigation requirement once the mitigation banking credits are purchased (prior to project construction) and no further action is needed. If Permittee-Responsible Mitigation is selected, then USACE and City of Charleston would work with natural resource agencies to identify success criteria for the saltmarsh restoration and develop a monitoring plan that includes realistic metrics for assessing those criteria, which will be included in this section. It will lay out an overall duration and timeline for monitoring, although this may vary depending on individual metrics. The monitoring plan would also identify responsible parties for monitoring and long-term maintenance costs. The plan would identify triggers for adaptive management, such as a percentage of plant mortality, and actions that would be taken to modify the mitigation work plan.

6.0 References

Florida Fish and Wildlife Conservation Commission (FWC). 2011. Manatee Standard Conditions for In-water Work.

Turner, R.E. and M.S. Brody. 1983. Habitat suitability index models: Northern Gulf of Mexico brown and white shrimp. U.S. Department of Interior, Fish and Wildlife Service. FWS/OBS-82/10.54. 24pp.

USACE. 2010. Guidelines for Preparing a Compensatory Mitigation Plan. Working Draft, Subject to Change, Last Revised October 7, 2010. U.S. Army Corps of Engineers, Charleston District.

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ENVIRONMENTAL CORRESPONDENCE

COPIES OF OTHER CORRESPONDENCE WILL BE ADDED HERE