US Army Corps of Engineers ®
Galveston District

Appendix B-1

Fish and Wildlife Coordination Act

for

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

November 2021

The Fish and Wildlife Coordination Act Report (FWCAR) will be placed here when it is received from US Fish and Wildlife Service.

US Army Corps of Engineers ®
Galveston District

Appendix B-3

Clean Water Act Compliance

for

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

October 2021

Section 404

404(b)1 Short-Form

EVALUATION OF SECTION 404(b)(1) GUIDELINES (SHORT FORM)

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

GUIDELINE COMPLIANCE:

1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:	Yes	No*
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	X	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	X	
2) Jeopardize the existence of Federally-listed endangered or threatened species or their habitat; and	X	
3) Violate requirements of any Federally-designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see values, Section 2)	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	X	

2. Technical Evaluation Factors (Subparts C-F)	Not Applicable	Not Significant	Significant*
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)		X	
1) Substrate impacts		X	
2) Suspended particulates/turbidity impacts		X	
3) Water column impacts		X	
4) Alteration of current patterns and water circulation		X	
5) Alteration of normal water fluctuation/ hydroperiod		X	
6) Alteration of salinity gradients		X	
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)		X	
1) Effect on threatened/endangered species and their habitat		X	
2) Effect on the aquatic food web		X	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		X	
c. Special Aquatic Sites (Subpart E)		X	
1) Sanctuaries and refuges	X		
2) Wetlands		X	
3) Mud flats	X		
4) Vegetated shallows		X	
5) Coral reefs	X		
6) Riffle and pool complexes	X		
d. Human Use Characteristics (Subpart F)		X	
1) Effects on municipal and private water supplies	X		
2) Recreational and commercial fisheries impacts		X	
3) Effects on water-related recreation		X	
4) Aesthetic impacts		X	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves	X		

* Where a 'Significant' category is checked, add explanation below.

List Appropriate References: Chapter 4 of the DIFR-EA.

Little or no movement of dredged or fill material is anticipated to occur following dewatering and consolidation of sediments used for the marsh restoration units. This is due to the typically low velocities of water flow across the marsh areas, construction of temporary containment dikes around the restoration units, and the use of the best available techniques and BMPs during construction.

During dredging and construction activities, localized effects to water quality is expected, including increased turbidity and total suspended sediments, organic enrichment, reduced dissolved oxygen, elevated carbon dioxide levels, and decreased light penetration, among others. Potential adverse effects on biota, including primary production photosynthesis, suspension/filter feeders, and sight feeders,

could be primarily associated with increased turbidity and total suspended sediments, water temperature changes, and lower dissolved oxygen during dredging and construction activities. Any such direct adverse effects to water quality and indirect adverse effects to biota would generally be temporary and localized. Following dredging, placement, and construction activities, overall water quality in the localized impact area would return to pre-construction conditions.

Dredging and placement of dredged material would smother and destroy immobile benthic organisms and force mobile benthos to move from the borrow and discharge areas. It is expected that benthic organisms would re-colonize the borrow sites and the dredged material fill/discharge sites within 1-3 years due to its similarity with the existing substrate in the disposal areas . The repair of the existing containment levee breaches would preclude aquatic organisms from re-entering the disposal area; however, establishment of a living shoreline and accretion of marsh anticipated from trapping sediment behind the breakwater would increase suitable habitat for aquatic organisms resulting in no net loss. Temporary containment/exclusion dikes would naturally degrade or would be breached in multiple places following construction, if necessary, to restore aquatic organism and fish access from other marsh areas if natural degradation is not sufficient. Following construction, dredged sediments would consolidate and differentially settle to different elevations thereby resulting in development of lower-lying areas that would develop into small ponds and streams further enabling aquatic organism access from surrounding waters. Coastal marshes in the project area have been fragmenting, degrading, and converting to less productive marshes or open water at a significant rate. Therefore, restoring marsh is considered to have a higher ecological value than open-water because of its benefits to terrestrial and aquatic organisms in an areas with decreasing wetland habitats.

Stone placed for the breakwater structures is expected to settle initially following construction due to the overburden pressure that the stone would create on underlying unconsolidated substrate. However, placement of geotextile fabric between the stone and substrate would help to prevent the complete sinking of the rock over time. Placement of stone would have localized effects to water quality, including increased turbidity and total suspended sediments. These impacts would be expected to cease following placement.

During construction of the breakwaters, the placement of geotextile fabric and stone would smother sessile and slow-moving benthic organisms and force mobile organisms to move from the placement site. The rock and geotextile fabric, by design, covers benthic subtidal sediments; hence infauna would likely be absent. However, stone would provide substrate for epifaunal colonization . Opening in the structure would allow for continued movement of aquatic species between Sabine Lake and the shoreline.

Construction of the living shoreline would not involve placing dredged material or filling in Waters of the US.

3. Evaluation of Dredged or Fill Material (Subpart G)		
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)		
1) Physical characteristics		X
2) Hydrography in relation to known or anticipated sources of contaminants		X
3) Results from previous testing of the material or similar material in the vicinity of the project		X
4) Known, significant sources of persistent pesticides from land runoff or percolation		X
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances		X
6) Other public records of significant introduction of contaminants from industries, municipalities or other sources		X
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities		X
3. Evaluation of Dredged or Fill Material (Subpart G) (continued)	**Yes**	**No**
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	X	

Sediment dredged from the SNWW would be beneficially used to complete marsh restoration and existing containment levee repairs. The dredged material has been characterized as silt and clay, with varying amounts of organic material and sands.

USACE has collected and archived a significant amount of water and sediment chemistry data as well as elutriate data that provide information on the constituents that are dissolved into the water column contained during dredging and placement. Historical water and elutriate data for detected compounds from 1987, 1990, 1992, and 1998[1]. Lead and zinc were the only metals found above detection limits in 1987 at all stations in water and elutriate samples. One water sample from station S-SP-87-06 contained 98.0 µg/L of zinc that slightly exceeds the state water quality standards (92.7 µg/L). However, the elutriate value was low indicating no release of zinc to the water column during dredging or placement. Metals were not detected in 1990, and in 1992 the only metal found above detection limits was cadmium (in water) at station S-SP-92-06. In 1998, barium and zinc concentrations were found above detection limits for water and elutriate and were consistently higher in the elutriate samples. This contrasts to the 1987 samples, in which elutriate values were normally lower than water concentrations. Arsenic was detected at most stations in water and two stations for elutriate; cadmium and nickel were found in water only. All values, except the zinc value noted above, were below the water quality criteria (WQC) and state water quality standards.

Oil and grease were detected in 1987 in water and elutriate samples. Ammonia, which was not measured until 1996 was found above detection limits in all elutriate samples for 1998. For the organics,

[1] PBS&J. 2004. Sabine-Neches Waterway Entrance Channel 2004 Contaminant Assessment. Document No. 040338. PBS&J. Austin, Texas.

in 1987 fluoranthene was above detection limits at one station. TOC was detected in all water and elutriate samples during 1992, and elutriate concentrations were consistently higher than water concentrations. Based on available water and elutriate data, there is no indication of current water or elutriate contaminant problems along the SNWW.

For the breakwaters, stone and geotextile fabric would be used to construct the structure. The stone would come from an upland quarry and would be transported to the fill site by barge. Cranes and other heavy equipment would be used to place the stone to construct the breakwaters. The stone would be free of any chemicals or sealants that could be harmful to the environment.

4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	
1) Depth of water at placement site	X
2) Current velocity, direction, and variability at placement site	X
3) Degree of turbulence	X
4) Water column stratification	X
5) Discharge vessel speed and direction	X
6) Rate of discharge	X
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	X
8) Number of discharges per unit of time	X
9) Other factors affecting rates and patterns of mixing (specify)	

4. Placement Site Delineation (230.11(f)) (continued)	**Yes**	**No**
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	X	

5. Actions to Minimize Adverse Effects (Subpart H)	Yes	No
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken:

1) Best available practical techniques and BMPs would be utilized during dredging and construction activities to avoid and minimize potential temporary and long-term adverse impacts, such as maintaining a work area that remains aesthetically attractive free of floating or piled debris and trash, storing fuels and other hazardous materials in locations which would not be introduced to surface waters if spilled, using silt curtains when appropriate to minimize movement of sediments, etc.

2) Movement of heavy equipment and support vehicles would utilize placement pipeline corridors to the greatest extent possible. Staging areas, access corridors, and general ground disturbance not related to restoration would utilize the smallest footprint possible to maintain a safe work environment.

3) Geotextile/filter cloth would be placed under the breakwater structure to reduce subsidence of placed rock over time.

4) Movement of sediment during and post-construction would be contained by constructing temporary earthen containment/exclusion dikes around the marsh restoration sites. Dikes would be constructed of in-situ materials and would be breached through natural degradation or mechanical means following sufficient dewatering and settlement of the placed material. The dike would be able to maintain one-foot of freeboard at all times.

5) Only clean fill material (dredged material or stone) free of contaminants would be placed in the restoration area. Placed dredged material will be of such composition that it will not adversely affect the biological, chemical or physical properties of the receiving waters.

6. Factual Determination (230.11)	Yes	No*
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a, 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

7. Evaluation Responsibility
a. This evaluation was prepared by: **Melinda Fisher** Position: **Coastal Biologist,** Regional Planning and Environmental Center

8. Findings (Select One)	**Yes**
a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	X
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions: N/A	
c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s): 1) There is a less damaging practicable alternative 2) The proposed discharge will result in significant degradation of the aquatic ecosystem 3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	

_____ Date	_____ Amanda M. McGuire Chief, Environmental Branch

NOTES:

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

Negative responses to three or more of the compliance criteria at the preliminary stage indicate that the proposed projects may not be evaluated using this "short form" procedure. Care should be used in assessing pertinent portions of the technical information of items 2a-e before completing the final review of compliance.

Negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the Guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form" evaluation process is inappropriate.

SUPPORTING DOCUMENTATION

Project Description

The U.S. Army Corps of Engineers, Galveston District (USACE), in partnership with Ducks Unlimited and the Port of Orange, is exploring the feasibility of implementing a pilot project for the beneficial use of dredged material generated during operations and maintenance dredging of the Sabine Neches Waterway (SNWW) as a means to restore degraded marsh lands. This project is one of ten final proposals evaluated and selected from 95 submittals because it has a high environmental, economic, and social benefits, and exhibited geographic diversity.

The project is located within Hickory Cove Bay in an area known as the saddle where the Sabine and Neches rivers merge into Sabine Lake in Orange County, Texas. The project area includes 1,200 acres of impounded marsh lands and open water areas of Sabine Lake. The land is owned and operated by the Hawk Club, a private hunting club, and adjacent to the Lower Neches Wildlife Management Area (WMA) which is owned and operated by Texas Parks and Wildlife Department (TPWD). The Sabine Neches Waterway (SNWW) is the only federal navigation project immediately near the study area (Figure 1).

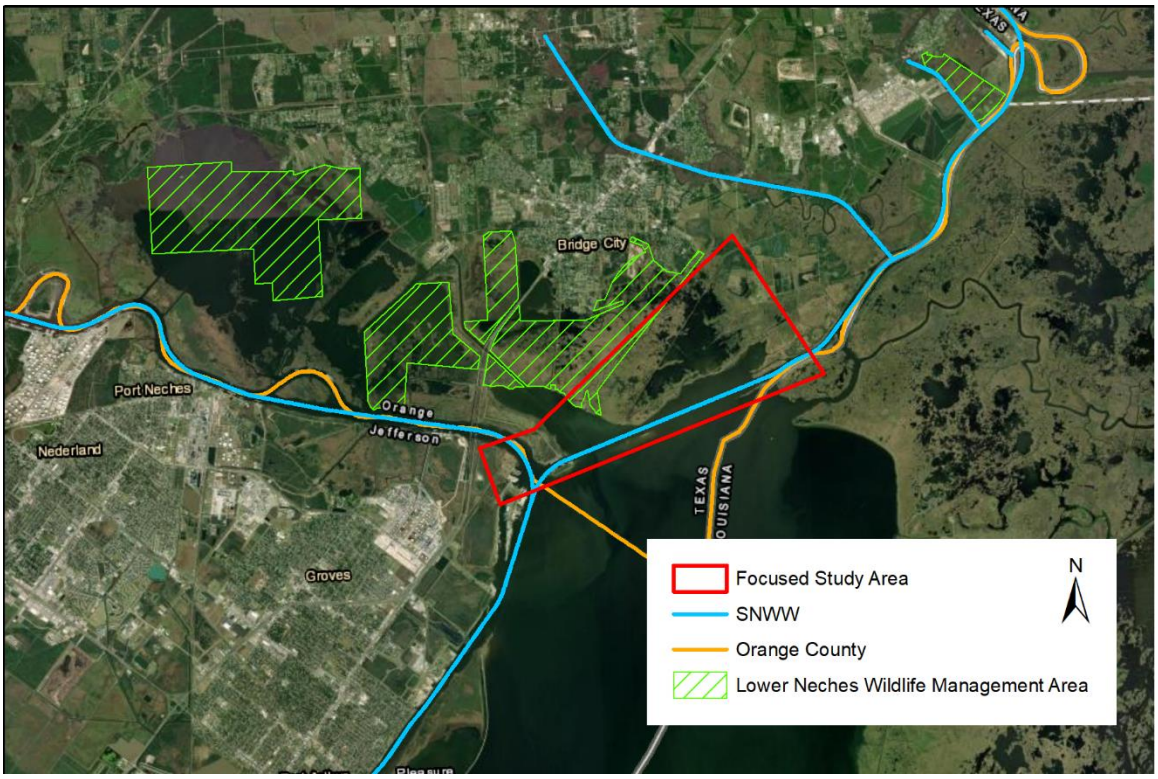

Figure 1. Study Area

Alternative 3 was chosen as the tentatively selected plan (TSP) (Figure 2). This plan involves beneficially using dredged material to restore up to 670 acres of marsh habitat and create resiliency against future conditions. Marsh measures consist of three phases of marsh restoration that would increase land coverage in the project area and improve terrestrial wildlife habitat, hydrology, and water quality. To protect marsh restoration efforts, the project involves repairing an existing containment that will limit

hydrologic connection between Sabine Lake and the interior marsh areas to only extreme conditions and create conditions conducive for reestablishment and sustainment of marsh under future conditions. Shoreline measures include construction of rock breakwaters and living shoreline features that help to mitigate erosion, dissipate wave energies, stabilize shorelines, reduce land loss, reduce saltwater intrusion, and support reestablishment of emergent marsh through retention of sediments. Material placed into the marsh and on the existing containment levee would have similar properties to the existing native material. Under the existing and projected future dredging cycles, there is sufficient quantities of suitable material available to meet all restoration needs without seeking other borrow sources (e.g. off-shore, upland placement areas).

Alternative 3 measures have been developed to a feasibility level of design (i.e. estimates, design level that is not detailed enough for construction) based on currently available data and information developed during plan formulation. There is significant institutional knowledge regarding the construction of the restoration measures; therefore, there is minimal uncertainty from a construction standpoint. Uncertainties relating to measure design and performance are mainly centered on site specific, design-level details (e.g. exact sediment quantities, invasive species removal needs, extent of erosion control needs, construction staging area locations, pipeline pathways, timing and duration of construction, etc.), which would be addressed during the pre-engineering and design phase (PED). Additional plan details are provided in the Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) and the Engineering Appendix of the DIFR-EA (Appendix A).

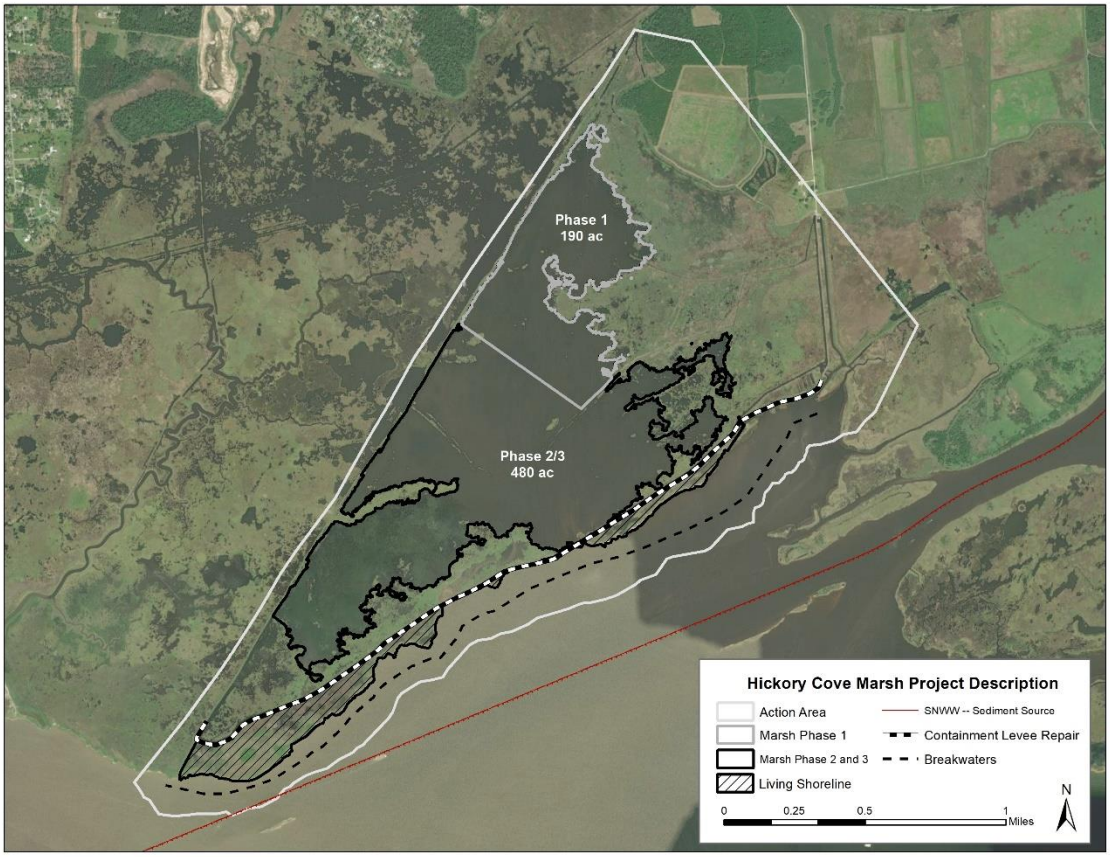

Figure 2. Project Description

Marsh Restoration

Implementation of this project would involve placing approximately 3.5 million cubic yards of material dredged from the SNWW to restore approximately 670 acres emergent marsh dominated by *Spartina patens*. Placement of material would occur over three phases as funding and sediment material becomes available. Phase 1 would involve placing approximately 1.3 million cubic yards of material in the unit, while the Phase 2 and Phase 3 units would need an estimated 2.2 million cubic yards of material.

Dredged material would be hydraulically pumped into open water and low lying areas assuming that 60% of the restoration unit will have a post-construction settlement target elevation of +1.2 feet mean sea level (MSL) and the remaining 40% of the unit will have a target elevation of +0.5 feet MSL. Target elevations were determined based on successful vegetation establishment at the Old River Cove restoration site on the Lower Neches WMA, which was used as an ecosystem restoration reference site, and resource agency input. As necessary, temporary training berms (containment dikes) would be constructed from in-situ material around the nourished areas to efficiently achieve the desired initial construction elevation. The berms would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages used at the reference site.

Following marsh restoration actions, non-native/undesirable species monitoring would be implemented. If species are found, measures would be taken to stop or slow the expansion of the species within the restoration units.

Containment Levee Repair

The existing containment levee would be repaired to a uniform elevation of +5.0 feet MSL and slopes restored to 3:1 (Figure 3) to limit tidal influence and salinity intrusion into interior existing and restored marshes. Sediment for the repair would come from material placed in the marsh restoration areas.

Under the existing condition, numerous breaches in the levee allow saltwater intrusion and high energy flows which scour and cause erosion, increase land loss, and convert marsh habitat to open water.

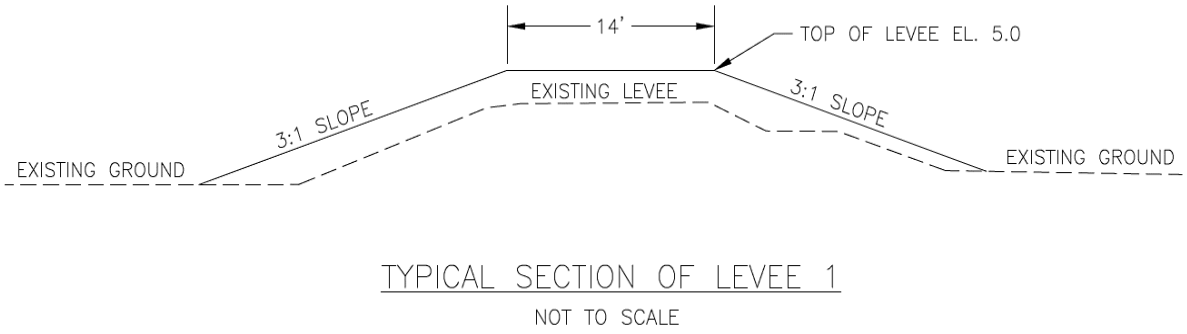

Figure 3. Typical cross-section of the repaired containment levee

Breakwaters

Hickory Cove's shoreline runs parallel to the SNWW/GIWW on the northern side of Sabine Lake and is exposed to wave action that has repeatedly degraded the containment levee on the exterior of the marsh. In addition to navigation traffic subjecting the shoreline to erosive forces, Hickory Cove's shoreline is along the northern boundary of the lake with a significant fetch leaving it vulnerable to wind-driven and ship induced wave action. Attenuating waves through construction of approximately 14,623 linear feet (LF) (~2.8 miles) of breakwaters was considered necessary to mitigate degradation and breach of the containment levee and subsequent marsh degradation exacerbated by these conditions. The preliminary design of this feature is shown in Figure 4.

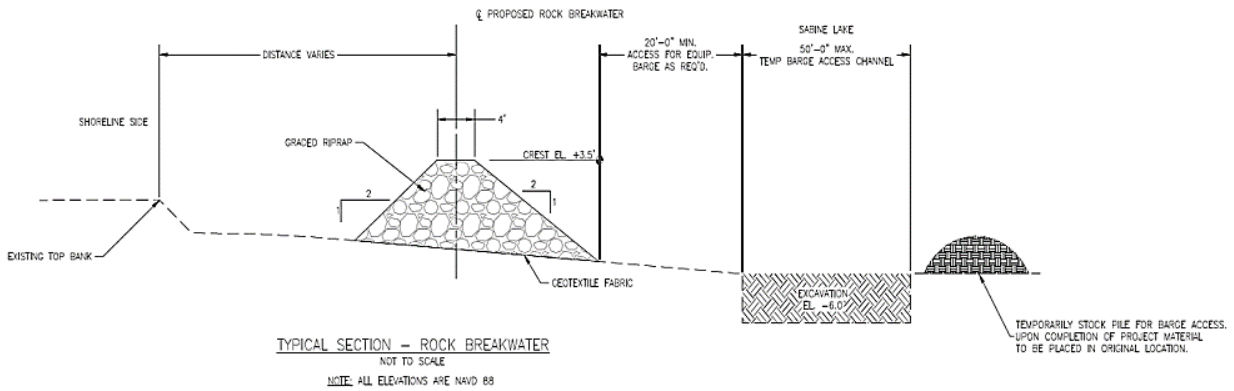

Figure 4. Typical cross-section of the breakwaters

The structures would be built in shallow water (<3 feet deep) at varying distances from the shoreline and where soils are conducive to supporting the weight of the stone without significant subsidence. The distance from the shoreline would be determined during PED, after site specific surveys have been completed, but sufficiently offset from the boundaries of the SNWW navigation channel to ensure continued safe navigation.

The design would be a trapezoidal structure built of approximately 138,000 tons of stone up to a height of +3.5 feet MSL, which will yield approximately 1-1.5 feet of rock exposed above the mean high tide level. Other approximate features of the design include a 4-foot wide crown, a 2:1 slope, and a base that is roughly 30 feet wide. The structure would have a total footprint of approximately 2 acres. The base of the structure would be on filter cloth ballasted to the water bottom to secure placement and prevent displacement of the outboard edges. The number of openings and width of each would be determined during PED and dependent on the location of major channel entrances or access points required for fishery access or circulation and potential for erosion to affect the existing containment levee.

Living Shoreline

A 95-acre living shoreline would be planted between the existing containment levee and the breakwaters. Invasive plant species, primarily Chinese tallow (*Triadica sebifera*) would be removed from the levee and smooth cordgrass (*Spartina alterniflora*) would be planted along the tow of the levee to form the living shoreline. Approximately 217,000 *S. alterniflora* plugs would be planted with 60-inch

spacing. Establishment of this feature would provide toe protection to the existing containment levee and promote sediment accretion to regain lost habitat.

Equipment Needs and Access Routes

Sediment transport equipment would most likely include cutterhead dredges, pipelines (submerged, floating, and land) and one booster pump. Heavy machinery would be used to move sediment and facilitate construction. Heavy equipment could include bulldozers, front-end loaders, track-hoes, marshbuggies, track-hoes, and backhoes. For breakwater construction, stone would be purchased from a commercial quarry and transported to the site by barge, where it would then be placed by crane or hopper barge. Various support equipment would also be used, such as crew and work boats, trucks, trailers, construction trailers, all-terrain vehicles, and floating docks and temporary access channels to facilitate loading and unloading of personnel and equipment.

Identification of staging areas, pipeline routes, and placement of floatation docks would occur during PED. Each disturbance for access and staging would be placed outside of environmentally sensitive areas to the greatest extent practicable and utilize areas already disturbed when possible (e.g. stage on existing agricultural bare ground, existing roadways, or mowed/pastured private lands). All ground disturbance for access and staging areas would be temporary and fully restored to result in no permanent loss.

Timing

Timing of initial construction of this project (Phase 1) is dependent on several factors including: timing of authorization, duration of the PED phase, and Federal- and non-federal funding cycles. It was assumed that construction would begin in March 2024 and have approximately 30 months of on-the-ground work (Table 1). These dates and are based on the next projected SNWW Neches River or Sabine River dredging cycle. The timing of Phase 2 and Phase 3 marsh restoration units are uncertain at this time but would not likely occur before 2027 unless an emergency dredging cycle occurs as a result of excess shoaling from a storm event.

Table 1. Anticipated construction schedule

Measure	Duration	Start	End
Dredging, Phase 1 Marsh Restoration, Containment Levee Repair	12	Mar 2024	Feb 2025
Breakwaters	16	Mar 2025	Jul 2026
Living Shoreline	2	Mar 2027	Apr 2027

Description of the Discharge Site(s)

Up to 3 restoration units would receive dredged material and would result in filling in of open water sites or extremely fragmented and deep marsh sites. The breakwaters would be located parallel to the Hickory Cove shoreline in shallow (<3 feet deep) open water. Salinity within the placement areas is variable due to tidal fluctuation.

The project area is along the most northern boundary of the Sabine-Neches Estuary, where the Sabine and Neches rivers enter the Sabine Lake. The estuary exhibits very complicated circulation and salinity patterns. Tidal flow originating from the Gulf, the strength and intensity of winds, intensity of rainfall and associated river inflows, and depth of the SNWW and lake strongly influence salinity in Sabine Lake and in particular the project area.

Approximately 80 percent of the project area is considered inland open water habitat. As described in the DIFR-EA, salinity in Sabine Lake in the project area seaward of the containment levee (breakwater location) is highly dependent on the flows of the Sabine and Neches rivers and the location of the saltwater wedge and can range from 0.0 to over 30.0 ppt with salinity more typically between 4.0 and 18.0 ppt. Here the depth of habitat is shallow (<4.0 feet) and typically very turbid due to the two rivers merging in the project area. This area support little to no rooted vascular plants (submerged aquatic vegetation [SAV]). Phytoplankton are the most likely plant or animal species to occur in this habitat.

Salinity within the open water areas in the interior of the containment levee (marsh restoration) has much higher salinity (well over 18 ppt) because with every tidal surge that breaches the containment levee the higher salinity water gets trapped behind the containment levee and there are not sufficient freshwater flows to reduce salinities. SAV, while very limited, is found along existing marsh edges.

Marshhay cordgrass (Spartina patens) dominates salt marshes where marsh habitat is not being broken up by open water within and external to the containment levee. While fresh and intermediate-brackish marsh are found in the action area in the interior of the containment levee, placement of material would not occur in these habitat types.

Project area sites are used by a variety of marine, freshwater, and terrestrial fauna for resting, nesting, spawning, foraging, etc.; however, diversity and abundance is relatively low because of degraded conditions. For a complete description of species commonly found in the project area see the DIFR-EA.

Section 401

Water Quality Certification

From: Fisher, Melinda CIV USARMY CESWF (USA)
To: "401CERTS@tceq.texas.gov"
Subject: Hickory Cove Marsh BU Pre-Filing Meeting Request
Date: Tuesday, October 12, 2021 2:43:00 PM
Attachments: USACE_HCM_PRE-FILING MEETING REQUEST_12Oct21.pdf

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Good Afternoon,

Please find attached the Pre-Filing Request for a USACE Civil Work beneficial use marsh restoration project in Orange County, TX.

Please let me know if you have any questions or need anything further.

Thanks!
Melinda

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Melinda Fisher
Wildlife Biologist
Regional Planning & Environmental Center (RPEC)
Environmental Branch
Compliance Section
Office: 918-669-7423
Cell: 918-953-9534

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Texas Commission on Environmental Quality
401 State Certification Pre-filing Meeting Request Form

Why is this Pre-Filing Meeting Request Required? The U.S. Environmental Protection Agency published its Clean Water Act Section 401 Certification Rule in the Federal Register on July 13, 2020. It took effect on September 11, 2020. The federal rule requires all project applicants to submit a Pre-filing Meeting Request to the state certifying authority, the Texas Commission on Environmental Quality (TCEQ), at least 30 days prior to submitting a Section 401 Water Quality Certification Request (Certification Request). The TCEQ has prepared this Pre-filing Meeting Request form to help project applicants comply with the new 401 Certification Rule requirements.

Next Steps: The TCEQ will review your request for a Pre-filing Meeting to determine whether it is necessary or appropriate for your specific project, though actually conducting a Pre-filing Meeting is optional. Completing this form will help with the TCEQ's determination. Thank you for using this form.

1. Please submit this request form and a project location map to 401Certs@tceq.texas.gov.

2. If a Pre-filing Meeting is determined to be necessary by either the applicant or the TCEQ, the meeting will be scheduled to discuss the project.

3. If you do not receive a response to your request for a pre-filing meeting, after at least 30 days, you may submit the certification request to the TCEQ if a Section 401 certification is required for your project. Projects that require state certification are 1) all individual permit U.S. Army Corps of Engineer 404 permit applications and, 2) individual conditional certifications for the return water of Nationwide Permit 16.

For more information: EPA's 401 rule: https://www.epa.gov/cwa-401/final-rule-clean-water-act-section-401-certification-rule

Project Information

Project Name: WRDA 2016 Section 1122 Hickory Cove Marsh, Bridge City, TX Beneficial Use Pilot Project
Project Applicant
Name: Melinda Fisher
Organization: US Army Corps of Engineers, Galveston District
Phone no.: 918-953-9534
Email: melinda.fisher@usace.army.mil
Consultant
Name: --
Organization: --
Phone no.: --
Email: --
Project Location *(Note: Please attach a project location map when submitting this form)*
Address: Hickory Cove at the confluence of the Neches and Sabine rivers
City: nearest city Bridge City

Texas Commission on Environmental Quality
401 State Certification Pre-filing Meeting Request Form

County: Orange

Latitude/Longitude of project location: 29°48'32.25" N 93°48'33.25"W

Brief Project Description and Scope:

The project (Alternative 3) involves beneficially using 3.5 million cubic yards of dredged material from the Sabine-Neches Waterway to restore up to 670 acres of marsh habitat and create resiliency against future conditions. Dredged material would be hydraulically pumped into open water and low lying areas assuming that 60% of the restoration unit will have a post-construction settlement target elevation of +1.2 feet mean sea level (MSL) and the remaining 40% of the unit will have a target elevation of +0.5 feet MSL. Target elevations were determined based on resource agency input and successful vegetation establishment at the Old River Cove restoration site on the Lower Neches WMA, which was used as an ecosystem restoration reference site. As necessary, temporary training berms (containment dikes) would be constructed from in-situ material around the nourished areas to efficiently achieve the desired initial construction elevation. The berms would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages used at the reference site.

To protect marsh restoration efforts, the project involves repairing an existing containment to a uniform elevation of +5.0 feet MSL and restoring the side slopes to a 3:1 to limit tidal influence and salinity intrusion into interior existing and restored marshes. Sediment would come from material placed in the marsh restorations area. Additionally, two shoreline measures would be completed and include construction of 14,623 linear feet (~2.8 miles) of rock breakwaters and a 95-acre living shoreline that will help to mitigate erosion, dissipate wave energies, stabilize shorelines, reduce land loss, reduce saltwater intrusion, and support reestablishment of emergent marsh through retention of sediments. The breakwater would be trapezoidal in shape and be placed in shallow water (<3') following the contour, which will yield approximately 1-1.5 feet of rock exposed. The structure would have a total footprint of about 2 acres. The living shoreline would be between the existing containment levee and the breakwaters on existing land and involves removing invasive species and planting approximately 217,000 Spartina alterniflora plugs.

Material placed into the marsh and on the existing containment levee would have similar properties to the existing native material. Under the existing and projected future dredging cycles, there is sufficient quantities of suitable material available to meet all restoration needs without seeking other borrow sources (e.g. off-shore, upland placement areas).

Please provide the type of federal permit for which the applicant is seeking state 401 certification. Please include a federal permit number if available.

No Federal Permit, this is a Civil Works Feasibility Study. A NWP 27 would be applicable but USACE Civil Work policy does not allow water quality certification by proxy for Civil Works projects.

Jurisdictional Impacts

Fill/Excavate	Wetland (Cowardian Class), Seagrass, Oyster	Acres	Stream (linear feet)		
			intermittent	*perennial*	*tidal*

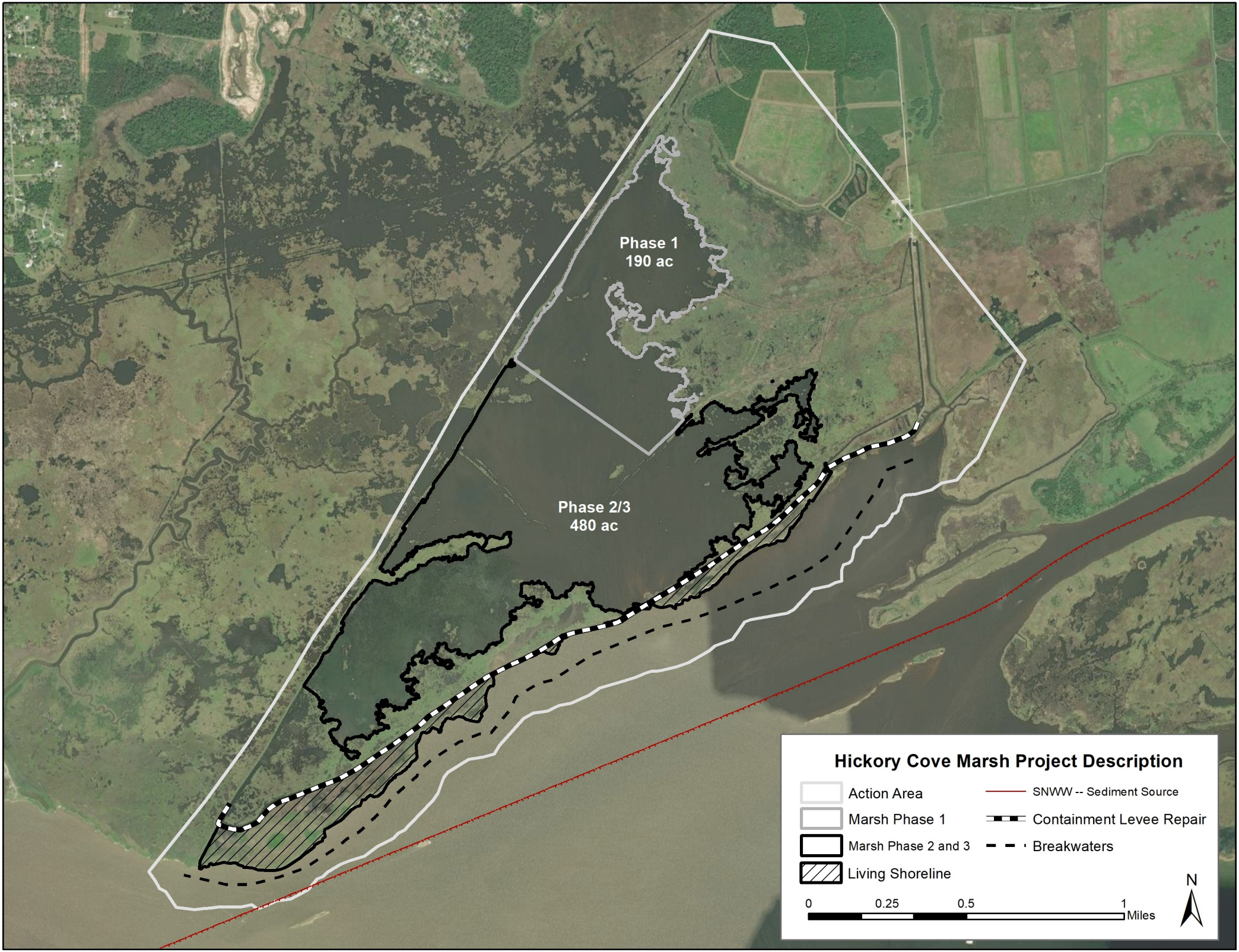
Texas Commission on Environmental Quality
401 State Certification Pre-filing Meeting Request Form

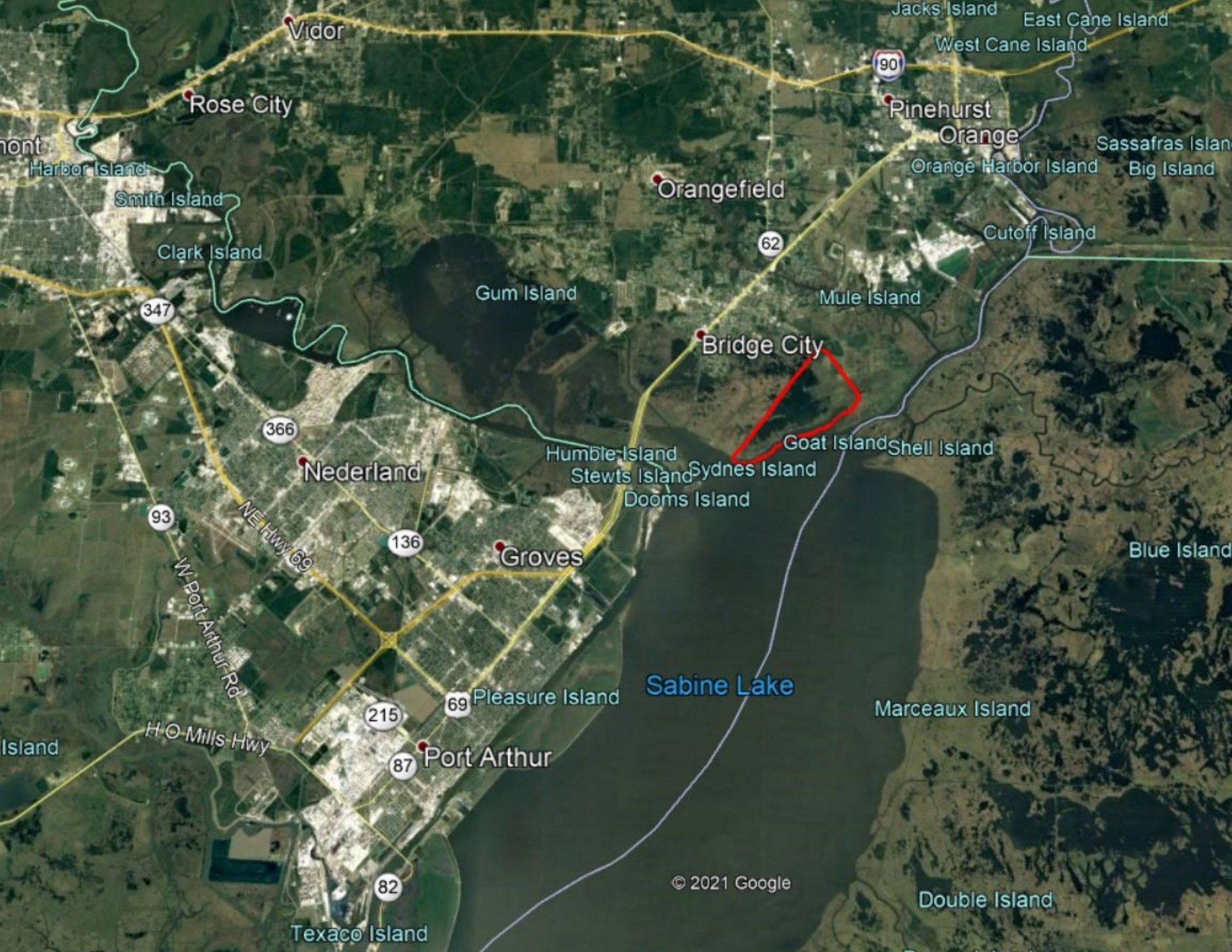
	Example. Fill	Example. Palustrine Emergent Wetland (PEM)	Example. 3				
	Example. Fill			Example. 300	Example. 100		
	Fill	Open Water based on site surveys (NWI maps it as Estuarine and Marine Deepwater [E1UBL] and Estuarine and Marine Wetland [E2EM1P])	670				
	Fill	Submerged lands	2				

Best Management Practices (BMPs) to be implemented:

1. Best available practical techniques and BMPs would be utilized during dredging and construction activities to avoid and minimize potential temporary and long-term adverse impacts, such as maintaining a work area that remains aesthetically attractive free of floating or piled debris and trash, storing fuels and other hazardous materials in locations which would not be introduced to surface waters if spilled, using silt curtains when appropriate to minimize movement of sediments, etc.
2. Movement of heavy equipment and support vehicles would utilize placement pipeline corridors to the greatest extent possible. Staging areas, access corridors, and general ground disturbance not related to restoration would utilize the smallest footprint possible to maintain a safe work environment.
3. Geotextile/filter cloth would be placed under the breakwater structure to reduce subsidence of placed rock over time.
4. Movement of sediment during and post-construction would be contained by constructing temporary earthen containment/exclusion dikes around the marsh restoration sites. Dikes would be constructed of in-situ materials and would be breached through natural degradation or mechanical means following sufficient dewatering and settlement of the placed material. The dike would be able to maintain one-foot of freeboard at all times.

5. Only clean fill material (dredged material or stone) free of contaminants would be placed in the restoration area. Placed dredged material will be of such composition that it will not adversely affect the biological, chemical or physical properties of the receiving waters.


Phase 1
190 ac
Phase 2/3
480 ac
Hickory Cove Marsh Project Description
Action Area
Marsh Phase 1
Marsh Phase 2 and 3
Living Shoreline
SNWW -- Sediment Source
Containment Levee Repair
Breakwaters
0
0.25
0.5
1
Miles
N


Jacks Island
East Cane Island
West Cane Island
Vidor
90
Rose City
Pinehurst
Orange
Sassafras Island
Big Island
Orange Harbor Island
Harbor Island
Smith Island
Orangefield
Cutoff Island
Clark Island
62
Gum Island
Mule Island
347
Bridge City
366
Goat Island
Shell Island
Humble Island
Nederland
Stewts Island
Sydnes Island
Dooms Island
93
NE Hwy 69
136
Groves
Blue Island
W Port Arthur Rd
Sabine Lake
69
Pleasure Island
Marceaux Island
215
H O Mills Hwy
Port Arthur
87
© 2021 Google
82
Double Island
Texaco Island

US Army Corps of Engineers ®
Galveston District

Appendix B-2

Endangered Species Act Compliance

for

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

November 2021

WRDA 2016 Section 1122
Hickory Cove Marsh, Bridge City, TX
Beneficial Use Pilot Project

Biological Assessment for Federally-Listed Threatened and Endangered Species

November 2021

Prepared by:

United States Army Corps of Engineers
Regional Planning and Environmental Center

US Army Corps of Engineers ®
Galveston District

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Contents

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1.0 INTRODUCTION

This Biological Assessment (BA) has been prepared in accordance with requirements outlined under Section 7 of the Endangered Species Act (ESA). Section (7)(a)(2) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that are proposed or listed as endangered or threatened, as well as their designated critical habitat, if applicable. This BA demonstrates the proposed action is in compliance with Section 7, which assures that, through consultation with the US Fish and Wildlife Service (USFWS), Federal actions do not jeopardize the continued existence of any threatened, endangered or proposed species, or result in the destruction or adverse modification of critical habitat.

1.1 Study Background

The purpose of this BA is to address the effect of the WRDA 2016 Section 1122 Hickory Cove Marsh, Bridge City, TX Beneficial Use Pilot Study's Tentatively Selected Plan (TSP) (or proposed action) on ESA-listed species and their designated critical habitat. The U.S. Army Corps of Engineers, Galveston District (USACE), in partnership with Ducks Unlimited and the Port of Orange, is exploring the feasibility of implementing a pilot project for the beneficial use of dredged material generated during operations and maintenance dredging of the Sabine Neches Waterway (SNWW) as a means to restore degraded marsh lands.

The US Army Corps of Engineers (USACE) intends to seek authorization to fund and execute the action described below, pursuant to Section 1122 of the Water Resources Development Act of 2016 which directs the USACE to establish a pilot program to carry out 10 projects for the beneficial use of dredged material, including for the project purposes of:

- reducing storm damage to property and infrastructure;
- promoting public safety;
- protecting, restoring, and creating aquatic ecosystem habitats;
- stabilizing stream systems and enhancing shorelines;
- promoting recreation;
- supporting risk management adaptation strategies; and
- reducing the costs of dredging and dredged material placement or disposal, such as for projects that use dredged material as construction or fill material, civic improvement objectives, and other innovative uses and placement alternatives that produce public economic or environmental benefits.

This pilot project is one of ten final proposals evaluated and selected from 95 submittals because it has high environmental, economic, and social benefits, and exhibits geographic diversity.

USACE is the lead Federal agency for the proposed project and will oversee compliance with applicable federal laws and regulations required for the project as well as protection measures for sensitive biological resources.

The TSP includes features that restore and sustain the form and function of the coastal marshes in the project area. Implementation of the TSP has the potential to impact the following ESA-listed species that

occur in the area: eastern black rail (L), whooping crane (*Grus americana*) West Indian manatee (*Trichechus manatus*) and the monarch butterfly (*Danaus plexippus*). No critical habitat for any of the species exists within the action area.

1.2 Consultation History

Very early in the study process, USFWS and Texas Parks and Wildlife (TPWD) were involved in identifying potential locations to beneficially use dredged material in the vicinity of the SNWW. Additionally, TPWD was present at site visits and assisted in data collection.

- 19 August 2021: Project was created in IPaC using the study area boundaries. An official species list was requested and returned from the Texas Coastal and Louisiana Ecological Services Field Offices (02ETTX00-2021-SLI-3042 and 04EL1000-2021-SLI-2249).
- 08 Sept 2021: Most recent NMFS species list for Texas was pulled (species list updated 01 Sept 2021).
- 01 October 2021: New project created in IPaC to reflect the action area and not the study area after the project had been refined and a determination was made of what the action area consisted of. An Official Species List was requested and received (Consultation Code: 02ETTX00-2022-SLI-007)
- 05 October 2021: E-mail communication with J. Culbertson to confirm accuracy of the Official Species List generated by IPaC. Species list did not include whooping crane or eastern black rail, which have both been identified as a concern during previous communications about the project. J. Culbertson recommended consideration of the two species for purposes of Section 7 compliance.

2.0 DESCRIPTION OF THE ACTION AND ACTION AREA

This section describes the proposed action including the benefits and impacts associated with implementing the action and a description of the action area. The information contained here is a summary of the overall project and impacts. Additional information, specifically regarding benefits and impacts can be found in the Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA).

2.1 Description of the Action

The project is located within Hickory Cove Bay in an area known as "the saddle" where the Sabine and Neches rivers merge into Sabine Lake in Orange County, Texas. The project area includes 1,200 acres of impounded marsh lands and open water areas of Sabine Lake. The land is owned and operated by the Hawk Club, a private hunting club, and adjacent to the Lower Neches Wildlife Management Area (WMA) which is owned and operated by TPWD. The Sabine Neches Waterway (SNWW) is the only federal navigation project immediately near the study area (Figure 1).

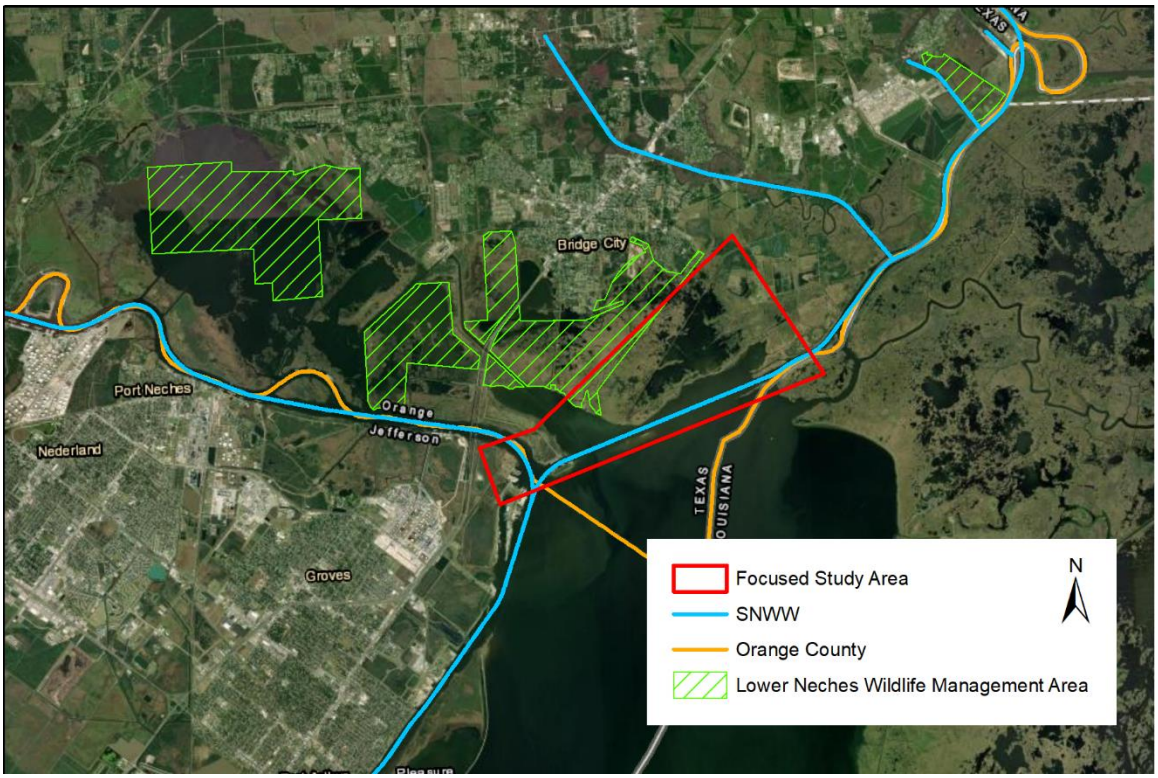

Figure 1. Study Area

Alternative 3 was chosen as the TSP (Figure 2). This plan involves beneficially using dredged material to restore up to 670 acres of marsh habitat and create resiliency against future conditions. Marsh measures consist of three phases of marsh restoration that would increase land coverage in the project area and improve terrestrial wildlife habitat, hydrology, and water quality. To protect marsh restoration efforts, the project involves repairing an existing containment that will limit hydrologic connection between Sabine Lake and the interior marsh areas to only extreme conditions and create conditions

conducive for reestablishment and sustainment of marsh under future conditions. Shoreline measures include construction of rock breakwaters and living shoreline features that help to mitigate erosion, dissipate wave energies, stabilize shorelines, reduce land loss, reduce saltwater intrusion, and support reestablishment of emergent marsh through retention of sediments. Material placed into the marsh and on the existing containment levee would have similar properties to the existing native material. Under the existing and projected future dredging cycles, there is sufficient quantities of suitable material available to meet all restoration needs without seeking other borrow sources (e.g. off-shore, upland placement areas).

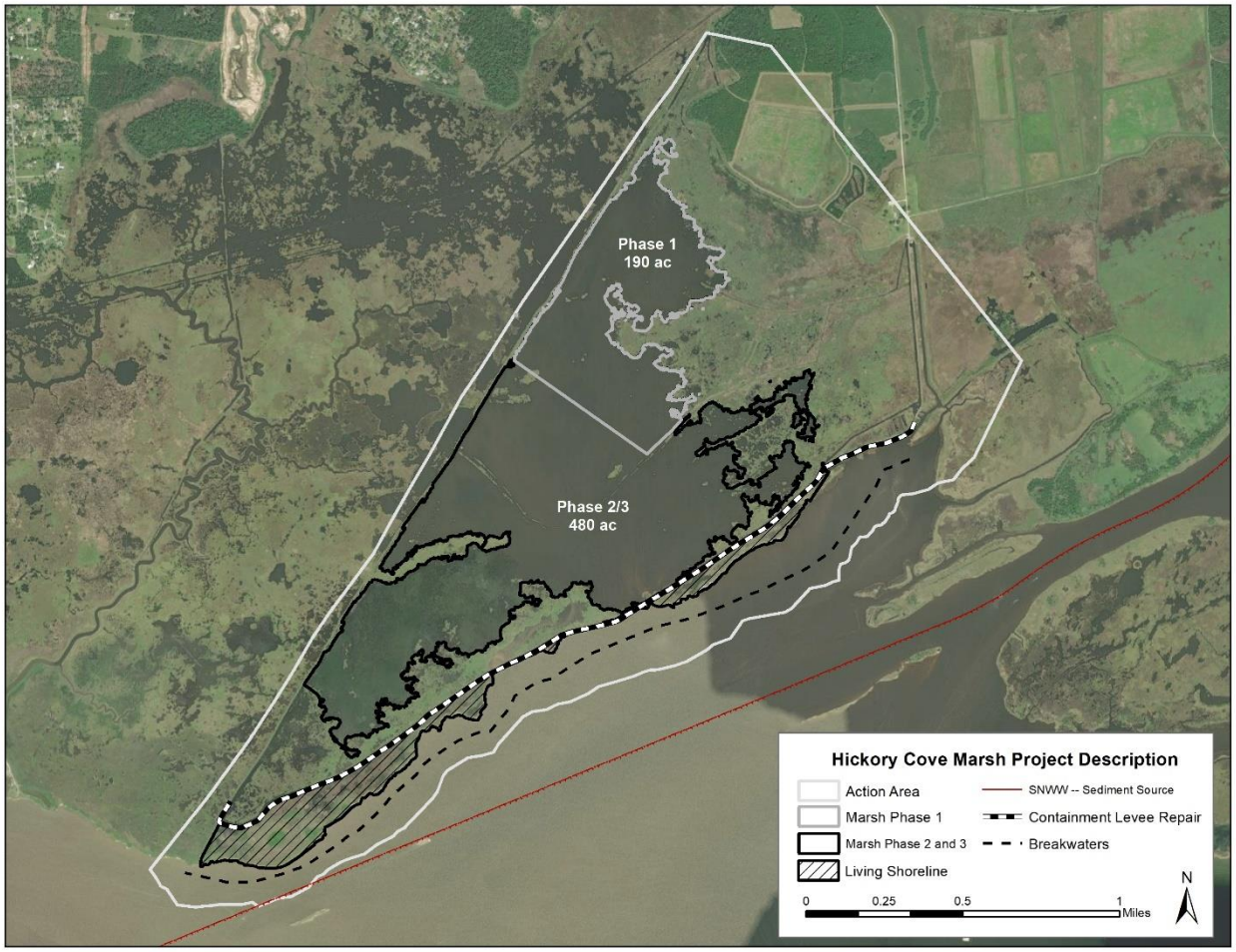

Figure 2. Project Description

Alternative 3 measures have been developed to a feasibility level of design (i.e. estimates, design level that is not detailed enough for construction) based on currently available data and information developed during plan formulation. There is significant institutional knowledge regarding the construction of the restoration measures; therefore, there is minimal uncertainty from a construction standpoint. Uncertainties relating to measure design and performance are mainly centered on site specific, design-level details (e.g. exact sediment quantities, invasive species removal needs, extent of erosion control needs, construction staging area locations, pipeline pathways, timing and duration of construction, etc.), which would be addressed during the pre-engineering and design phase (PED).

Additional plan details are provided in the Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) and the Engineering Appendix of the DIFR-EA (Appendix A).

Marsh Restoration

Implementation of this project would involve placing approximately 3.5 million cubic yards of material dredged from the SNWW to restore approximately 670 acres emergent marsh dominated by *Spartina patens*. Placement of material would occur over three phases as funding and sediment material becomes available. Phase 1 would involve placing approximately 1.3 million cubic yards of material in the unit, while the Phase 2 and Phase 3 units would need an estimated 2.2 million cubic yards of material.

Dredged material would be hydraulically pumped into open water and low-lying areas assuming that 60 percent (%) of the restoration unit will have a post-construction settlement target elevation of +1.2 feet mean sea level (MSL) and the remaining 40% of the unit will have a target elevation of +0.5 feet MSL. Target elevations were determined based on successful vegetation establishment at the Old River Cove restoration site on the Lower Neches WMA, which was used as an ecosystem restoration reference site, and resource agency input. As necessary, temporary training berms (containment dikes) would be constructed from in-situ material around the nourished areas to efficiently achieve the desired initial construction elevation. The berms would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages used at the reference site.

Following marsh restoration actions, non-native/undesirable species monitoring would be implemented. If species are found, measures would be taken to stop or slow the expansion of the species within the restoration units.

Containment Levee Repair

The existing containment levee would be repaired to a uniform elevation of +5.0 feet MSL and slopes restored to 3:1 (Figure 3) to limit tidal influence and salinity intrusion into interior existing and restored marshes. Sediment for the repair would come from material placed in the marsh restoration areas.

Under the existing condition, numerous breaches in the levee allow saltwater intrusion and high energy flows which scour and cause erosion, increase land loss, and convert marsh habitat to open water.

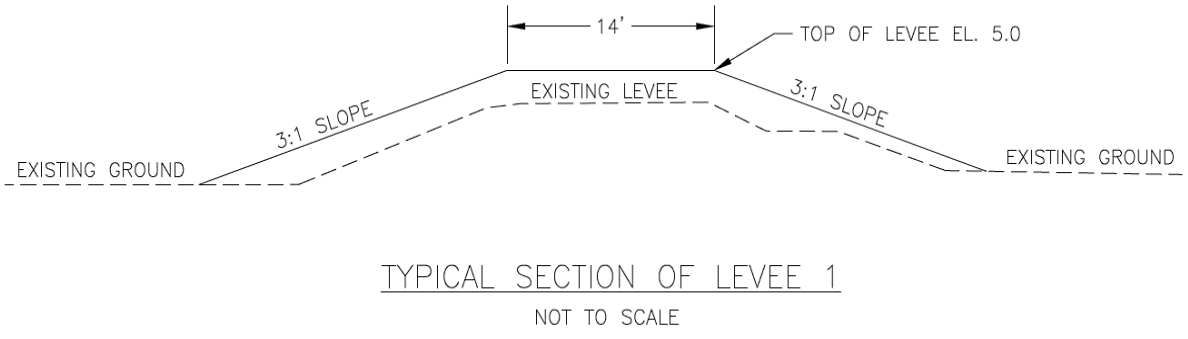

Figure 3. Typical cross-section of the repaired containment levee

Breakwaters

Approximately 14,623 linear feet (LF) (about 2.8 miles) of stone breakwaters would be constructed in shallow water (<three feet deep) at varying distances from the shoreline and where soils are conducive to supporting the weight of the stone without significant subsidence. The distance from the shoreline would be determined during PED, after site specific surveys have been completed, but sufficiently offset from the boundaries of the SNWW navigation channel to ensure continued safe navigation.

The design would be a trapezoidal structure built of approximately 138,000 tons of stone up to a height of +3.5 feet MSL, which will yield approximately 1-1.5 feet of rock exposed above the mean high tide level. Other approximate features of the design include a 4-foot wide crown, a 2:1 slope, and a base that is roughly 30 feet wide. The structure would have a total footprint of approximately 2 acres. The base of the structure would be on filter cloth ballasted to the water bottom to secure placement and prevent displacement of the outboard edges. The number of openings and width of each would be determined during PED and dependent on the location of major channel entrances or access points required for fishery access or circulation and potential for erosion to affect the existing containment levee. The preliminary design of this feature is shown in Figure 4.

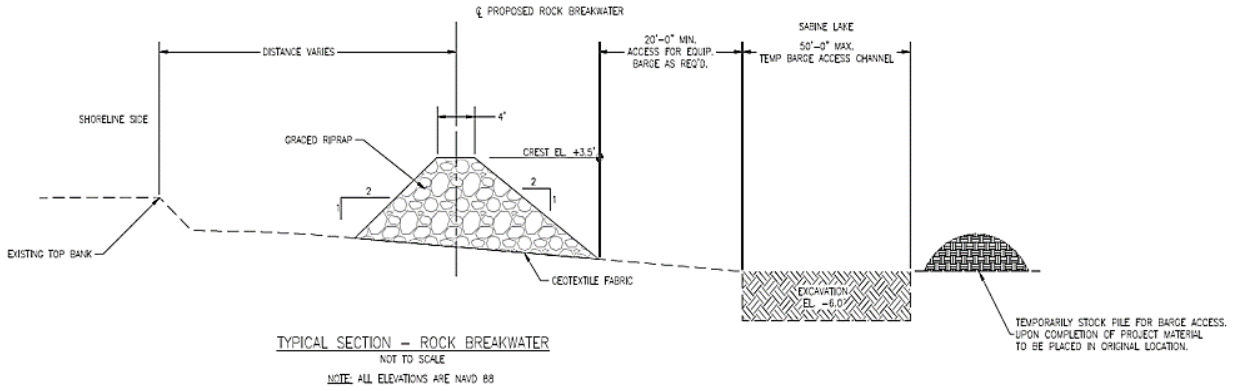

Figure 4. Typical cross-section of the breakwaters

Living Shoreline

A 95-acre living shoreline would be planted between the existing containment levee and the breakwaters. Invasive plant species, primarily Chinese tallow (*Triadica sebifera*) would be removed from the levee and smooth cordgrass (*Spartina alterniflora*) would be planted along the toe of the levee to form the living shoreline. Approximately 217,000 *S. alterniflora* plugs would be planted with 60-inch spacing. Establishment of this feature would provide toe protection to the existing containment levee and promote sediment accretion to regain lost habitat.

Equipment Needs and Access Routes

Sediment transport equipment would most likely include cutterhead dredges, pipelines (submerged, floating, and land) and one booster pump. Heavy machinery would be used to move sediment and facilitate construction. Heavy equipment could include bulldozers, front-end loaders, track-hoes, marshbuggies, track-hoes, and backhoes. For breakwater construction, stone would be purchased from a commercial quarry and transported to the site by barge, where it would then be placed by crane or

hopper barge. Various support equipment would also be used, such as crew and work boats, trucks, trailers, construction trailers, all-terrain vehicles, and floating docks and temporary access channels to facilitate loading and unloading of personnel and equipment.

Identification of staging areas, pipeline routes, and placement of floatation docks would occur during PED. Each disturbance for access and staging would be placed outside of environmentally sensitive areas to the greatest extent practicable and utilize areas already disturbed when possible (e.g. stage on existing agricultural bare ground, existing roadways, or mowed/pastured private lands). All ground disturbance for access and staging areas would be temporary and fully restored to result in no permanent loss.

Timing

Timing of initial construction of this project (Phase 1) is dependent on several factors including: timing of authorization, duration of the PED phase, and Federal- and non-federal funding cycles. It was assumed that construction would begin in March 2024 and have approximately 30 months of on-the-ground work (Table 1). These dates and are based on the next projected SNWW Neches River or Sabine River dredging cycle. The timing of Phase 2 and Phase 3 marsh restoration units are uncertain at this time but would not likely occur before 2027 unless an emergency dredging cycle occurs as a result of excess shoaling from a storm event.

Table 1. Anticipated construction schedule

Measure	Duration	Start	End
Dredging, Phase 1 Marsh Restoration, and Containment Levee Repair	12	Mar 2024	Feb 2025
Breakwaters	16	Mar 2025	Jul 2026
Living Shoreline	2	Mar 2027	Apr 2027

2.1.1 Benefits of the Action

The unconfined placement of dredged material in marsh restoration units and construction of other TSP features along the shoreline would have a net beneficial effect on the environment. A total of 670 acres of marsh habitat would be restored by reducing the extent of deep open water in the restoration unit, which is considered less productive than marsh habitat, and decreasing salinity in order to support fresher marsh habitats. As well, increasing available sediment in the marsh units is expected to increase the potential for accretion into the future by supporting an assemblage of desired vegetative species. Once vegetative species composition is restored, the value of the marsh habitat to avian, terrestrial, and aquatic wildlife and fish is expected to increase by providing higher quality nesting, foraging, roosting, and nursery habitat.

Hickory Cove's shoreline runs parallel to the SNWW on the northern side of Sabine Lake and is exposed to wave action that has repeatedly degraded the containment levee on the exterior of the marsh. In addition to navigation traffic subjecting the shoreline to erosive forces, Hickory Cove's shoreline is along the northern boundary of the lake with a significant fetch leaving it vulnerable to wind-driven and ship

induced wave action. Attenuating waves through construction of about 2.8 miles of breakwaters and 95-acres of living shoreline was considered necessary to mitigate degradation and breach of the containment levee and subsequent marsh degradation exacerbated by these conditions.

Along the shoreline, approximately 2.8 miles of stone breakwaters would be constructed. The breakwaters allow for the stabilization and protection of the existing shoreline and also support the reestablishment of intertidal emergent vegetation along the shoreline through retention of sediments and reduced land loss. Under the existing condition, the rate of loss is approximately four feet per year, which translates to approximately 260 acres of interior marsh that would be protected and improve with implementation of the breakwaters. Additionally, breakwaters are expected to improve overall water quality with reduced saltwater intrusion and turbidity, and may decrease operations and maintenance costs of the GIWW by reducing the amount of dredging. Overall, emergent shoreline habitats and interior marshes are expected to improve thereby supporting a more diverse and productive habitat for aquatic and terrestrial species. The breakwater structure itself can provide additional aquatic habitat by facilitating formation of a reef to support a greater abundance and diversity of aquatic species. Rock substrate is expected to also provide benefits to some aquatic species by providing them a refuge from predation.

Habitat Evaluation Procedures (HEP) was used to quantify existing and future habitat quality with and without the action. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each HEP model used. For this project, the mottled duck Habitat Suitability Index (HSI) model was used. The model consists a list of variables that are considered important in characterizing habitat that supports the species. To determine the Future Without Project (FWOP) and Future With Project (FWP) habitat function, the variables in the model were modified to reflect anticipated future conditions based on historic monitoring and data results and best professional judgment. The model then determines the assumed relationship between habitat qualities (Suitability Indices) based on a specified Suitability Index graph for each variable. The model then uses a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI).

Data for the model runs primarily came from data collected at the ecosystem restoration reference site on the Lower Neches WMA; Geographic Information System (GIS) exercises analyzing land cover change over time, vegetative cover, width/length/area, etc.; from existing monitoring such as salinity and shoreline change; and existing data collected during the Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Feasibility Study or Sabine-Neches Waterway Channel Improvement Project (SNWW CIP). Results indicate that just doing phase 1 of the project would increase the quality of the action area by 291.5 average annual habitat units (AAHUs).

2.1.2 Impacts of the Action

Direct and indirect impacts associated with implementing the TSP are temporary in nature and limited in scope. Construction activities would contribute the greatest impacts to the environment and could include: localized effects to water quality, including increased turbidity and total suspended sediments, organic enrichment, reduced dissolved oxygen, elevated carbon dioxide levels, and decreased light penetration, among others; habitat removal and/or fragmentation; temporary habitat avoidance because of increased noise, dust generation, vibrations, and overall lower quality habitat; losses of slow moving and less mobile species (small mammals, aquatic invertebrates, benthic species,

smaller/younger fish, and herptofauna); temporary changes in hydrologic flow; and temporary loss of recreation opportunities. The level and duration of the impacts is dependent on the final design of each restoration measure, type of equipment used, and duration of construction activities. However, it is anticipated that once construction is complete, temporary impacts related to construction activities would cease.

Although marsh restoration would result in the loss of deep open water habitat in the restoration units, wildlife species currently utilizing this habitat would not be expected to be adversely affected. Most of these species are mobile allowing them to relocate into adjacent open water habitats outside immediate placement area. The conversion of open water to marsh habitat is generally considered a benefit to aquatic species.

Under the TSP, breakwaters would convert a very narrow strip of soft bottom to a hardened structure thereby reducing available habitat for aquatic species and resulting in the loss of immobile species. However, these impacts would have an overall minimal impact to fisheries and aquatic populations in the area and would in the long-term protect adjacent habitat that aquatic species depend on for survival that would be lost in the future if the measures were not implemented. As well, the structures would be designed in such a way as to not hinder movement of aquatic species.

2.2 Description of the Action Area

The project area is along the most northern boundary of the Sabine-Neches Estuary, where the Sabine and Neches rivers enter the Sabine Lake. The estuary exhibits very complicated circulation and salinity patterns. Tidal flow originating from the Gulf, the strength and intensity of winds, intensity of rainfall and associated river inflows, and depth of the SNWW and lake strongly influence salinity in Sabine Lake and in particular the project area.

Approximately 80% of the project area is considered inland open water habitat. As described in the DIFR-EA, salinity in Sabine Lake in the project area seaward of the containment levee (breakwater location) is highly dependent on the flows of the Sabine and Neches rivers and the location of the saltwater wedge and can range from 0.0 to over 30.0 ppt with salinity more typically between 4.0 and 18.0 ppt. Here the depth of habitat is shallow (<four feet) and typically very turbid due to the two rivers merging in the project area. This area support little to no rooted vascular plants (submerged aquatic vegetation [SAV]). Phytoplankton are the most likely plant or animal species to occur in this habitat.

Salinity within the open water areas in the interior of the containment levee (marsh restoration) has much higher salinity (well over 18 ppt) because with every tidal surge that breaches the containment levee the higher salinity water gets trapped behind the containment levee and there are not sufficient freshwater flows to reduce salinities. SAV, while very limited, is found along existing marsh edges.

Marshhay cordgrass (*Spartina patens*) dominates salt marshes where marsh habitat is not being broken up by open water within and external to the containment levee. While fresh and intermediate-brackish marsh are found in the action area in the interior of the containment levee, placement of material would not occur in these habitat types.

Project area sites are used by a variety of marine, freshwater, and terrestrial fauna for resting, nesting, spawning, foraging, etc.; however, diversity and abundance is relatively low because of degraded conditions. For a complete description of species commonly found in the project area see the DIFR-EA.

3.0 LISTED SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

Four ESA-listed, candidate or proposed for listing species were identified in the USFWS Official Species List dated October 1, 2021 and an additional two species were identified by the Clear Lake Ecological Services Office as a potential species that could occur in the area despite not being on the Official Species List (Attachment A). The Official Species list noted that two of the species – piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*) – only needs to be considered for wind related projects within the migratory route. Because this is not a wind related project, these two species will not be included in the analysis. No critical habitat has been designated in the action area.

Table 2. ESA-listed Species Identified by USFWS as Potentially Occurring in the Action Area

Species	Scientific Name	Jurisdiction	Status
Birds			
Eastern black rail	*Laterallus jamaicensis jamaicensis*	USFWS	Threatened
Whooping Crane	*Grus americana*	USFWS	Endangered/ Threatened for the Non-Essential Population
Mammals			
West Indian Manatee	*Trichechus manatus*	UFWS	Threatened
Insects			
Monarch butterfly	*Danaus plexippus*	USFWS	Candidate

To assess the status of species in the action area and potential impacts of the action on ESA-listed species, several sources were consulted including: literature review of scientific data; interview of recognized experts on listed species including local and regional authorities and Federal (USFWS and National Marine Fisheries Service [NMFS]) and State (TPWD) wildlife personnel; on-site inspections; and compiled lists of ESA-listed species. Significant literature sources consulted include the USFWS and NMFS species specific webpages, Federal status reports and recovery plans, TPWD species occurrence and monitoring reports, peer-reviewed journals, and other standard references.

3.1 Eastern Black Rail

The eastern black rail is the most secretive of the secretive marsh birds and one of the least understood species in North America. The sparrow-sized bird with slate gray plumage and red eyes lives in remote wetlands of the Midwest and along the coasts of the Atlantic and Pacific oceans and the Gulf of Mexico. Because it only comes out at night, prefers to walk hidden in tall grasses instead of fly and rarely makes a call, very little is known about its behavior and habitat needs.

Not much is known about the subspecies diet, but they are probably opportunistic foragers. Their bill shape suggests generalized feeding methods such as gleaning or pecking at individual items, thus a reliance on sight for finding food. Examination of specimens collected indicates a diet of small aquatic

and terrestrial invertebrates, as well as small seeds. Foraging most likely occurs on or near the edges of stand of emerging vegetation -- both above and below the high-water line.

Status

The eastern black rail was listed as threatened on October 8, 2020 with a Section 4(d) Rule (FR 63764). No critical habitat has been designated for the species. The Section 4(d) Rule allows the Service to establish prohibitions or exceptions to prohibitions for threatened species while providing for the conservation of a threatened species by allowing flexibility under ESA. None of the 4(d) Rule prohibitions or exceptions to prohibitions apply to this project.

The primary threats to eastern black rail are: (1) Habitat fragmentation and conversion, resulting in the loss of wetland habitats across the range; (2) sea level rise and tidal flooding; (3) land management practices (i.e., incompatible fire management practices, grazing, and haying/mowing/other mechanical treatment activities); and (4) stochastic events (e.g., extreme flooding, hurricanes). Human disturbance, such as birders using excessive playback calls of black rail vocalizations, is also a concern for the species. Additional stressors to the species (including oil and chemical spills and environmental contaminants; disease, specifically West Nile virus; and predation and altered food webs resulting from invasive species (fire ants, feral pigs, nutria, mongoose, and exotic reptiles) introductions.

Range and Habitat

All of the information found in this section were summarized from Watts (2016), unless otherwise indicated.

The eastern black rail is a widely distributed, secretive marsh bird with little known about its population structure and dynamics. The subspecies is broadly distributed, living in salt and freshwater marshes in portions of the United States, Central America, and South America. The species is partially migratory wintering in the southern part of its breeding range.

The eastern black rail has a broad but poorly known breeding range that includes the Atlantic and Gulf Coasts of North America, parts of Colorado, Oklahoma and the mid-west, the West Indies including Cuba, Jamaica and historically Puerto Rico and parts of Central America from Mexico through Panama. A total of 1,937 occurrence records were found within this area between 1836 and 2016. Credible evidence of occurrence was found for 21 of the 23 states including 174 counties, parishes and independent cities and 308 named properties. Based on breeding evidence and seasonality of occurrence 34 (19%) counties were classified as confirmed, 97 (56%) as probable breeding and 43 (25%) as possible breeding. Many of the named properties are well-known conservation lands including 46 (15%) national wildlife refuges, 44 (14%) state wildlife management areas, 26 (8%) state and municipal parks and many named lands managed by non-governmental conservation organizations.

Since 2010, 247 black rail occurrences have been recorded within 11 of the 23 states in the study area. Records were found for 53 counties, parishes and independent cities (Figure 7). Based on breeding evidence and seasonality of occurrence 2 (4%) counties were classified as confirmed, 35 (66%) as probable breeding and 16 (30%) as possible breeding. Records were found for 92 named properties including 2 (3%) properties classified as confirmed, 73 (79%) as probable breeding and 17 (18%) properties classified as possible breeding.

The eastern black rail is a wetland dependent bird requiring dense overhead cover and soils that are moist to saturated (occasionally dry) and interspersed with or adjacent to very shallow water (typically ≤three centimeters [cm]) to support its resource needs. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their contiguous uplands. Their location across this gradient may vary depending on the hydrologic conditions. These habitat gradients have gentle slopes so that wetlands are capable of having large areas of shallow inundation (sheet water). These wetlands are able to shrink and expand based on hydrologic conditions and thus provide dependable foraging habitat across the wetted areas and wetland-upland transition zone for the subspecies. Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events due to the propensity of juvenile and adult black rails to walk and run rather than fly and chicks' inability to fly. (USFWS 2019)

The subspecies requires dense vegetation that allows movement underneath the canopy, and because are found in a variety of salt, brackish, and freshwater wetland habitats that can be tidally or non-tidally influenced, plant structure is considered more important than plant species composition in predicting habitat suitability. In terms of nest success, nests must be well hidden in a dense clump of vegetation over moist soil or shallow water to provide shelter from the elements and protection from predators. Flooding is a frequent cause of nest failure; therefore, water levels must be lower than nests during egg-laying and incubation in order for nets to be successful. In addition, shallow pools that are one to three cm deep may be the most optimal for foraging and for chick-rearing. (USFWS 2019)

Occurrence in the Action Area

All information in this section was summarized from Watt (2016) unless otherwise noted.

Texas is a black rail crossroad making it difficult to differentiate breeders from winter residents from migrants. Black rail in Texas use tidal salt marshes along the barrier islands and the mainland fringe, as well as, drier coastal prairie. The upper Texas coast (Jefferson, Chambers, Galveston, Harris, and Brazoria counties) has a long history of black rail records that are concentrated within national wildlife refuges and state wildlife management areas. Much of the black rail activity along the upper Texas coast has been concentrated on the Bolivar Peninsula and Brazoria, Anahuac and San Bernard National Wildlife Refuges. Presence of black rail in Orange county (action area) is uncertain but is presumed to be likely.

Within the action area, dredged material would be placed into open water areas and severely degraded and fragmented marsh habitat with current platform elevations of less than +0.5 feet. Adjacent to the marsh restoration units, intact marsh habitat is present and could be suitable habitat for eastern black rail.

3.2 Whooping Crane

The whooping crane (*Grus americana*) is the tallest North American bird with males approaching 1.5 meters in height, is snowy white with black primary feathers on the wings, and a bare red face and crown. Whooping cranes form monogamous pairs for life and all whooping cranes return to the same breeding territory in Wood Buffalo National Park, in Canada to nest in late April or May. Whooping cranes return to wintering grounds of Aransas National Wildlife Refuge (NWR) by late October to mid-November where they migrate singly, in pairs, in family groups or in small flocks and remain until March or April.

Whooping cranes are omnivorous and forage by probing and gleaning foods from soil, water, and vegetation. Summer goods include dragonflies, damselflies, other aquatic insects, crayfish, clams, snails, grasshoppers, cricket, frogs, mice, voles, small birds, minnows, reptiles, and berries. During the winter in Texas, they eat a wide variety of plan and animal foods, with blue crabs, clams, and berries of Carolina wolfberry (*Lycium carolinianum*) being predominant in the diet. Foods taken at upland sites include acorns, snails, crayfish, and insects. Waste grains, such as barley and wheat, form an important part of the diet during the spring and fall migrations (Lewis 1995, Campbell 2003, Canadian Wildlife Service [CWS] and USFWS 2007).

Status

The whooping crane was federally listed as endangered on March 11, 1967 (32 FR 4001). Critical habitat has been designated in Aransas, Calhoun, and Refugio counties in Texas, and includes the Aransas National Wildlife Refuge. There is no critical habitat in or near the vicinity of the project area.

The main factors for the decline of the whooping crane were loss of habitat to agriculture (hay, pastureland, and grain production), human disturbance of nesting areas, uncontrolled hunting, specimen and egg collection, collisions with power lines, fences, and other structures, loss and degradation of migration stopover habitat, disease such as avian cholera, predation, lead poisoning, and loss of genetic diversity. Biological factors, such as delayed sexual maturity and small clutch size, prevent rapid population recovery. Drought during the breeding season presents serious hazards to the species. Exposure to disease is a special problem when large numbers of birds are concentrated in limited areas, as often happens during times of drought (Lewis 1995, Campbell 2003, CWS and USFWS 2007).

Range and Habitat

Whooping cranes were originally found throughout most of North America. In the nineteenth century, the main breeding area was from the Northwest Territories to the prairie provinces in Canada, and the northern prairie states to Illinois. Only four populations of whooping cranes exist in the wild, the largest of which is the Aransas-Wood Buffalo population, which breeds in isolated marshy areas of Wood Buffalo National Park in Canada's Northwest Territories. Each fall, the entire population of whooping cranes from this national park migrates some 2,600 miles (4,183 kilometers) primarily to the Aransas NWR and adjacent areas of the central Texas coast in Aransas, Calhoun, and Refugio counties, where it overwinters in oak savannahs, salt marshes, and bays (USFWS 1995). During migration they use various stopover areas in western Canada and the American Midwest. The three other wild populations have been introduced: an eastern population that migrates between Wisconsin and Florida and two non-migratory populations, one in central Florida, the other in Louisiana.

The natural wild population of whooping cranes spends its winters at Aransas NWR, Matagorda Island, Isla San Jose, portions of Lamar Peninsula, and Welder Point on the east side of San Antonio Bay (CWS and USFWS 2007). The main stopover points in Texas for migrating birds are in the central and eastern Panhandle (USFWS 1995).

USFWS reintroduced a non-essential experimental population (NEP) to Vermillion Parish in southwestern Louisiana in 2011. The reintroduced population was designated as NEP under section 10(j) of the ESA of 1973, as amended. A NEP population is a reintroduced population believed not be essential for the survival of the species, but important for its fully recovery and eventual removal from

the endangered and threatened list. Since 2011, 10-16 hatched juveniles have been released annually at White Lake Wetlands Conservation Area, and in 2016 a new release area was added 19 miles to the south at Rockefeller Wildlife Refuge. The NEP is approximately 175 miles from the action area.

Nesting habitat in northern Canada is in poorly drained regions of freshwater marshes and wet prairies interspersed with numerous potholes and narrow-wooded ridges. Whooping cranes use a variety of habitats during migration, including freshwater marshes, wet prairies, inland lakes, small farm ponds, upland grain fields, and riverine systems. Shallow flooded palustrine wetlands are used for roosting, while croplands and emergent wetlands are used for feeding. Riverine habitats, such as submerged sandbars, are often used for roosting. The principal winter habitat in Texas is brackish bays, marshes, and salt flats, although whooping cranes sometimes feed in upland sites characterized by oak mottes, grassland swales, and ponds on gently rolling sandy soils (Lewis 1995, Campbell 2003, CWS and USFWS 2007).

Occurrence in the Action Area

Members of the NEP population are known to use typical marsh habitat along with rice and crawfish fields year-round in Orange county and a nesting pair has been documented not too far from the action area. Whooping crane use of the project area is likely particularly in intact marsh areas.

3.3 West Indian Manatee

Manatees are large, elongated marine mammals with paired flippers and a large, spoon-shaped tail. They can reach lengths of over 14 feet and weights of over 3,000 pounds. Manatees are herbivores that feed opportunistically on a wide variety of submerged, floating, and emergent vegetation.

Status

USFWS listed the West Indian manatee as endangered on March 11, 1967 (32 FR 4001) and later received protection under ESA in 1973. On May 5, 2017, the species was reclassified from endangered to threatened because the endangered designation no longer reflected the status of the species at the time of reclassification (82 FR 16668). Critical habitat for the Florida manatee subspecies (*Trichechus manatus latirostris*) was designated in 1976 (41 FR 41914).

The major threats faced by manatees today are numerous. Collisions with watercraft account for an average of 24-30% of the known manatee deaths in Florida annually. Deaths attributed to water control structures and navigational locks represent four percent of known deaths.

There are also threats to their habitat as a result of intensive coastal development throughout much of the manatee's range. As well, the availability of warm-water refuges for manatee is uncertain if minimum flows and levels are not established for the natural springs on which many manatees depend and as deregulation of the power industry in Florida occurs. There are also threats from natural events such as red tide and cold events. (USFWS 2001b)

Range and Habitat

The West Indian manatee was historically found in shallow coastal waters, bays, lagoons, estuaries, rivers, and inland lakes throughout much of the tropical and sub-tropical regions of the New World Atlantic, including many of the Caribbean islands. However, at the present time, manatees are now rare or extinct in most parts of their former range. Today, manatees occur primarily in Florida and southeastern Georgia, but individuals can range as far north as Rhode Island on the Atlantic coast (Reid 1996) and as far west as Texas on the Gulf coast.

Manatees live in marine, brackish, and freshwater systems in coastal and riverine areas throughout their range. Preferred habitats include areas near the shore featuring underwater vegetation like seagrass and eelgrass. They feed along grass bed margins with access to deep water channels, where they flee when threatened. Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, cavorting, mating, and calving (Marine Mammal Commission 1986). In estuarine and brackish areas, natural and artificial fresh water sources are sought by manatees.

When ambient water temperatures drop below 68 degrees Fahrenheit in autumn and winter, manatees aggregate within the confines of natural and artificial warm-water refuges or move to the southern tip of Florida (Snow 1991). Most artificial refuges are created by warm-water outfalls from power plants or paper mills. The largest winter aggregations are at refuges in Central and Southern Florida. The northernmost natural warm-water refuge used regularly on the west coast is at Crystal River and at Blue Springs in the St. Johns River on the east coast. Most manatees return to the same warm-water refuges each year; however, some use different refuges in different years and others use two or more refuges in the same winter (Reid and Rathbun 1986, Reid et al. 1995). Many lesser known, minor aggregation sites are used as temporary thermal refuges. Most of these refuges are canals or boat basins where warmer water temperatures persist as temperatures in adjacent bays and rivers decline.

As water temperatures rise manatees disperse from winter aggregation areas. While some remain near their winter refuges, others undertake extensive travels along the coast and far up rivers and canals. On the east coast, summer sightings drop off rapidly north of Georgia (Lefebvre et al. 2001) and are rare north of Cape Hatteras (Schwartz 1995); the northernmost sighting is from Rhode Island (Reid 1996). On the west coast, sightings drop off sharply west of the Suwannee River in Florida (Marine Mammal Commission 1986). Rare sightings also have been made in the Dry Tortugas (Reynolds and Ferguson 1984) and the Bahamas (Lefebvre et al. 2001).

During the summer, manatees may be commonly found almost anywhere in Florida where water depths and access channels are greater than one to two meters (O'Shea 1988). Manatees can be found in very shallow water. In warm seasons, they usually occur alone or in pairs, although interacting groups of five to ten animals are not unusual.

Occurrence in the Action Area

The West Indian manatee historically inhabited the Laguna Madre, the Gulf, and tidally influenced portions of rivers. It is currently, however, extremely rare in Texas waters and the most recent sightings are likely individuals migrating or wandering from Mexican waters. Historical records from Texas waters include Cow Bayou (in the action area), Sabine Lake (adjacent to the action area), Copano bay, the

Bolivar Peninsula, and the mouth of the Rio Grande (Schmidly 2004, Würsig 2017). In May 2005, a live manatee appeared in the Laguna Madre near Port Mansfield (Blankinship 2005) several hundred miles south of the action area. Due to the species' extreme rarity in the action area, its presence is highly unlikely; however, with historic records from Cow Bayou and Sabine Lake, it cannot be ruled out with certainty that the species could not occur in the action area.

3.4 Monarch Butterfly

The monarch butterfly is one of the most recognizable species in North America with its iconic orange and black markings. During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily Asclepias spp.) and larvae emerge after two to five days. Larvae develop through five larval instars (intervals between molts) over a period of 9 to 18 days, feeding on milkweed and sequestering toxic cardenolides as a defense again predators. The larva pupate into chrysalis before eclosing six to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months.

Status

On December 15, 2020, the USFWS announced that listing the monarch as endangered or threatened under ESA is warranted but precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants (85 FR 81813). The monarch is now a candidate species under ESA; its status will be reviewed each year until a listing decision is made.

Threats to the monarch include loss of milkweed and nectar resources (i.e. breeding and migratory habitat) from conversion and development of grasslands and widespread use of herbicides), exposure to insecticides, availability and quality of overwintering habitat, and climate change.

Range and Habitat

The life cycle varies by geographic locations and in many regions breed year-round. While in more temperate climates, the species can migrate long distances (over 1850 miles) lasting for over two months to reach their overwintering sites.

Texas is situated between the principal breeding grounds in the north and the overwintering areas in Mexico. Monarchs funnel through Texas both in the fall and spring. During the fall, monarchs use two principal flyways. One traverses Texas in a 300-mile wide path stretch from Wichita Falls to Eagle Pass. Monarchs enter the Texas portion of this flyway during the last days of September and by early November most have passed through to Mexico. The second flyway is situated along the Texas coast and lasts roughly from the third week of October to the middle of November. Early each March overwintering monarchs begin arriving from their overwintering grounds in Mexico seeking emerging milkweeds where they lay their eggs before dying. Most of their offspring continue heading north to repopulate the eastern half of the US and southern Canada.

Adult monarch butterflies during breeding and migration require a sufficient quality and quantity of nectar from nectar blooming resources, which they feed on throughout their migration routes and at their breed grounding (spring through fall). Monarchs also need healthy and abundant milkweed (for

both oviposition and larval feeding) embedded within this diverse nectaring habitat. Many monarchs use a variety of roosting trees along the fall migration route. The size and spatial arrangement of habitat patches are generally thought to be important aspects but is not well understood.

Occurrence in the Action Area

Within a couple of miles of the action area, there are grasslands, fields, and marshes that could support milkweed and nectar flowering species in the fall and spring that monarchs could use along their migration paths. Specifically in the action area, suitable habitat is absent in the open water areas and is generally very limited in the existing marsh areas with only a few nectar flowering plants sporadically growing. Common nectar plants include sea ox-eye, seaside golden rod (*Solidago sempevirens*) and salt marsh aster (*Aster tenufolius*). Milkweed, specifically swamp milkweed (*Asclepias incarnata*) is uncommon in the area.

4.0 EFFECTS OF THE PROPOSED ACTION

This chapter describes the potential effects of the proposed action on listed species.

4.1 Eastern Black Rail

The USACE has determined implementation of any of the actionable measures ***may affect but is not likely to adversely affect*** the Eastern black rail because the temporary adverse impacts are anticipated to be insignificant and discountable, especially since conservation measures have been incorporated into the plan, the overall beneficial impacts would far outweigh any negative impacts, and no work would be completed in suitable habitat.

Breakwaters

Construction of the breakwaters would have no direct effect on eastern black rail or their habitat due to the lack of suitable habitat along the alignment. Indirect effects from noise are unlikely due to the construction occurring on average about 250-300 feet from the nearest shoreline with the closest distance being about 150 feet to the shoreline.

The likelihood of the species being near the active construction zone and affected by noise from construction activities is extremely remote and is considered negligible and discountable because all of these actions are completed in or near deep water that is tidally influenced. Marsh habitat immediately adjacent to these sites (at least several hundred feet away from the active construction site) is severely eroded and in general maintains a deeper water level than is preferred by the eastern black rail. The nearest suitable habitat would be well outside the range of potential disturbance for noise; therefore, the listed actions in this section are expected to have no effect on the species.

Marsh Restoration

Beneficial Effects: Implementation of this action will indirectly contribute to the recovery of the species through marsh restoration and protection from future development. Marsh restoration would restore the balance between open water and vegetation and reestablish elevations that would be less tidally influenced and more conducive to foraging and breeding without concern for frequent flooding.

Direct Impacts: None of the prohibitions of the Section 4(d) rule are triggered through implementation of the ER measures.

Attempts would be made to avoid construction during the breeding season (March 01 through August 31). If construction must be completed during this time, in order to take advantage of the dredging windows, potential impacts to Eastern black rail include noise disturbance during foraging activities or habitat avoidance of individuals that may be present within intact marsh while construction equipment is operating in open water areas. Impacts to the species would cease after construction is complete.

The habitat where marsh restoration would be completed is considered open water or degraded marsh with more than several centimeters of continual inundation and no connectivity to upland areas making these sites unsuitable for nesting or foraging. Additionally, the containment levee is a 3:1 sloped berm that would not support any suitable habitat. However, along the perimeter of the restoration unit, existing marsh is considered suitable habitat and could support individuals. It is highly unlikely that

mortality of any individuals were to occur during construction due to lack of suitable habitat; however, birds in the adjacent wetlands could be temporarily affected by the noise of the construction equipment operating in open water areas resulting in temporary habitat avoidance. The distance from the suitable habitat to the active construction zone should be sufficient enough that equipment noise (usually only one or two pieces of equipment to move sediment and the noise from the discharge pipe) would be moderated enough to not affect calling during the breeding season. Voluntary conservation measures, such as biological monitors and nest avoidance measures, have been incorporated into the plan to further minimize any potential for impacts (section 5.2).

Living Shoreline

Construction of the living shoreline does not involve construction equipment and would be limited to volunteers planting plugs and removing invasive species. Any potential disturbance to eastern black rail would be from a volunteer accidentally flushing an individual as they are walking to or from the planting site. In general, planting of the living shoreline will increase the amount of available suitable habitat and by removing brush species and planting more desirable species.

4.2 Whooping Crane

Attempts would be made to avoid construction from October 1 through April 15 when birds are most likely to be present. If construction must be completed during this time in order to take advantage of the dredging windows, potential impacts to whooping cranes include noise disturbance during foraging activities or habitat avoidance while construction equipment is operating. Impacts to the species would cease after construction is complete. It is highly unlikely that mortality of any individuals would occur during construction due to their ability to avoid the construction area. However, additional voluntary conservation measures have been incorporated into the plan and are described in section 5.3.

Implementation of this plan will indirectly contribute to recovery of the species through marsh restoration and protection from future development. The International Recovery Plan lists several recovery actions including protecting wintering habitat to accommodate expanding crane populations (CWS and US Fish and Wildlife Service 2007), which is already evidenced by the presence of NEP birds in the study area. By restoring marsh habitat at least two identified recovery actions have been addressed (1.5.3.6—Better manage deposition of dredge material, 1.5.5—Create wetland habitat). In general, marsh restoration actions would be beneficial to the whooping crane through an increase in quality foraging habitat and in the future could serve as a wintering site.

The only individuals that are likely to occur in the action area are members of the NEP population. Usually, NEP populations are treated as "threatened" species except that the ESA's section 7 consultation regulations do not apply. However, since the birds are crossing out of the NEP boundaries, the birds are afforded full ESA protection as endangered, which includes complying with Section 7 consultation regulations. Therefore, USACE has determined the proposed action ***may affect, but is not likely to adversely affect*** the whooping crane because the temporary adverse impacts are anticipated to be insignificant and discountable, especially since conservation measures have been incorporated into the plan, and the overall beneficial impacts would far outweigh any negative impacts.

4.3 West Indian Manatee

The proposed action would not alter marine habitats or food sources, such as seagrass or other aquatic food plants, in the action area. In the rare instance that the manatee could occur in the action area, in-water work during placement of pipelines, operation of watercraft to move material or equipment, etc. could impact manatees. Impacts could include temporary habitat avoidance, exposure to underwater sound, and visual disturbances, which would all cease after construction is complete. The most extreme impact could include entrapment and/or collision with pipes, silt barriers, pumps, placement equipment, support watercraft or other in-water construction equipment. Although this is unlikely due to the extremely rare occurrence of West Indian manatee in the action area, conservation measures are being incorporated into the plan to avoid harassment and take of manatee, see Section 5.1.

Due to the rarity of the manatee in the action area and the conservation measures that would be implemented, implementation of the action ***may affect, but not adversely affect*** the West Indian manatee.

4.4 Monarch Butterfly

The proposed action would not involve placement of sediment into exiting marsh habitat; therefore, there would be no impact to existing potentially suitable habitat that may be present in the action area. Over the long-term, marsh restoration and planting of the living shoreline would increase the amount of area available for nectar producing species to establish thereby increasing suitable habitat in the action area for monarchs.

Construction is likely to occur during fall and/or spring migration. Construction activities may produce vibrations and noise that monarchs find undesirable. However, construction equipment and presence of individuals would be limited to only a couple of earth moving equipment that would not produce noise or vibration levels reaching significant distances. Therefore, any habitat avoidance would be shifted by a couple hundred feet if at all. Monarchs are known to utilize roadside patches of milkweed and flowering plants, which would produce as much or more noise than the construction equipment operating to move and place the sediment.

Due to the lack of suitable habitat immediately in the active construction area and an anticipated undetectable level of habitat avoidance if an individual happens to be present, implementation of the action would have ***no effect*** on the monarch butterfly.

5.0 VOLUNTARY CONSERVATION MEASURES AND MONITORING

5.1 General Conservation Measures

The following conservation measures would be incorporated into operations for the protection of all listed species:

- All personnel (contractors, workers, etc.) will attend training sessions prior to the initiation of, or their participation in, project work activities. Training will include: 1) recognition of eastern black rail, whooping crane, and West Indian manatee, their habitat, and sign; 2) impact avoidance measures; 3) reporting criteria; 4) contact information for rescue agencies in the area; and 5) penalties of violating the ESA.
- Project equipment and vehicles transiting between the staging area and restoration site will be minimized to the extent practicable, including but not limited to using designated routes and confining vehicle access to the immediate needs of the project.
- The contractor will coordinate and sequence work to minimize the frequency and density of vehicular traffic within and near the restoration unit(s) and limit driving to the greatest extent practicable.
- Use of construction lighting at night shall be minimized, directed toward the construction activity area, and shielded from view outside of the project area to the maximum extent practicable.
- A designated monitor(s) will be identified who will act as the single point of contact responsible for communicating and reporting endangered species issues throughout the construction period.

5.2 Eastern Black Rail

The following conservation measures would be implemented to minimize the potential for adverse effects to Eastern black rail:

- No marsh construction activities will occur from March 1st through September 30th (breeding, nesting, chick rearing, and molting season). If this timing restriction cannot be achieved, then the following will take place:
    - On site vegetative field surveys will be conducted before work begins to identify black rail habitat types along the GIWW adjacent to the proposed breakwater structures.
    - No material for marsh restoration will be placed in high marsh dominated by gulf cordgrass (*Spartina spartinea*), saltmeadow cordgrass (*S. patens*), sea-oxeye (*Borrichia frutescens*), and/or saltgrass (*Distichlis spicata*) or dense overhead cover that meets the target marsh elevation for black rail habitat.

- If temporary access routes, pipeline routes, or staging areas occur within identified black rail habitat the contractor must minimize traffic in these areas therefore minimizing the construction footprint (i.e. limited paths).
- In addition to minimizing access routes, areas of high marsh habitat should be left intact to provide refugia for the black rail to ensure escape access routes. The USACE will work with the Service to identify refugia areas once site specific planning begins.
- Biological monitors are required to assist construction crews with avoidance and minimization of black rail habitats once work begins.

- Tidal connections must not be restricted such that the flow and salinity regimes are modified.
- Use of construction lighting at night shall be minimized, directed toward the construction activity area, and shielded from view outside of the project area.

5.3 Whooping Crane

The following conservation measures would be implemented to minimize the potential for adverse effect to whooping crane:

- Seasonal timing restriction between January 15th and June 15th in which construction should be avoided if possible. If the seasonal timing restriction cannot be avoided:
  - A biological monitor qualified in identifying whooping cranes and with stop work authority will be on site while construction is in progress.
  - A 1,000 foot-radius of the work site would be delineated before work begins. If a whooping crane is observed within the 1,000-foot radius, the biological monitor shall halt construction activities, including shutting down any running equipment until the bird has vacated the radius.
  - If construction equipment is over 15 feet tall, the equipment must be marked with visual flagging as bird avoidance measures when equipment is in use and laid horizontally on the ground when not in use.
- Workers, temporary or permanent, should be educated on the importance and protections allocated to this species, including but not limited to: no collection of features or eggs, and do not touch or harass birds.
- All whooping crane sightings should be immediately reported to the Texas Coastal ES Field Office at 281-286-8282; Wade Harrel (Service Species Lead) at Wade_Harrell@fws.gov, Trey Barron (TPWD) at Trey.Barron@tpwd.texas.gov, and Eva Szyszkoski (Louisiana Wildlife and Fisheries Department) at ESzyszkoski@wlf.la.gov or by phone at (337) 536-9596.

5.4 West Indian Manatee

The following conservation measures would be implemented to minimize the potential for adverse effects to manatees:

- Qualified biologists will monitor for the presence of manatee during phases which involve open water areas capable of supporting manatees.
- Before activities occur in open water areas, a 50-foot radius of the work area should be delineated. If a manatee is observed within the 50-foot radius, the biological monitor shall halt construction activities, including shutting down any running equipment until the animal has moved beyond the radius, either through sighting or by waiting until enough time has elapsed (approximately 15 minutes) to assume that the animal has moved beyond the buffer.
- If a manatee is sighted within 100 yards of the active work zone, vessels will operate at no wake/idle speeds.
- If siltation barriers are used, they will be made of material in which manatees cannot become entangled, should be properly secured, and regularly monitored to avoid entrapment. Barrier should not impede manatee movement.
- Any manatee sightings will be immediately reported to the USFWS Houston Ecological Services Office.

No additional monitoring would be required pre- or post-construction, due to the extremely low potential for the species to occur in the action area.

6.0 CONCLUSION

Based upon the findings of this BA, USACE has made the following effects determination for species that were identified as occurring or potentially occurring in the action area:

Species	Scientific Name	Jurisdiction	Effect Determination
Birds			
Eastern black rail	*Laterallus jamaicensis jamaicensis*	USFWS	NLAA
Whooping Crane	*Grus americana*	USFWS	NLAA
Mammals			
West Indian Manatee	*Trichechus manatus*	UFWS	NLAA
Insects			
Monarch Butterfly	*Danaus plexippus*	USFWS	No effect

NLAA= Not likely to adversely affect

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Appendix A: Species List Request

Texas

Threatened and Endangered Species and Critical Habitats Under NOAA Fisheries Jurisdiction

Species	Listing Status	Recovery Plan	Critical Habitat
Green sea turtle	Threatened - North and South Atlantic Distinct Population Segment (81 FR 20057; April 6, 2016)	October 1991	63 FR 46693; September 2, 1998
Kemp's ridley sea turtle	Endangered (35 FR 18319; December 2, 1970)	September 2011	None
Leatherback sea turtle	Endangered (35 FR 8491; June 2, 1970)	April 1992	44 FR 17710; March 23, 1979
Loggerhead sea turtle	Threatened - Northwest Atlantic Ocean Distinct Population Segment (76 FR 58868; September 22, 2011)	December 2008	79 FR 39856; July 10, 2014
Hawksbill sea turtle	Endangered (35 FR 8491; June 2, 1970)	December 1993	63 FR 46693; September 2, 1998
Oceanic whitetip shark	Threatened (83 FR 4153; January 30, 2018)	2018 Recovery Outline	None
Giant manta ray	Threatened (83 FR 2916; January 22, 2018)	December 2019 Recovery Outline	None
Fin whale	Endangered (35 FR 18319; December 2, 1970)	August 2010	None
Sperm whale	Endangered (35 FR 18319; December 2, 1970)	December 2010	None
Sei whale	Endangered (35 FR 12222; December 2, 1970)	December 2011	None
Rice's whale[1] [1] **FINAL RULE TO REVISE TAXONOMY AND COMMON NAME (86 FR 47022, 08/23/2021)**	Endangered (84 FR 15446, April 15, 2019)	September 2020 Recovery Outline	None

Last updated by Southeast Regional Office on September 01, 2021

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
4444 Corona Drive, Suite 215
Corpus Christi, TX 78411
Phone: (281) 286-8282 Fax: (281) 488-5882
http://www.fws.gov/southwest/es/TexasCoastal/
http://www.fws.gov/southwest/es/ES_Lists_Main2.html

In Reply Refer To: October 01, 2021
Consultation Code: 02ETTX00-2022-SLI-0007
Event Code: 02ETTX00-2022-E-00026
Project Name: Sec. 1122 BU of Dredged Material Pilot Program: Hickory Cove Marsh Restoration and Living Shoreline

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Tx, and Corpus Christi, Tx, have combined administratively to form the Texas Coastal Ecological Services Field Office. A map of the Texas Coastal Ecological Services Field Office area of responsibility can be found at: http://www.fws.gov/southwest/es/TexasCoastal/Map.html. All project related correspondence should be sent to the field office responsible for the area in which your project occurs. For projects located in southeast Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058. For projects located in southern Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; P.O. Box 81468; Corpus Christi, Texas 78468-1468. For projects located in six counties in southern Texas (Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata) please write: Santa Ana NWR, ATTN: Ecological Services Sub Office, 3325 Green Jay Road, Alamo, Texas 78516.

The enclosed species list identifies federally threatened, endangered, and proposed to be listed species; designated critical habitat; and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project.

New information from updated surveys, changes in the abundance and distribution of species, changes in habitat conditions, or other factors could change the list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation for updates to species list and information. An updated list may be

requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Candidate species have no protection under the Act but are included for consideration because they could be listed prior to the completion of your project. The other species information should help you determine if suitable habitat for these listed species exists in any of the proposed project areas or if project activities may affect species on-site, off-site, and/or result in "take" of a federally listed species.

"Take" is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In addition to the direct take of an individual animal, habitat destruction or modification can be considered take, regardless of whether it has been formally designated as critical habitat, if the activity results in the death or injury of wildlife by removing essential habitat components or significantly alters essential behavior patterns, including breeding, feeding, or sheltering.

Section 7

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify or destroy critical habitat of such species. It is the responsibility of the Federal action agency to determine if the proposed project may affect threatened or endangered species. If a "may affect" determination is made, the Federal agency shall initiate the section 7 consultation process by writing to the office that has responsibility for the area in which your project occurs.

Is not likely to adversely affect - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

Is likely to adversely affect - adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires the Federal action agency to initiate formal section 7 consultation with this office.

No effect - the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No further coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related articles.

Please be advised that while a Federal agency may designate a non-Federal representative to conduct informal consultations with the Service, assess project effects, or prepare a biological assessment, the Federal agency must notify the Service in writing of such a designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

The Service's Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Act requirements for your projects at: http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

Section 10

If there is no federal involvement and the proposed project is being funded or carried out by private interests and/or non-federal government agencies, and the project as proposed may affect listed species, a section 10(a)(1)(B) permit is recommended. The Habitat Conservation Planning Handbook is available at: http://www.fws.gov/endangered/esa-library/pdf/HCP_Handbook.pdf

Service Response

Please note that the Service strives to respond to requests for project review within 30 days of receipt, however, this time period is not mandated by regulation. Responses may be delayed due to workload and lack of staff. Failure to meet the 30-day timeframe does not constitute a concurrence from the Service that the proposed project will not have impacts to threatened and endangered species.

Proposed Species and/or Proposed Critical Habitat

While consultations are required when the proposed action may affect listed species, section 7(a)(4) was added to the ESA to provide a mechanism for identifying and resolving potential conflicts between a proposed action and proposed species or proposed critical habitat at an early planning stage. The action agency should seek conference from the Service to assist the action agency in determining effects and to advise the agency on ways to avoid or minimize adverse effect to proposed species or proposed critical habitat.

Candidate Species

Candidate species are species that are being considered for possible addition to the threatened and endangered species list. They currently have no legal protection under the ESA. If you find you have potential project impacts to these species the Service would like to provide technical assistance to help avoid or minimize adverse effects. Addressing potential impacts to these species at this stage could better provide for overall ecosystem healh in the local area and ay avert potential future listing.

Several species of freshwater mussels occur in Texas and four are candidates for listing under the ESA. The Service is also reviewing the status of six other species for potential listing under the ESA. One of the main contributors to mussel die offs is sedimentation, which smothers and suffocates mussels. To reduce sedimentation within rivers, streams, and tributaries crossed by a project, the Service recommends that that you implement the best management practices found at: http://www.fws.gov/southwest/es/TexasCoastal/FreshwaterMussels.html.

Candidate Conservation Agreements (CCAs) or Candidate Conservation Agreements with Assurances (CCAAs) are voluntary agreements between the Service and public or private entities to implement conservation measures to address threats to candidate species. Implementing conservation efforts before species are listed increases the likelihood that simpler, flexible, and more cost-effective conservation options are available. A CCAA can provide participants with assurances that if they engage in conservation actions, they will not be required to implement additional conservation measures beyond those in the agreement. For additional information on CCAs/CCAAs please visit the Service's website at http://www.fws.gov/endangered/what-we-do/cca.html.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Many may nest in trees, brush areas or other suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals or eggs. If project activities must be conducted during this time, we recommend surveying for active nests prior to commencing work. A list of migratory birds may be viewed at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html.

The bald eagle (*Haliaeetus leucocephalus*) was delisted under the Act on August 9, 2007. Both the bald eagle and the goden eagle (*Aquila chrysaetos*) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For more information on bald and golden eagle management guidlines, we recommend you review information provided at http://www.fws.gov/midwest/eagle/pdf/NationalBaldEagleManagementGuidelines.pdf.

The construction of overhead power lines creates threats of avian collision and electrocution. The Service recommends the installation of underground rather than overhead power lines whenever possible. For new overhead lines or retrofitting of old lines, we recommend that project developers implement, to the maximum extent practicable, the Avian Power Line Interaction Committee guidelines found at http://www.aplic.org/.

Meteorological and communication towers are estimated to kill millions of birds per year. We recommend following the guidance set forth in the Service Interim Guidelines for Recommendations on Communications Tower Siting, Constructions, Operation and Decommissioning, found online at: http://www.fws.gov/habitatconservation/communicationtowers.html, to minimize the threat of avian mortality at these towers.

Monitoring at these towers would provide insight into the effectiveness of the minimization measures. We request the results of any wildlife mortality monitoring at towers associated with this project.

We request that you provide us with the final location and specifications of your proposed towers, as well as the recommendations implemented. A Tower Site Evaluation Form is also available via the above website; we recommend you complete this form and keep it in your files. If meteorological towers are to be constructed, please forward this completed form to our office.

More information concerning sections 7 and 10 of the Act, migratory birds, candidate species, and landowner tools can be found on our website at: http://www.fws.gov/southwest/es/TexasCoastal/ProjectReviews.html.

Wetlands and Wildlife Habitat

Wetlands and riparian zones provide valuable fish and wildlife habitat as well as contribute to flood control, water quality enhancement, and groundwater recharge. Wetland and riparian vegetation provides food and cover for wildlife, stabilizes banks and decreases soil erosion. These areas are inherently dynamic and very sensitive to changes caused by such activities as overgrazing, logging, major construction, or earth disturbance. Executive Order 11990 asserts that each agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial value of wetlands in carrying out the agency's responsibilities. Construction activities near riparian zones should be carefully designed to minimize impacts. If vegetation clearing is needed in these riparian areas, they should be re-vegetated with native wetland and riparian vegetation to prevent erosion or loss of habitat. We recommend minimizing the area of soil scarification and initiating incremental re-establishment of herbaceous vegetation at the proposed work sites. Denuded and/or disturbed areas should be re-vegetated with a mixture of native legumes and grasses. Species commonly used for soil stabilization are listed in the Texas Department of Agriculture's (TDA) Native Tree and Plant Directory, available from TDA at P.O. Box 12847, Austin, Texas 78711. The Service also urges taking precautions to ensure sediment loading does not occur to any receiving streams in the proposed project area. To prevent and/or minimize soil erosion and compaction associated with construction activities, avoid any unnecessary clearing of vegetation, and follow established rights-of-way whenever possible. All machinery and petroleum products should be stored outside the floodplain and/or wetland area during construction to prevent possible contamination of water and soils.

Wetlands and riparian areas are high priority fish and wildlife habitat, serving as important sources of food, cover, and shelter for numerous species of resident and migratory wildlife. Waterfowl and other migratory birds use wetlands and riparian corridors as stopover, feeding, and nesting areas. We strongly recommend that the selected project site not impact wetlands and riparian areas, and be located as far as practical from these areas. Migratory birds tend to concentrate in or near wetlands and riparian areas and use these areas as migratory flyways or corridors. After every effort has been made to avoid impacting wetlands, you anticipate unavoidable wetland impacts will occur; you should contact the appropriate U.S. Army Corps of Engineers office to determine if a permit is necessary prior to commencement of construction activities.

If your project will involve filling, dredging, or trenching of a wetland or riparian area it may require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (COE). For permitting requirements please contact the U.S. Corps of Engineers, District Engineer, P.O. Box 1229, Galveston, Texas 77553-1229, (409) 766-3002.

Beneficial Landscaping

In accordance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping (42 C.F.R. 26961), where possible, any landscaping associated with project plans should be limited to seeding and replanting with native species. A mixture of grasses and forbs appropriate to address potential erosion problems and long-term cover should be planted when seed is reasonably available. Although Bermuda grass is listed in seed mixtures, this species and other introduced species should be avoided as much as possible. The Service also recommends the use of native trees, shrubs, and herbaceous species that are adaptable, drought tolerant and conserve water.

State Listed Species

The State of Texas protects certain species. Please contact the Texas Parks and Wildlife Department (Endangered Resources Branch), 4200 Smith School Road, Austin, Texas 78744 (telephone 512/389-8021) for information concerning fish, wildlife, and plants of State concern or visit their website at: http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/listed_species/.

If we can be of further assistance, or if you have any questions about these comments, please contact 281/286-8282 if your project is in southeast Texas, or 361/994-9005, ext. 246, if your project is in southern Texas. Please refer to the Service consultation number listed above in any future correspondence regarding this project.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Texas Coastal Ecological Services Field Office
4444 Corona Drive, Suite 215
Corpus Christi, TX 78411
(281) 286-8282

Project Summary

Consultation Code: 02ETTX00-2022-SLI-0007
Event Code: Some(02ETTX00-2022-E-00026)
Project Name: Sec. 1122 BU of Dredged Material Pilot Program: Hickory Cove Marsh Restoration and Living Shoreline
Project Type: LAND - RESTORATION / ENHANCEMENT
Project Description: Alternative 3 was selected as the Tentatively Selected Plan (TSP). This plan incorporates marsh and shoreline restoration features which are critical to the stabilization and sustainment of the critical marsh resources now and into the future. Marsh measures consist of using about 3.5 million cubic yards of maintenance dredged material to nourish up to 670 acres of marsh in 3 restoration units to increase land coverage in the area and improve terrestrial wildlife habitat, hydrology, water quality, and fish nurseries. The marsh will be nourished to an elevation conducive to support Spartina patens (60% of the restoration unit will have a post-construction settlement target elevation of +1.2 feet mean sea level (MSL) and the remaining 40% of the unit will have a target elevation of +0.5 feet MSL). Additionally, in-situ material would be used to repair breaches in the existing containment levee to restore a uniform +5.0 ft MSL and 3:1 slopes.

Shoreline measures include construction of a rock breakwater structure and a living shoreline that would mitigate some effects erosion along the the shoreline. Approximately 14,623 LF of stone breakwater structures, modeled after the existing Ducks Unlimited designs, would be constructed on approximately 2.0 acres of shallow (<3 ft) submerged land to dissipate wave energies, stabilize shorelines, reduce land loss, reduce saltwater intrusion, and support reestablishment of emergent marsh along the shoreline through retention of sediments. The 95-acre living shoreline feature involves removing invasive species and planting the seaward face with salinity tolerant vegetation (primarily Spartina alterniflora) as it will be exposed to the Sabine Lake estuary. This living shoreline will armor the containment levee from future breaches and restore lost brackish and saline marshes as well as promote accretion of sediments.

The marsh restoration, repairs of the existing containment levee, and the living shoreline would be constructed on private lands, while the breakwaters would be constructed on State Submerged lands of Sabine Lake. Timing of initial construction of this project (Phase 1) is dependent on several factors including: timing of authorization, duration of the PED phase, and Federal- and non-federal funding cycles. It was assumed that construction would begin in March 2024 and have approximately 30 months of on-the-ground work. These dates and are based on the next projected SNWW Neches River or Sabine River dredging cycle. The

timing of Phase 2 and Phase 3 marsh restoration units are uncertain at this time but would not likely occur before 2027 unless an emergency dredging cycle occurs as a result of excess shoaling from a storm event.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@29.99809705,-93.80269891146519,14z

Counties: Orange County, Texas

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
West Indian Manatee *Trichechus manatus*	Threatened

There is **final** critical habitat for this species. The location of the critical habitat is not available.
This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.
Species profile: https://ecos.fws.gov/ecp/species/4469

Birds

NAME	STATUS
Piping Plover *Charadrius melodus*	Threatened

Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered.
There is **final** critical habitat for this species. The location of the critical habitat is not available.
This species only needs to be considered under the following conditions:

- Wind related projects within migratory route.

Species profile: https://ecos.fws.gov/ecp/species/6039

Red Knot *Calidris canutus rufa*	Threatened

There is **proposed** critical habitat for this species. The location of the critical habitat is not available.
This species only needs to be considered under the following conditions:

- Wind related projects within migratory route.

Species profile: https://ecos.fws.gov/ecp/species/1864

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

US Army Corps of Engineers ®
Galveston District

Appendix B-4

Coastal Zone Management Act Compliance

for

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

November 2021

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

Texas Coastal Management Plan Consistency Determination

November 2021

US Army Corps of Engineers ®
Galveston District

Prepared by:

United States Army Corps of Engineers
Regional Planning and Environmental Center

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INTRODUCTION

The U.S. Army Corps of Engineers, Galveston District (USACE), in partnership with Ducks Unlimited and the Port of Orange, is exploring the feasibility of implementing a pilot project for the beneficial use of dredged material generated during operations and maintenance dredging of the Sabine Neches Waterway (SNWW) as means to restore degraded marsh lands. This project is one of ten final proposals evaluated and selected from 95 submittals because it has a high environmental, economic, and social benefits, and exhibited geographic diversity.

The project is located within Hickory Cove Bay in an area known as "the saddle" where the Sabine and Neches rivers merge into Sabine Lake in Orange County, Texas. The project area includes 1,200 acres of impounded marsh lands and open water areas of Sabine Lake. The land is owned and operated by the Hawk Club, a private hunting club, and adjacent to the Lower Neches Wildlife Management Area (WMA) which is owned and operated by Texas Parks and Wildlife Department (TPWD). The Sabine Neches Waterway (SNWW) is the only federal navigation project immediately near the study area (Figure 1).

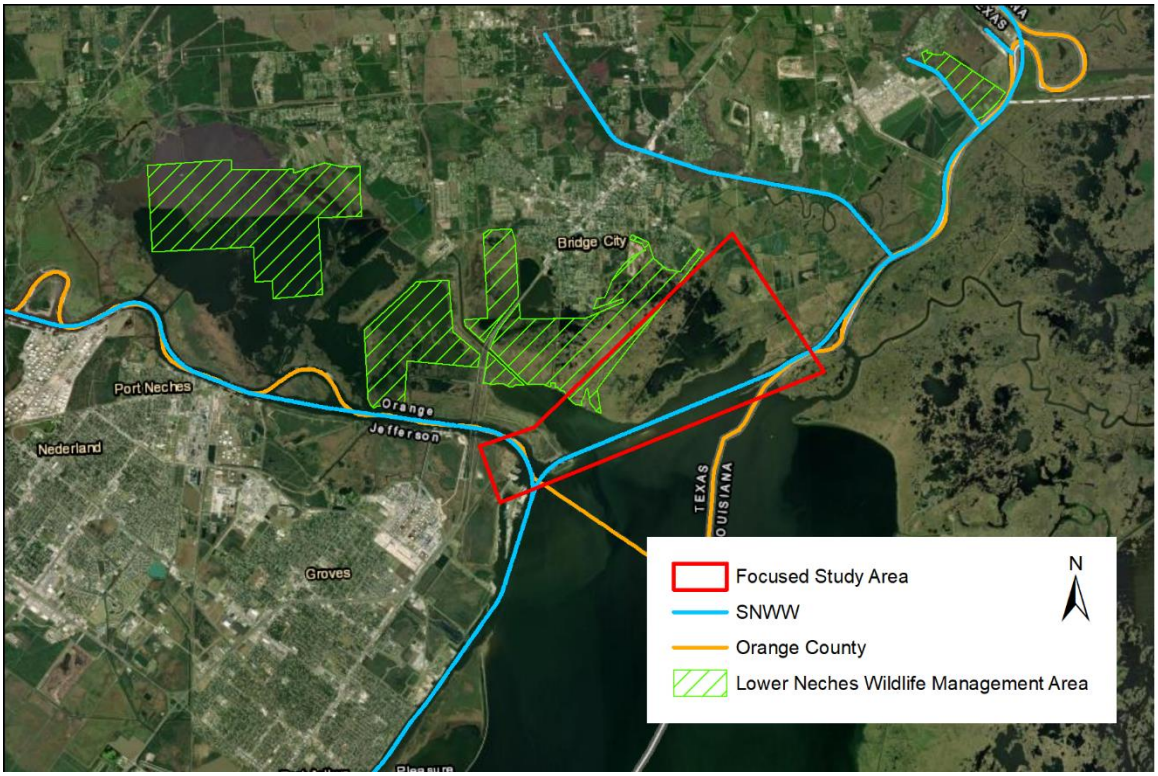


Figure 1. Study Area

Alternative 3 was chosen as the tentatively selected plan (TSP) (Figure 2). This plan involves beneficially using dredged material to restore up to 670 acres of marsh habitat and create resiliency against future conditions. Marsh measures consist of three phases of marsh restoration that would increase land coverage in the project area and improve terrestrial wildlife habitat, hydrology, and water quality. To protect marsh restoration efforts, the project involves repairing an existing containment that will limit hydrologic connection between Sabine Lake and the interior marsh areas to only extreme conditions and create conditions conducive for reestablishment and sustainment of marsh under future conditions.

Shoreline measures include construction of rock breakwaters and living shoreline features that help to mitigate erosion, dissipate wave energies, stabilize shorelines, reduce land loss, reduce saltwater intrusion, and support reestablishment of emergent marsh through retention of sediments. Material placed into the marsh and on the existing containment levee would have similar properties to the existing native material. Under the existing and projected future dredging cycles, there is sufficient quantities of suitable material available to meet all restoration needs without seeking other borrow sources (e.g. off-shore, upland placement areas).

Alternative 3 measures have been developed to a feasibility level of design (i.e. estimates, design level that is not detailed enough for construction) based on currently available data and information developed during plan formulation. There is significant institutional knowledge regarding the construction of the restoration measures; therefore, there is minimal uncertainty from a construction standpoint. Uncertainties relating to measure design and performance are mainly centered on site specific, design-level details (e.g. exact sediment quantities, invasive species removal needs, extent of erosion control needs, construction staging area locations, pipeline pathways, timing and duration of construction, etc.), which would be addressed during the pre-engineering and design phase (PED). Additional plan details are provided in the Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) and the Engineering Appendix of the DIFR-EA (Appendix A).

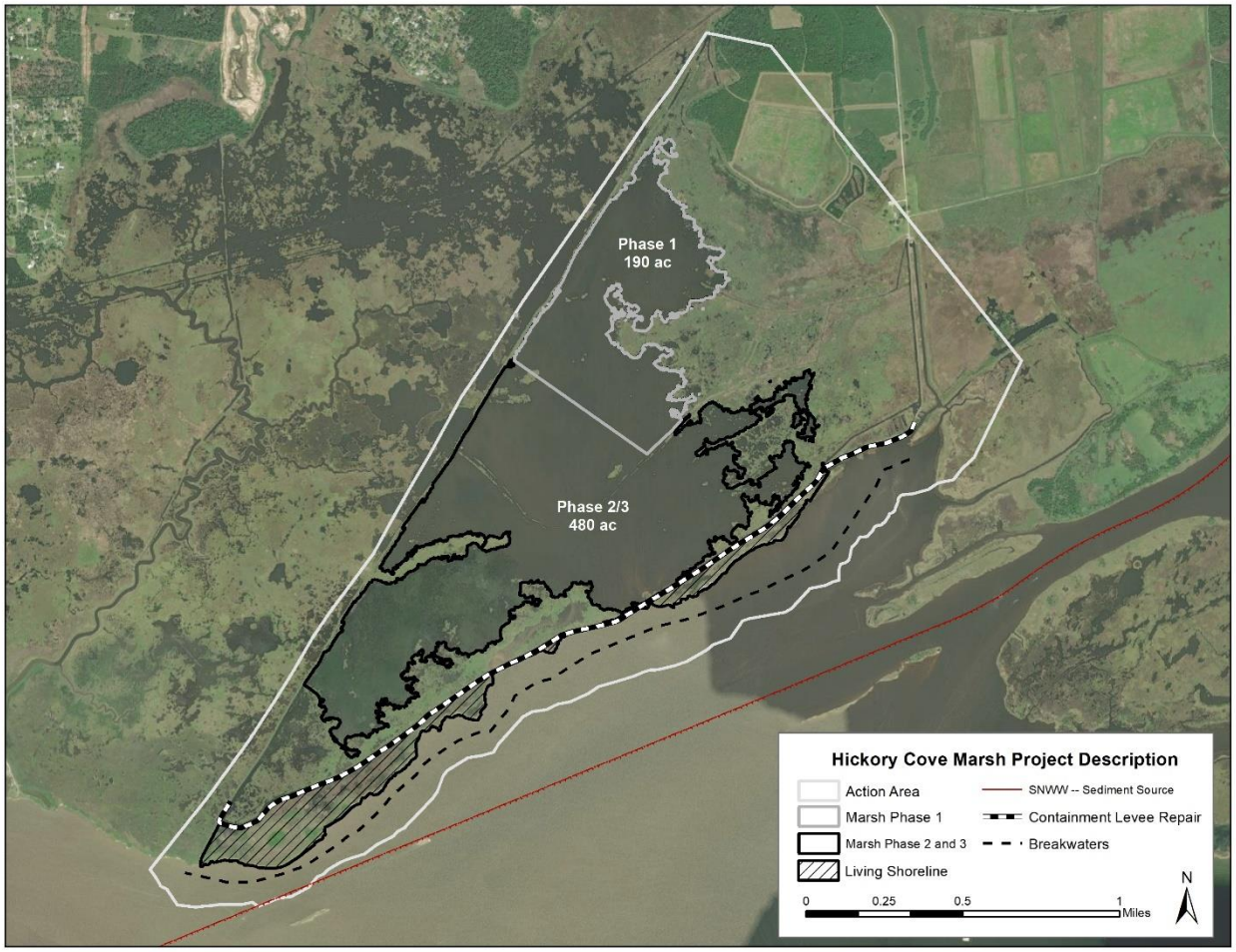


Figure 2. Project Description

Marsh Restoration

Implementation of this project would involve placing approximately 3.5 million cubic yards of material dredged from the SNWW to restore approximately 670 acres emergent marsh dominated by *Spartina patens*. Placement of material would occur over three phases as funding and sediment material becomes available. Phase 1 would involve placing approximately 1.3 million cubic yards of material in the unit, while the Phase 2 and Phase 3 units would need an estimated 2.2 million cubic yards of material.

Dredged material would be hydraulically pumped into open water and low-lying areas assuming that 60% of the restoration unit will have a post-construction settlement target elevation of +1.2 feet mean sea level (MSL) and the remaining 40% of the unit will have a target elevation of +0.5 feet MSL. Target elevations were determined based on successful vegetation establishment at the Old River Cove restoration site on the Lower Neches WMA, which was used as an ecosystem restoration reference site, and resource agency input. As necessary, temporary training berms (containment dikes) would be constructed from in-situ material around the nourished areas to efficiently achieve the desired initial construction elevation. The berms would be breached following construction to allow dewatering and settlement to the final target marsh elevation. Vegetation plantings would follow protocols and species assemblages used at the reference site.

Following marsh restoration actions, non-native/undesirable species monitoring would be implemented. If species are found, measures would be taken to stop or slow the expansion of the species within the restoration units.

Containment Levee Repair

The existing containment levee would be repaired to a uniform elevation of +5.0 feet MSL and slopes restored to 3:1 (Figure 3) to limit tidal influence and salinity intrusion into interior existing and restored marshes. Sediment for the repair would come from material placed in the marsh restoration areas.

Under the existing condition, numerous breaches in the levee allow saltwater intrusion and high energy flows which scour and cause erosion, increase land loss, and convert marsh habitat to open water.

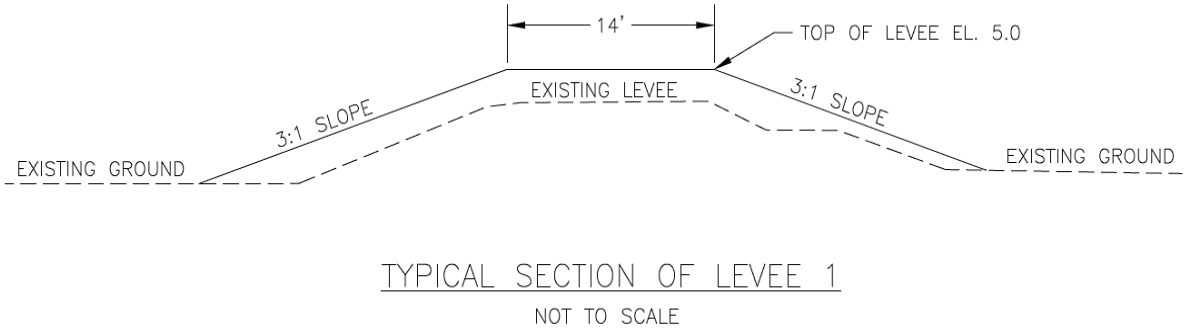


Figure 3. Typical cross-section of the repaired containment levee

Breakwaters

Hickory Cove's shoreline runs parallel to the SNWW/GIWW on the northern side of Sabine Lake and is exposed to wave action that has repeatedly degraded the containment levee on the exterior of the marsh. In addition to navigation traffic subjecting the shoreline to erosive forces, Hickory Cove's shoreline is along the northern boundary of the lake with a significant fetch leaving it vulnerable to wind-driven and ship induced wave action. Attenuating waves through construction of approximately 14,623 linear feet (LF) of breakwaters was considered necessary to mitigate degradation and breach of the containment levee and subsequent marsh degradation exacerbated by these conditions. The preliminary design of this feature is shown in Figure 4.

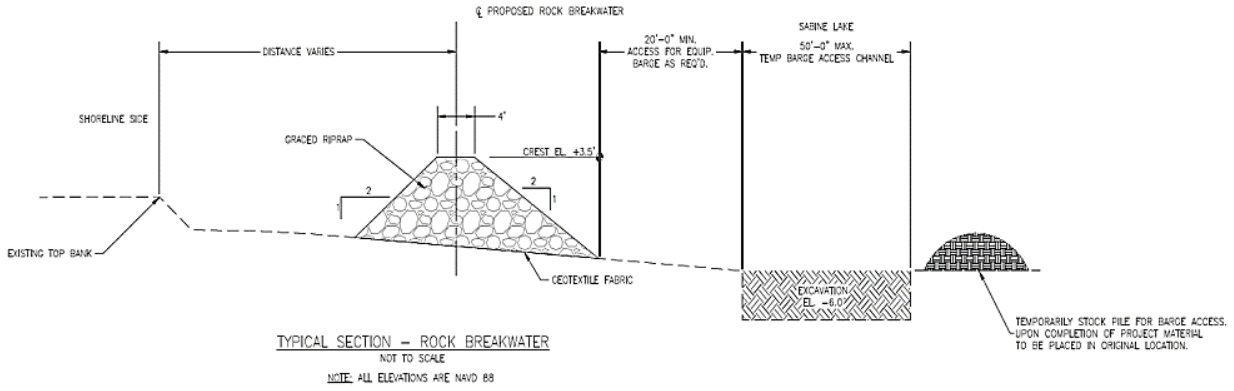


Figure 4. Typical cross-section of the breakwaters

The structures would be built in shallow water (<three feet deep) at varying distances from the shoreline and where soils are conducive to supporting the weight of the stone without significant subsidence. The distance from the shoreline would be determined during PED, after site specific surveys have been completed, but sufficiently offset from the boundaries of the SNWW navigation channel to ensure continued safe navigation.

The design would be a trapezoidal structure built of approximately 138,000 tons of stone up to a height of +3.5 feet MSL, which will yield approximately 1-1.5 feet of rock exposed above the mean high tide level. Other approximate features of the design include a four-foot wide crown, a 2:1 slope, and a base that is roughly 30 feet wide. The structure would have a total footprint of approximately 2 acres. The base of the structure would be on filter cloth ballasted to the water bottom to secure placement and prevent displacement of the outboard edges. The number of openings and width of each would be determined during PED and dependent on the location of major channel entrances or access points required for fishery access or circulation and potential for erosion to affect the existing containment levee.

Living Shoreline

A 95-acre living shoreline would be planted between the existing containment levee and the breakwaters. Invasive plant species, primarily Chinese tallow (*Triadica sebifera*) would be removed from the levee and smooth cordgrass (*Spartina alterniflora*) would be planted along the tow of the levee to form the living shoreline. Approximately 217,000 *S. alterniflora* plugs would be planted with 60-inch

spacing. Establishment of this feature would provide toe protection to the existing containment levee and promote sediment accretion to regain lost habitat.

Equipment Needs and Access Routes

Sediment transport equipment would most likely include cutterhead dredges, pipelines (submerged, floating, and land) and one booster pump. Heavy machinery would be used to move sediment and facilitate construction. Heavy equipment could include bulldozers, front-end loaders, track-hoes, marshbuggies, track-hoes, and backhoes. For breakwater construction, stone would be purchased from a commercial quarry and transported to the site by barge, where it would then be placed by crane or hopper barge. Various support equipment would also be used, such as crew and work boats, trucks, trailers, construction trailers, all-terrain vehicles, and floating docks and temporary access channels to facilitate loading and unloading of personnel and equipment.

Identification of staging areas, pipeline routes, and placement of floatation docks would occur during PED. Each disturbance for access and staging would be placed outside of environmentally sensitive areas to the greatest extent practicable and utilize areas already disturbed when possible (e.g. stage on existing agricultural bare ground, existing roadways, or mowed/pastured private lands). All ground disturbance for access and staging areas would be temporary and fully restored to result in no permanent loss.

Timing

Timing of initial construction of this project (Phase 1) is dependent on several factors including: timing of authorization, duration of the PED phase, and Federal- and non-federal funding cycles. It was assumed that construction would begin in March 2024 and have approximately 30 months of on-the-ground work (Table 1). These dates and are based on the next projected SNWW Neches River or Sabine River dredging cycle. The timing of Phase 2 and Phase 3 marsh restoration units are uncertain at this time but would not likely occur before 2027 unless an emergency dredging cycle occurs as a result of excess shoaling from a storm event.

Table 1. Anticipated construction schedule

Measure	Duration	Start	End
Dredging, Phase 1 Marsh Restoration, Containment Levee Repair	12	Mar 2024	Feb 2025
Breakwaters	16	Mar 2025	Jul 2026
Living Shoreline	2	Mar 2027	Apr 2027

CONSISTENCY WITH THE TEXAS COASTAL MANAGEMENT PROGRAM

Transportation to and placement of the dredged material in the restoration units and all associated restoration activities will be analyzed in this document for consistency with the policies of the Texas Coastal Management Program (TCMP). Dredging is not assessed in this document as they have been assessed in the SNWW Channel Improvement Plan (CIP) Final Feasibility Report and Final Environmental Impact Statement (USACE 2011). CIP dredging and placement activities have been identified as consistent with the policies of the TCMP. The proposed activities would not include additional dredging needs greater than described in the CIP.

Impacts on Coastal Natural Resource Areas

Potential impacts to Coastal Natural Resource Areas (CNRAs) listed in 31 Texas Administrative Code (TAC) §501.3, and methods to minimize or avoid potential impacts, are discussed below. Eleven of the 16 CNRAs would not be temporarily or permanently affected (negatively/adversely or beneficially) by project implementation including: Coastal Barriers, Coastal Historic Areas, Coastal Preserves, Coastal Wetlands, Critical Dune Areas, Critical Erosion Areas, Gulf Beaches, Hard Substrate Reefs, Oyster Reefs, Tidal Sand and Mud Flats, and Waters of Gulf of Mexico, due to the lack of the resource, as defined in §501.3, in the project area. The following five CNRAs have the potential to be impacted by implementation of the TSP; however, all impacts would be less than adverse.

Coastal Shore Areas

A coastal shore area is defined as areas within 100 feet landward of the high-water mark on submerged land. Restoration units closest to the SNWW have coastal shore areas found within them. These areas would not be adversely impacted by project implementation because it is anticipated that the form and function of the current coastal system improve through restoration and resiliency of existing and historic marsh in the action area after construction is complete.

Special Hazard Areas

Special hazard areas are areas designated by the Administrator of the Federal Insurance Administration under the National Flood Insurance Act as having special flood, mudslide, and/or flood-related erosion hazards and shown on a Flood Hazard Boundary Map or Flood Insurance Rate Map as Zone A, AO, A1-30, AE, A99, AH, VO, V1-30, VE, V, M, or E. All areas in the action area are designated as within the 100-year coastal floodplain and have a V12 or A8 designation on the Federal Emergency Management Agency Flood Maps for Orange County, Texas (Unincorporated Areas). Implementation of the project may ease the impacts of flooding under relative sea level change (RSLC) but would not induce development of special hazard areas.

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) is defined as rooted aquatic vegetation growing in permanently inundated areas in estuarine and marine systems. Submerged aquatic vegetation exists within the shallow areas of existing interior marsh areas and is very limited to non-existent in the existing interior open water as observed during field surveys. On the seaward side of the containment levee, no SAV was found during field surveys. A potential for some very minor SAV loss in the open water areas is possible,

however, it would be anticipated that a net increase in SAV post-construction would occur due to shallower and less turbid water similar to conditions found in existing interior marsh areas in the action area and at the reference site. Since no SAV was found on the seaward side of the containment levee, placement of stone and planting of vegetation would have no impact.

Submerged Lands

Submerged lands are lands located under waters under tidal influence or under waters of the open Gulf of Mexico, without regard to whether the land is owned by the state or a person other than the state. The Texas General Land Office (GLO) shapefile for "State Submerged Lands" shows the breakwater and dredging sites as submerged lands, while the living shoreline, containment levee, and interior marsh restoration areas are not considered submerged lands. Construction of 14,623 LF of breakwater would be constructed exclusively upon approximately two acres of submerged lands, therefore navigation servitude will be exercised and no acquisition will be required for this aspect of the project. The presence of the breakwater would beneficially modify the tidal flows and erosion rates affecting the shoreline by reducing erosive forces and stabilizing the shoreline. The structures would be close enough to the shoreline to have no adverse effects in any submerged lands seaward of the breakwaters including having no impact on recreational opportunities or navigation safety.

The dredged material used to restore marshes would come from areas in which dredging activities could impact submerged lands. These impacts were analyzed in the SNWW CIP Final Feasibility Report and Final Environmental Impact Assessment and in the Operations and Maintenance plans of the SNWW and were found to be not significant or adverse.

Waters under Tidal Influence

Waters under tidal influence are defined as water in the state that is subject to tidal influence according to the Texas Commission on Environmental Quality (TCEQ) stream segment map, which includes coastal wetlands. The project area is located in a tidally influenced region. Implementation of the project would result in minimal, temporary localized adverse impacts from dredging and placement activities. Temporary impacts include release of suspended solids and turbidity, both which lead to decreased water quality. In the long-term, restoration activities would be beneficial to waters under tidal influence because proposed activities would restore form and function within the restoration unit, which should allow tidal energies to work as nature designed, including reducing subsidence, increasing sediment inputs into the system and creating nursery, foraging, and migrating habitat for a host of freshwater, marine, and terrestrial species, and creating a sustainable and resilient system.

Enforceable Policies

The 20 enforceable policies were reviewed, and it was determined that five policies are applicable to this study (Table 2).

Table 2. CMP Enforceable Policies

Policy	Applicability
§ 501.15 Policy for Major Actions	N/A
§ 501.16 Policies for Construction of Electric Generating and Transmission Facilities	N/A
§ 501.17 Policies for Construction, Operation, and Maintenance of Oil and Gas Exploration and Production Facilities	N/A
§ 501.18 Policies for discharges of Wastewater and Disposal of Waste from Oil and Gas Exploration and Production Activities	N/A
§ 501.19 Policies for Construction and Operation of Solid Waste Treatment, Storage, and Disposal Facilities	N/A
§ 501.20 Policies for Prevention, Response and Remediation of Oil Spills	N/A
§ 501.21 Policies for Discharge of Municipal and Industrial Wastewater to Coastal Waters	N/A
§ 501.22 Policies for Nonpoint Source (NPS) Water Pollution	N/A
§ 501.23 Policies for Development in Critical Areas	**Yes**
§ 501.24 Policies for Construction of Waterfront Facilities and Other Structures on Submerged Lands	**Yes**
§ 501.25 Policies for Dredging and Dredged Material Disposal and Placement	**Yes**
§ 501.26 Policies for Construction in the Beach/Dune System	N/A
§ 501.27 Policies for Development in Coastal Hazard Areas	**Yes**
§ 501.28 Policies for Development Within Coastal Barrier Resource System Units and Otherwise Protected Areas on Coastal Barriers	N/A
§ 501.29 Policies for Development in State Parks, Wildlife Management Areas or Preserves	N/A
§ 501.30 Policies for Alteration of Coastal Historic Areas	N/A
§ 501.31 Policies for Transportation Projects	N/A
§ 501.32 Policies for Emission of Air Pollutants	**Yes**
§ 501.33 Policies for Appropriations of Water	N/A
§ 501.34 Policies for Levee and Flood Control Projects	N/A

§ 501.23 Policies for Development in Critical Areas

(a) Dredging and Construction of structures in, or the discharge of dredged or fill material into, critical areas shall comply with the policies in this section. In implementing this section, cumulative and secondary adverse effects of these activities will be considered.

(1) The policies in this section shall be applied in a manner consistent with the goal of achieving no net loss of critical area functions and values.

Compliance: There is no net loss of critical area functions and values. The purpose of the plan is to restore critical areas and minimize future loss due to RSLC and general area degradation from irreversible cultural modifications (e.g. altered hydrologic regimen) to the coastal system.

(2) Persons proposing development in critical areas shall demonstrate that no practicable alternative with fewer adverse effects is available.

Compliance: During plan formulation, all measures that would have greater impacts than others were screened from further inclusion in any of the formulated plans. The recommended TSP takes advantage of sediment from existing dredging cycles from the SNNW which reduces the need for upland placement or offshore disposal of maintenance dredge materials. As well, there is sufficient material, in quantity and quality, from maintenance dredging that there is no demonstrated need to find an offshore borrow source of material. The identified restoration area was based on the critical need for restoration. Other areas were identified but were determined to not have as great of a need and were therefore screened from incorporation into the plan. With incorporation of beneficial use of dredge material (BUDM) and selection of only the most critical units in need of restoration, there is no practicable alternative with fewer adverse effects that also provides the same level of restoration benefits.

(3) In evaluating practicable alternatives, the following sequence shall be applied:

(A) Adverse effects on critical areas shall be avoided to the greatest extent practicable.

(B) Unavoidable adverse effects shall be minimized to the greatest extent practicable by limiting the degree or magnitude of the activity and its implementation

(C) Appropriate and practicable compensatory mitigation shall be required to the greatest extent practicable for all adverse effects that cannot be avoided or minimized.

Compliance: There are no anticipated adverse effects to critical areas. Implementation of the TSP would result in temporary impacts to critical areas that would not rise to the level of adverse per §501.3. All long-term impacts are beneficial in nature and would result in overall higher quality critical areas due to the restoration nature of the project.

(4) Compensatory mitigation includes restoring adversely affected critical areas or replacing adversely affected critical areas by creating new critical areas. Compensatory mitigation should be undertaken, when practicable, in areas adjacent or contiguous to the affected critical areas (on-site)…

(5) Mitigation banking is acceptable compensatory mitigation if use of the mitigation bank has been approved by the agency authorizing the development and mitigation credits are available for withdrawal…

(6) In determining compensatory mitigation requirements, the impaired functions and values of the affected critical area shall be replaced on a one-to-one ratio…

Compliance: There is no net loss of critical areas therefore no mitigation is needed. All negative impacts are temporary in nature occurring only during the construction periods. Long-term permanent impacts are beneficial resulting in a net increase in function and value of the critical areas.

(7) Development in critical areas shall not be authorized if significant degradation of critical areas will occur. Significant degradation occurs is:

(A) The activity will jeopardize the continued existence of species listed as endangered or threatened, or will result in likelihood of the destruction or adverse modification of a habitat determined to be a critical habitat under the Endangered Species Act, 16 United States Code Annotated, §§1531-1544;

(B) the activity will cause or contribute, after consideration of dilution and dispersion, to violation of any applicable surface water quality standards established under §501.21 of this title;

(C) the activity violates any applicable toxic effluent standard or prohibition established under §501.21 of this title;

(D) the activity violates any requirement improved to protect a marine sanctuary designated under the Marine Protection, Research, and Sanctuaries Act of 1972, 33 United States Code Annotated, Chapter 27; or

(E) taking into account the nature and degree of all identifiable adverse effects, including their persistence, permanence, areal extent, and the degree to which these effects will have been mitigated pursuant to subsections (c) and (d) of this section, the activity will, individually or collectively, cause or contribute to significant adverse effects on:

(i) human health and welfare, including effects on water supplies, plankton, benthos, fish, shellfish, wildlife, and consumption of fish and wildlife;

(ii) the life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, or spread of pollutants or their byproducts beyond the site, or their introduction into an ecosystem, through biological, physical, or chemical processes;

(iii) ecosystem diversity, productivity, and stability, including loss of fish and wildlife habitat or loss of the capacity of a coastal wetland to assimilate nutrients, purify water, or reduce wave energy; or

(iv) generally accepted recreational, aesthetic or economic values of the critical area which are of exceptional character and importance.

Compliance: The project would not cause significant adverse effects on human health and welfare or any of the natural resources or systems listed above. It would not reduce ecosystem diversity, productivity, or the capacity of the wetland systems to assimilate nutrients, purify water, or reduce wave energy. In fact, the project would improve ecosystem diversity and productivity, while increasing the capacity of the wetland systems to function.

(b) The TCEQ and the RRC shall comply with the policies in this section when issuing certifications and adopting rules under Texas Water Code, Chapter 26, and the Texas Natural Resources Code, Chapter 91, governing certification of compliance with surface water quality standards for federal actions and permits authorizing development affecting critical areas; provided that activities exempted from the requirement for a permit for the discharge of dredge or fill material, described in Code of Federal Regulations, Title 33, §323.4 and/or Code of Federal Regulations, Title 40, §232.3, including…shall not be considered activities for which a certification in required. The GLO and the SLB shall comply with the policies in this section when approving oil, gas, or other mineral lease plans of operation or granting surface leases, easements, and permits and adopting rules under the Texas Natural Resources Code, Chapters 32, 33, and 51-53, and Texas Water Code, Chapter 61, governing development affecting critical areas on state submerged lands and private submerged lands, and when issuing approval and adopting rules under Texas Natural Resources Code, Chapter 221, for mitigation banks operated by subdivisions of the state.

Compliance: A 404(b)(1) analysis has been prepared and will be submitted to TCEQ for approval.

(c) Agencies required to comply with this section will coordinate with one another and with federal agencies when evaluating alternatives, determining appropriate and practicable mitigation, and accessing significant degradation. Those agencies' rules governing authorizations for development in critical areas shall require a demonstration that the requirements of subsection (a)(1)-(7) of this section have been satisfied.

Compliance: Coordination has been conducted with U.S. Fish and Wildlife Service, National Marine Fisheries Service, Texas Parks and Wildlife Department, and GLO. Other agencies, such as the Environmental Protection Agency, TCEQ, and Texas Historical Commission have been notified of the project but have not commented.

(d) For any dredging or construction of structures in, or discharge of dredge or fill material into, critical areas that is subject to the requirements of §501.15 of this title (relating to Policy for Major Actions), data and information on the cumulative and secondary adverse affects of the project need not be produced or evaluated to comply with this section if such data and information is produced and evaluated in compliance with §501.15(b)-(c) of this title.

Compliance: The project complies with §501.15(b) – (c).

§501.24 Policies for Construction of Waterfront Facilities and Other Structures on Submerged Lands

(a) Development on submerged lands shall comply with the policies in this section.

(1) Marinas shall be designed and, to the greatest extent practicable, sited so that tides and currents will aid in flushing of the site or renew its water regularly.

(2) Marinas designed for anchorage of private vessels shall provide facilities for the collection of waste, refuse, trash, and debris.

(3) Marinas with the capacity for long-term anchorage of more than ten vessels shall provide pump-out facilities for marine toilets, or other such measures or facilities that provide an equal or better level of water quality protection.

Compliance: The project does not involve construction of a marina.

(4) Marinas, docks, piers, wharves and other structures shall be designed and, to the greatest extent practicable, sited to avoid and otherwise minimize adverse effects on critical areas from boat traffic to and from those structures.

Compliance: The breakwater structure would not be placed in any critical areas and would not modify the current navigational routes; therefore, the project will not have any direct or indirect effect on critical areas.

(5) Construction of docks, piers, wharves, and other structures shall be preferred instead of authorizing dredging of channels or basins or filling of submerged lands to provide access to coastal waters if such construction is practicable, environmentally preferable, and will not interfere with commercial navigation.

Compliance: The breakwater structure is not intended to provide access to coastal waters and would protect the existing shoreline from commercial navigation along the SNWW. It is possible that stabilization of the shoreline (breakwaters and living shoreline) would reduce the need for dredging through this section of the SNWW by trapping sediments and preventing them from shoaling in the Federal channel.

(6) Piers, docks, wharves, bulkheads, jetties, groins, fishing cabins, and artificial reefs (including artificial reefs for compensatory mitigation) shall be limited to the minimum necessary to serve the project purpose and shall be constructed in a manner that:

(A) does not significantly interfere with public navigation;

Compliance: The alignment of the breakwaters would be sufficiently offset from the SNWW to not interfere with public navigation or create hazardous navigational conditions.

(B) does not significantly interfere with the natural coastal processes which supply sediments to shore areas or otherwise exacerbate erosion of shore areas; and

Compliance: The breakwaters would attenuate wave and tidal energies along the shoreline and minimize the movement of sediments into and out of the area. However, this modification is considered beneficial since the current high rates of erosion would be mitigated and the shoreline stabilized thereby protecting existing shoreline (marsh) resources. Additionally, breakwaters and the living

shoreline have been shown to trap sediments allowing for an accretion of land and area for marsh establishment.

(C) avoids and otherwise minimizes shading of critical areas and other adverse effects

Compliance: The alignment of the breakwater avoids all critical areas and would not induce adverse effects.

(7) Facilities shall be located at sites or designed and constructed to the greatest extent practicable to avoid and otherwise minimize the potential for adverse effects from:

(A) construction and maintenance of other development associated with the facility;

(B) direct release to coastal waters and critical areas of pollutants from oil or hazardous substance spills or stormwater runoff; and

(C) deposition of airborne pollutants in coastal waters and critical areas.

Compliance: The project does not involve construction of any facilities that would induce development or modify existing development operations, nor would the structure produce or emit hazardous substances or emissions.

(8) Where practicable, pipelines, transmission lines, cables, roads, causeways, and bridges shall be located in existing rights-of-way or previously disturbed areas if necessary to avoid or minimize adverse effects and if it does not result in unreasonable risks to human health, safety, and welfare.

Compliance: The project does not involve construction or long-term operation of pipelines, transmission lines, cables, roads, causeways, or bridges.

(9) To the greatest extent practicable, construction of facilities shall occur at sites and times selected to have the least adverse effects on recreational uses of CNRAs and on spawning or nesting seasons or seasonal migrations of terrestrial and aquatic wildlife.

Compliance: Construction of the breakwater would span approximately 16 months which would overlap with spawning and nesting seasons of terrestrial and aquatic wildlife. However, the disturbance area would be limited to the immediate construction site in open water areas and should not affect aquatic migration or spawning outside of the active construction site and would have no effect on nesting or migration patterns of terrestrial species. Openings in the breakwater would be placed in the structure so long-term migration and spawning would be unaffected. The alignment of the breakwater would be in close proximity to the shoreline and is not expected to affect recreation in or near CNRAs outside of the alignment.

(10) Facilities shall be located at sites which avoid the impoundment and draining of coastal wetlands. If impoundment or draining cannot be avoided, adverse effects to the impounded or drained wetlands shall be mitigated in accordance with the sequencing requirements of §501.23 of this title. To the greatest extent practicable, facilities shall be located at sites at which expansion will not result in development in critical areas.

Compliance: Coastal wetlands, as defined in §501.3, are not found in or near the project area. Coastal marshes would not be directly affected by construction and long-term operation of the breakwater; however, over the long-term, the breakwaters would protect and stabilize the shoreline thereby also protecting marsh habitats and potentially increasing their area through accretion of sediments and reduction in saltwater intrusion.

(11) Where practicable, piers, docks, wharves, bulkheads, jetties, groins, fishing cabins, and artificial reefs shall be constructed with materials that will not cause any adverse effects on coastal waters or critical areas.

Compliance: The breakwaters would be constructed of stone free of any chemicals or sealants that could cause adverse effects on coastal waters or critical areas.

(12) Developed sites shall be returned as closely as practicable to pre-project conditions upon completion or cessation of operations by the removal of facilities and restoration of any significantly degraded areas, unless:

(A) the facilities can be used for public purposes or contribute to the maintenance or enhancement of coastal water quality, critical areas, beaches, submerged lands, or shore areas; or

(B) restoration activities would further degrade CNRAs.

Compliance: The breakwater structure would not be removed, and the area would not be returned to pre-project conditions at the end of the project life (estimated 50 years). The breakwaters are expected to have long-term beneficial impacts that if the breakwaters were removed would contribute to degradation of the shoreline and marsh areas. As well removal of the structure would result in the loss of hard substrate habitat that will have provided habitat for colonized by small fish, crustaceans, and mollusks, provide a food source for wildlife such as raccoons, skunks, reptiles, and small mammals, and loafing and roosting habitat for avian species.

(13) Water-dependent uses and facilities shall receive preference over those uses and facilities that are not water-dependent.

Compliance: The breakwater would promote the protect and stabilization of the shoreline and marsh habitats which contributes to recreational opportunities in the project area.

(14) Nonstructural erosion response methods such as beach nourishment, sediment bypassing, nearshore sediment berms, and planting of vegetation shall be preferred instead of structural erosion response methods.

Compliance: A living shoreline (planting of native marsh vegetation) has been incorporated into the plan as a secondary method of shoreline stabilization and toe protection of the existing containment levee. Construction of a living shoreline alone would not be sufficient to reduce the ship-wake induced energies contributing to current shoreline erosion; therefore, over the long-term construction of a structural erosion response feature – a breakwater – is warranted and in the best interest of the coastal resources in the action area.

(15) Major residential and recreational waterfront facilities shall to the greatest extent practicable accommodate public access to coastal waters and preserve the public's ability to enjoy the natural aesthetic values of coastal submerged lands.

(16) Activities on submerged land shall avoid and otherwise minimize any significant interference with the public's use of and access to such lands.

Compliance: Construction of the breakwaters would not interfere with public access to or use of coastal waters and preserves. Opening in the structure would provide access to open water areas of the landward side of the structure.

(17) Erosion of Gulf beaches and coastal shore areas caused by construction or modification of jetties, breakwaters, groins, or shore stabilization projects shall be mitigated to the extent the costs of mitigation are reasonably proportionate to the benefits of mitigation. Factors that shall be considered in determining whether the costs of mitigation are reasonably proportionate to the cost of the construction or modification and benefits include, but are not limited to, environmental benefits, recreational benefits, flood or storm protection benefits, erosion prevention benefits, and economic development benefits.

Compliance: The project would not modify any existing shoreline protection measures and construction of the feature would reduce erosion along the coastal shore area; therefore, no mitigation is needed. It is anticipated that long-term operation of the breakwater would result in shoreline stabilization and increase in marsh habitat between the landward side of the breakwater and the existing containment levee and provide resiliency to interior marshes from sea level rise through protection of the existing containment levee and a reduction in saltwater intrusion.

(b) To the extent applicable to the public beach, the policies in this section are supplemental to any further restrictions or requirements relating to the beach access and use rights of the public.

Compliance: No beaches are present or would be affected by construction of the breakwater.

(c) The GLO and the SLB, in governing development on state submerged lands, shall comply with the policies in this section when approving oil, gas, and other mineral lease plans of operation and granting surface leases, easements, and permits and adopting rules under the Texas Natural Resources Code, Chapters 32, 33 and 51 - 53, and Texas Water Code, Chapter 61.

Compliance: The project does not involve development of oil, gas, or other mineral lease plans of operation or granting of surface leases, easements, or permits or adopting rules.

§501.25 Policies for Dredging and Dredged Material and Placement

(a) Dredging and the disposal and placement of dredge material shall avoid and otherwise minimize adverse effects to coastal waters, submerged land, critical areas, coastal shore areas, and Gulf beaches to the greatest extent practicable. The policies of this section are supplement to any further restrictions or requirements relating to the beach access and use rights of the public. In implementing this section, cumulative and secondary adverse effects of dredging and the disposal and the placement of dredge material and the unique characteristics of affected sites shall be considered.

Compliance: Dredged material would be beneficially used to restore emergent marshes. Placement in each of the restoration units would have some effects on tidally influenced areas and coastal shore areas. Effects include but are not limited to burying benthic organisms, temporary increase in turbidity in the area, and temporary restrictions to specific areas. Restoration activities would result in a net increase in CNRAs and overall quality of existing CNRAs (see Appendix B-6 of the Integrated Feasibility Report and Environmental Assessment).

(1) Dredging and dredged material disposal and placement shall not cause or contribute, after consideration of dilution and dispersion, to violation of any applicable surface water quality standards established under §501.21 of this title.

Compliance: Placement of dredge material would not violate any applicable surface water quality standards.

(2) Except as otherwise provided in paragraph (4) of this subsection, adverse effects on critical areas from dredging and dredged material disposal or placement shall be avoided and otherwise minimized, and appropriate and practicable compensatory mitigation shall be required, in accordance with §501.23 of this title.

Compliance: Project implementation would not result in any long-term, permanent, or irreversible adverse effects on CNRAs and would realize a net increase in some critical areas (e.g. SAV habitat); therefore, no compensatory mitigation is needed. Placement of beneficial use of dredge material into critical areas would restore function to the affected CNRAs and improve the overall system.

(3) Except as provided in paragraph (4) of this subsection, dredging and the disposal and placement of dredged material shall not be authorized if:

(A) there is a practicable alternative that would have fewer adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches, so long as that alternative does not have other significant adverse effects;

(B) all appropriate and practicable steps have not been taken to minimize adverse effects on coastal waters submerged lands, critical areas, coastal shore areas, and Gulf beaches; or

(C) significant degradation of critical areas under §501.23(a)(7)(E) of this title would result.

Compliance: Critical and coastal shore areas would be temporarily affected by the project during construction, but not result in a long-term net loss of any of the resources that make up these areas. The project has net environmental benefits that would result from restoration activities and project actions would result in restored form and function of critical and coastal shore areas. Construction activities have been minimized to the greatest extent practicable, including reducing overall construction footprint to only what is absolutely necessary and seasonal timing restrictions to avoid breeding/spawning and migrating fish and wildlife impacts to the greatest extent practicable.

(4) A dredging or dredged material disposal or placement project that would be prohibited solely by application of paragraph (3) of this subsection may be allowed if it is determined to be of overriding importance to the public and national interest in light of economic impacts on navigation and maintenance of commercially navigable waterways.

Compliance: Placement is not precluded by paragraph (3), as noted above.

(b) Adverse effects from dredging and dredged material disposal and placement shall be minimized as required in subsection (a) of this section. Adverse effects can be minimized by employing the techniques in this subsection where appropriate and practicable.

(5) Adverse effects from dredging and dredge material disposal and placement can be minimized by controlling the location and dimensions of the activity. Some of the ways to accomplish this include:

Compliance: Placement of material into the restoration unit does not induce adverse effects. Temporary impacts associated with placement have been minimized to the greatest extent possible. See compliance discussions found in section (a) above.

(A) locating and confining discharges to minimize smothering of organisms;

(B) locating and designing projects to avoid adverse disruption of water inundation patterns, water circulation, erosion and accretion processes, and other hydrodynamic processes;

(C) using existing or natural channels and basins instead of dredging new channels or basins, and discharging materials in areas that have been previously disturbed or used for disposal or placement of dredged material;

(D) limiting the dimensions of channels, basins, and disposal and placement sites to the minimum reasonably required to serve the project purpose, including allowing for reasonable overdredging of channels and basins, and taking into account the need for capacity to accommodate future expansion without causing additional adverse effects;

(E) discharging materials at sites where the substrate is composed of material similar to that being discharged;

(F) locating and designing discharges to minimize the extent of any plume and otherwise dispersion of material; and

(G) avoiding the impoundment or drainage of critical areas.

Compliance: Open water impacts are minimized by placing dredge material in marshes. All dredged material requirements to implement the project can be provided through existing maintenance dredging cycles, so no modifications to the channel (e.g. widening or deepening, or more frequent dredging) are required to ensure sufficient quantity of sediment to implement. The project's restoration features were designed to improve ecological functions of CNRAs, including proper drainage and suitable substrate material for species composition, and increase resiliency and sustainability to future conditions.

Discharges would be confined with temporary containment/exclusion dikes where applicable to minimize discharge into adjacent areas. The containment dikes would be breached after dewatering and not result in any long-term impoundment or drainage changes to critical areas.

(6) Dredging and disposal and placement of material to be dredged shall comply with applicable standards for sediment toxicity. Adverse effects from constituents contained in materials discharged can be minimized by treatment of or limitations on the material itself. Some ways to accomplish this include;

(A) disposal or placement of dredged material in a manner that maintains physiochemical conditions at discharge sites and limits or reduces the potency and availability of pollutants;

(B) limiting the solid, liquid, and gaseous components of material discharged;

(C) adding treatment substances to the discharged material; and

(D) adding chemical flocculants to enhance the deposition of suspended particulates in confined disposal areas.

Compliance: Sediments dredged from the SNWW have been tested for a variety of chemical parameters of concern. Samples yielded no cause for concern and sediments are safe for beneficial use.

(7) Adverse effects from dredging and dredged material disposal or placement can be minimized through control of the materials discharged. Some ways of accomplishing this include:

(A) use of containment levees and sediment basins designed, constructed, and maintained to resists breaches, erosion, slumping, or leaching;

(B) use of lined containment areas to reduce leaching where leaching of chemical constituents from the material is expected to be a problem;

(C) capping in-place contaminated material or, selectively discharging the most contaminated material first and then capping it with the remaining material;

(D) properly containing discharged material and maintaining discharge sites to prevent point and nonpoint pollution; and

(E) timing the discharge to minimize adverse effects from unusually high water flows, wind, wave, and tidal actions.

Compliance: Small, temporary containment/exclusion dikes may be created during marsh restoration efforts to limit movement of sediments outside the placement site. After all ground disturbing activities are complete and the site has sufficiently dewatered and settled, the dike would be mechanically breached if sufficient natural degradation has not occurred. Marsh nourishment measures may have some temporary and local impacts by increasing turbidity; however, material to be generated from construction activities has been tested and found not to contain harmful concentrations of pollutants. Discharges would not occur during conditions involving high water flows, waves, or tidal actions.

(8) Adverse effects from dredging and dredged material disposal or placement can be minimized by controlling the manner in which material is dispersed. Some ways of accomplishing this include:

(A) where environmentally desirable, distributing the material in a thin layer;

(B) orienting material to minimize undesirable obstruction of the water current or circulation patterns;

(C) using silt screens or other appropriate methods to confine suspended particulates or turbidity to a small area where settling or removal can occur;

(D) using currents and circulation patterns to mix, disperse, dilute, or otherwise control the discharge;

(E) minimizing turbidity by using a diffuser system or releasing material near the bottom;

(F) selecting sites or managing discharges to confine and minimize the release of suspended particulates and turbidity and maintain light penetration for organisms; and

(G) setting limits on the amount of material to be discharged per unit of time or volume of receiving waters.

Compliance: All of the sites minimize or avoid adverse dispersal effects to the greatest extent practicable during construction. Material to be used for restoration would be hydraulically discharged at specific discharge points in low elevation and open water areas. As needed, material would be mechanically moved into place with heavy equipment, which should reduce dispersal of material into undesirable areas. Additionally, temporary containment/exclusion dikes would be constructed around marsh restoration units to limit movement of sediments outside of the intended placement area. After all ground disturbing activities are complete and the site has sufficiently dewatered and settled, the dike would be mechanically breached if sufficient natural degradation has not occurred. There are no sediments of concern.

(9) Adverse effects from dredging and dredged material disposal or placement operations can be minimized by adapting technology to the needs of each site. Some ways of accomplishing this include:

(A) using appropriate equipment, machinery, and operating techniques for access to sites and transport of material, including those designed to reduce damage to critical areas;

(B) having personnel on site adequately trained in the avoidance and minimization techniques and requirements; and

(C) designing temporary and permanent access roads and channel spanning structures using culverts, open channels, and diversions that will pass both low and high water flows, accommodate fluctuating water levels, and maintain circulation and faunal movement.

Compliance: Dredged material placement into the restoration areas would minimize impacts to the greatest extent practicable including, but not limited to siting pumps and pipes outside of environmentally sensitive and critical areas where possible; utilizing existing access roads and channels to move material, equipment and personnel; and employing Best Management Practices (BMPs) to avoid adverse impacts. During PED, ways to further reduce environmental impacts to all areas and resources will be considered and employed to the greatest extent practicable.

(10) Adverse effects on plant and animal populations from dredging and dredged material disposal or placement can be minimized by:

(A) avoiding changes in water current and circulation patterns that would interfere with the movement of animals;

(B) selecting sites or managing discharges to prevent or avoid creating habitat conducive to the development of undesirable predators or species that have a competitive edge ecologically over indigenous plants or animals;

(C) avoiding sites having unique habitat or other value, including habitat of endangered species;

(D) using planning and construction practices to institute habitat development and restoration to produce a new or modified environmental state of higher ecological value by displacement of some or all of the existing environmental characteristics;

(E) using techniques that have been demonstrated to be effective in the circumstances similar to those under consideration whenever possible and, when proposed development and restoration techniques have not yet advanced to the pilot demonstration stage, initiating their use on a small scale to allow corrective action if unanticipated adverse effects occur;

(F) timing dredging and dredged material disposal or placement activities to avoid spawning or migration seasons and other biologically critical time periods; and

(G) avoiding the destruction of remnant natural sites within areas already affected by development.

Compliance: The project would be designed and implemented in such a way to avoid adverse impacts to plant and animal populations and their habitat to the greatest extent practicable including, but not limited to seasonal timing restrictions, using existing access roads and channels, employing construction BMPs, siting pumps and pipes in areas that would have the least disturbance on the overall system, and utilizing the smallest construction footprint possible. The project is intended to restore the natural form and function of the coastal system; therefore, all long-term impacts are expected to be beneficial to the overall ecosystem by increasing suitable habitat and increasing resiliency and sustainability.

(11) Adverse effects on human use potential from dredging and dredged material disposal or placement can be minimized by:

(A) selecting sites and following procedures to prevent or minimize any potential damage to the aesthetically pleasing features of the site, particularly with respect to water quality;

(B) selecting sites which are not valuable as natural aquatic areas;

(C) timing dredging and dredged material disposal or placement activities to avoid the seasons or periods when human recreational activity associated with the site is most important; and

(D) selecting sites that will not increase incompatible human activity or require frequent dredge or fill maintenance activity in remote fish and wildlife areas.

Compliance: Placement of dredged material into restoration sites may adversely impact the human environment in and around the placement sites by visually disturbing the scenic view with construction equipment and activity, increasing noise, and reducing the amount of recreational opportunities. All of these impacts would be temporary, only lasting as long as it takes for the material to be appropriately placed and for the restoration area to stabilize. Timing of construction is entirely dependent on dredging cycles; however, during PED it would be advised to avoid the peak recreational seasons (fall/winter) if possible. After construction is complete and vegetation has grown within the restoration sites, recreation and scenic value is expected to increase through increased recreational areas and opportunities (i.e. more wetlands=more hunting).

(12) Adverse effects from new channels and basins can be minimized by locating them at sites:

(A) that ensure adequate flushing and avoid stagnant pockets; or

(B) that will create the fewest practicable adverse effects on CNRAs from additional infrastructure such as roads, bridges, causeways, piers, docks, wharves, transmission line crossing, and ancillary channels reasonably likely to be constructed as a result of the project; or

(C) with the least practicable risk that increased vessel traffic could result in navigation hazards, spills or other forms of contamination which could adversely affect CNRAs;

(D) provided that, for any dredging of new channels or basins subject to the requirements of §501.15 of this title (relating to Policy for Major Actions), data and information on minimization of secondary adverse effects need not be produced or evaluated to comply with this paragraph if such data and information is produced and evaluated in compliance with §501.15(b)(1) of this title.

Compliance: The project does not include constructing new channels or basins, therefore §501.25(8)(A)-D) does not apply.

(c) Disposal or placement of dredged material in existing contained dredge disposal sites identified and actively used as described in an environmental assessment or environmental impact statement issued prior to the effective date of this chapter shall be presumed to comply with the requirements of subsection (a) of this section unless modified in design, sign, use, or function.

(d) Dredged material from dredging projects in commercially navigable waters is a potentially reusable resource and must be used beneficially in accordance with this policy.

(1) If the costs of beneficial use of dredged material area reasonably comparable to the costs of disposal in a non-beneficial manner, the material shall be used beneficially.

(2) If the costs of the beneficial use of dredged material are significantly greater than the costs of disposal in a non-beneficial manner, the material shall be used beneficially unless it is demonstrated that the costs of using the material beneficially are not reasonably proportionate to the costs of the project and benefits that will result. Factors that shall be considered in determining whether the costs of the beneficial use are not reasonably proportionate to the benefits include but are not limited to:

(A) environmental benefits, recreational benefits, floor or storm protection benefits, erosion prevention benefits, and economic development benefits;

(B) the proximity of the beneficial use site to the dredge site; and

(C) the quantity and quality of the dredged material and its suitability for beneficial use.

(3) Examples of the beneficial use of dredged material include, but are not limited to:

(A) projects designed to reduce or minimize erosion or provide shoreline protection;

(B) projects designed to create or enhance public beaches or recreational areas;

(C) projects designed to benefit the sediment budget or littoral system;

(D) projects designed to improve or maintain terrestrial or aquatic wildlife habitat;

(E) projects designed to create new terrestrial or aquatic wildlife habitat, including the construction of marshlands, coastal wetlands, or other critical areas;

(F) projects designed and demonstrated to benefit benthic communities or aquatic vegetation;

(G) projects designed to create wildlife management areas, parks, airports, or other public facilities;

(H) projects designed to cap landfills or other water disposal areas;

(I) projects designed to fill private property or upgrade agricultural land, if cost-effective public beneficial uses are not available; and

(J) projects designed to remediate past adverse impacts on the coastal zone.

(e) If dredged material cannot be used beneficially as provided in subsection (d)(2) of this section, to avoid and otherwise minimize adverse effects as required in subsection (a) of this section, preference will be given to the greatest extent practicable to disposal in…

Compliance: Dredged material would be beneficially used to restore marsh habitat throughout the project area; therefore, the project is consistent with §501.25(d)(1) –(3) and §501.25(c) and §501.25(e)(1) –(3) do not apply to this project.

(f) For new sites, dredged materials shall not be disposed of or placed directly on the boundaries of submerged lands or at such location so as to slump or migrate across the boundaries of submerged lands in the absence of an agreement between the affected public owner and the adjoining private owner or owners that defined the location of the boundary or boundaries affected by the deposition of the dredged material.

Compliance: Placement of dredged materials would not be placed directly on submerged lands. If during PED, it is identified that placement would occur on submerged lands, appropriate real estate agreements would be drafted and in place prior to construction to ensure all landowners are appropriately notified and compensated for any loss or impacts.

(g) Emergency dredging shall be allowed without a prior consistency determination as required in the applicable consistency rule when…

Compliance: An emergency situation does not exist with implementation of the project. Consistency of the project with program policy would be determined prior to project authorization.

(h) Mining of sand, shell, marl, gravel, and mudshell on submerged lands shall be prohibited unless there is an affirmative showing of no significant impact on erosion within the coastal zone and no significant adverse effect of coastal water quality or terrestrial and aquatic wildlife habitat within a CNRA.

Compliance: Project activities do not involve mining for shell, marl, gravel or mudshell; however, sand would be dredged from submerged lands of the SNWW for use in restoration units. Dredging sand from this location has already been addressed in other documents.

(i) The GLO and the SLB shall comply with the policies in this section when approving oil, gas, and other mineral lease plans of operation and granting surface leases, easements, and permits and adopting rules under the Texas Natural Resources Code, Chapter 32, 33, and 51 – 53, and Texas Water Code, Chapter 61, for dredging and dredge material disposal and placement TxDOT shall comply with the policies in this subchapter when adopting rules and taking actions as local sponsor of the Gulf Intracoastal Waterway under Texas Transportation Code, Chapter 51. The TCEQ and the RRC shall comply with the policies in this section when issuing certifications and adopting rules under Texas Water Code, Chapter 26, and the Texas Natural Resources Code, Chapter 91, governing certification of compliance with surface water quality standards for federal actions and permits authorizing dredging or the discharge or placement of dredged material. The TPWD shall comply with the policies in this section when adopting rules at Chapter 57 of this title (relating to Fisheries) governing dredging and dredged material disposal and placement. TPWD shall comply with the policies in subsection (h) of this section when adopting

rules and issuing permits under Texas Parks and Wildlife Code, Chapter 86, governing the mining of sand, shell, marl, gravel, and mudshell.

Compliance: This project does not involve oil, gas, and other mineral lease plans of operation or granting of surface leases, easements, or permits; therefore, §501.25(i) does not apply.

§501.32 Policies for Emission of Air Pollutants

TCEQ rules under Texas Health and Safety Code, Chapter 382, governing emissions of air pollutants, shall comply with regulations at Code of Federal Regulations, Title 40, adopted pursuant to the Clean Air Act, 42 United States Code Annotated, §§7401, et seq, to protect and enhance air quality in the coastal area so as to protect CNRAs and promote the public health, safety, and welfare.

Compliance: The project is fully compliant with the Clean Air Act as documented in the DIFR-EA.

CONCLUSION

The project complies with the Texas Coastal Management Program and will be conducted in a manner consistent with all rules and regulations of the program.

US Army Corps of Engineers ®
Galveston District

Appendix B-5

National Historic Preservation Act Compliance

for

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

November 2021

Programmatic Agreement

Programmatic Agreement will be placed here when available.

Tribal and State Coordination for Cultural Resources

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Mr. Wolfe:

The U.S. Army Corps of Engineers (USACE), in partnership with the Orange County Navigation and Port District (non-federal sponsor for the project), is preparing a draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) for the Hickory Cove Marsh Restoration and Living Shoreline Project in Orange County, Texas, UTM 15N 421893E 3318528N. The study was authorized by Section 1122 of the Water Resources Development Act of 2016 which requires the USACE to establish a pilot program to carry out projects for the beneficial use of dredged material. The Hickory Cove Marsh Restoration and Living Shoreline Project was selected by the Office of the Assistant Secretary of the Army for Civil Works to be one of the pilot projects. This project includes the beneficial use of dredged maintenance material from the Sabine-Neches Waterway to restore approximately 650 acres of marsh within an existing 1200-acre impoundment and native plantings along 95 acres of adjacent coastline to create a living shoreline feature. The project also includes repairs to the existing containment levee and the installation of a rock breakwater adjacent to the shoreline to combat wave erosion (see enclosed maps). The marsh restoration is expected to require several dredge cycles to complete. The first dredge cycle is anticipated to begin in 2023 and will discharge 1.3 million cubic yards of maintenance dredged material to restore approximately 190 acres of marsh habitat.

Currently, the shoreline in the project area has eroded due to wave action and navigation traffic. Much of the shoreline has experienced significant loss, to the point that the containment levee surrounding the marsh has been breached. This has allowed estuary water to enter the marshes, where sediments are continually eroding and has converted approximately 80 percent of the project area to open water.

The study area was examined for any known historic properties using the Texas Historical Commission's (Atlas) database. This review found nine previous terrestrial cultural resource surveys and five maritime cultural resources surveys within the focused study area. The area for the proposed living shoreline has been surveyed in its

entirety; however, the areas proposed for the breakwater and the interior portions of the existing impoundment have not been previously surveyed.

Twenty-two previously recorded sites have been identified in the focused study area. Sixteen of those sites are within the living shoreline area that will be directly impacted by the project. Sites within the living shoreline area include: 41OR17, 41RO18, 41OR19, 41OR20, 41OR21, 41OR29, 41OR30, 41OR31, 41OR32, 41OR33, 41OR43, 41OR44, 41OR45, 41OR46, 41OR47, and 41OR48. Sites within the focused study area that will not be directly impacted include: 41OR41, 41OR75, 41OR79, 41JF18, 41JF19, and 41JF20. All locations within the focused study area are shell middens that have not been evaluated for the National Register of Historic Places (NRHP). Twenty sites were recorded in 1940 as many were being mined for the shell. Site 41OR33 was recorded in 1956 as it was actively being destroyed for shell mining. Site 41OR79 was recorded in 1973, and it was noted that a large portion of the site had been removed during dredging activities.

Five additional sites, including 41OR36, an unevaluated shell midden; 41OR73 an ineligible surface shell scatter; 41OR74, an unevaluated destroyed shell midden; 41OR77, an unevaluated shell midden; and 41JF17, an unevaluated shell midden, are located within 1-kilometer of the focused study area. No historic properties or districts listed on the NRHP or cemeteries are present within the focused study area or within 1-kilometer of the concentrated study area. Two Texas historical markers for the Rainbow Bridge (11509 and 10555, respectively) are located within 1-kilometer of the focused study area. The levee surrounding the marsh is less than 50 years old and is not eligible for consideration for the NRHP.

In 1973, the Texas Archaeological Survey conducted a cultural resources survey investigation which included the current project area and was conducted prior to the planned USACE placement of dredged material from the Sabine Neches Waterway. Access to the current project area for the survey was limited due to safety hazards from the high-water table, shallow standing water, and thick vegetation. The survey was limited to shorelines accessible by boat and aerial investigation by helicopter (see attached report). During the 1973 survey, none of the sites recorded between 1940 and 1956 could be accurately relocated and were instead lumped together into three locales. The three locales were described as either destroyed or extremely degraded. Destruction of the sites was mainly attributed to shell mining and continued erosion. Since the 1973 survey, dredged material was placed over the majority of the current project area, including where the remnants of all 16 shoreline sites were located.

Continuing shoreline erosion, subsidence, relative sea level change, and previous disturbances have caused the project area to degrade to the current state which is

approximately 80 percent open water. Given the current state of the project area and the determinations listed in the 1973 cultural resources survey for all of the previously recorded sites, the USACE has determined that No Historic Properties will be effected by the proposed undertaking. We request your concurrence with our determination that no historic properties are present and that the proposed action complies with Section 106 of the National Historic Preservation Act of 1966. A copy of the DIFR-EA for the Hickory Cove Marsh Restoration and Living Shoreline project will be provided to your office for review.

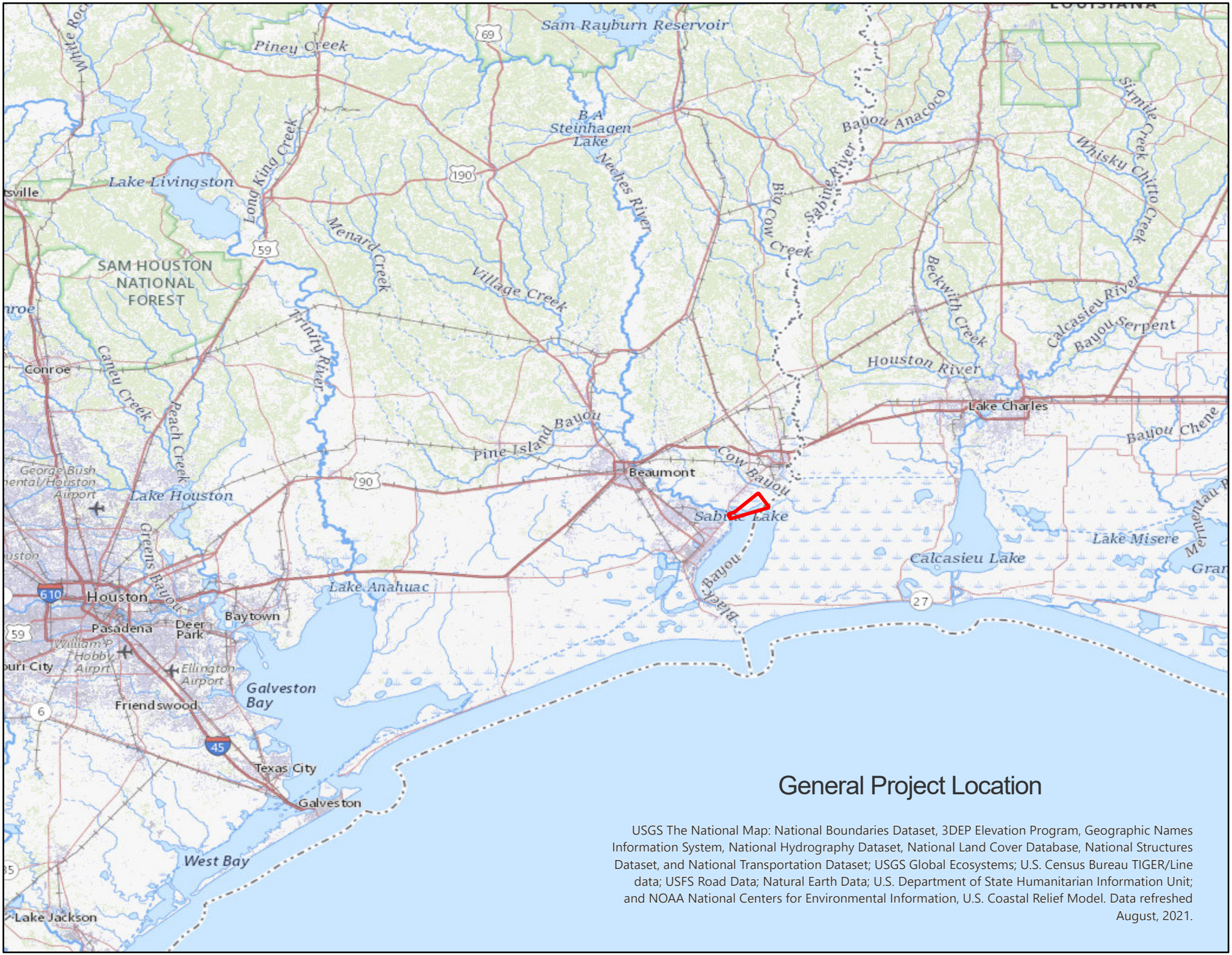
Thank you for your cooperation in this review process. If you have any questions concerning this project or need further assistance, please contact Jackie Rodgers, Archaeologist, Regional Environmental Planning Center at (918) 669-4964 or via email at Jacqueline.Rodgers@usace.army.mil. Your comments would be appreciated within 30 days of receipt of this letter.

Sincerely,

Amanda McGuire

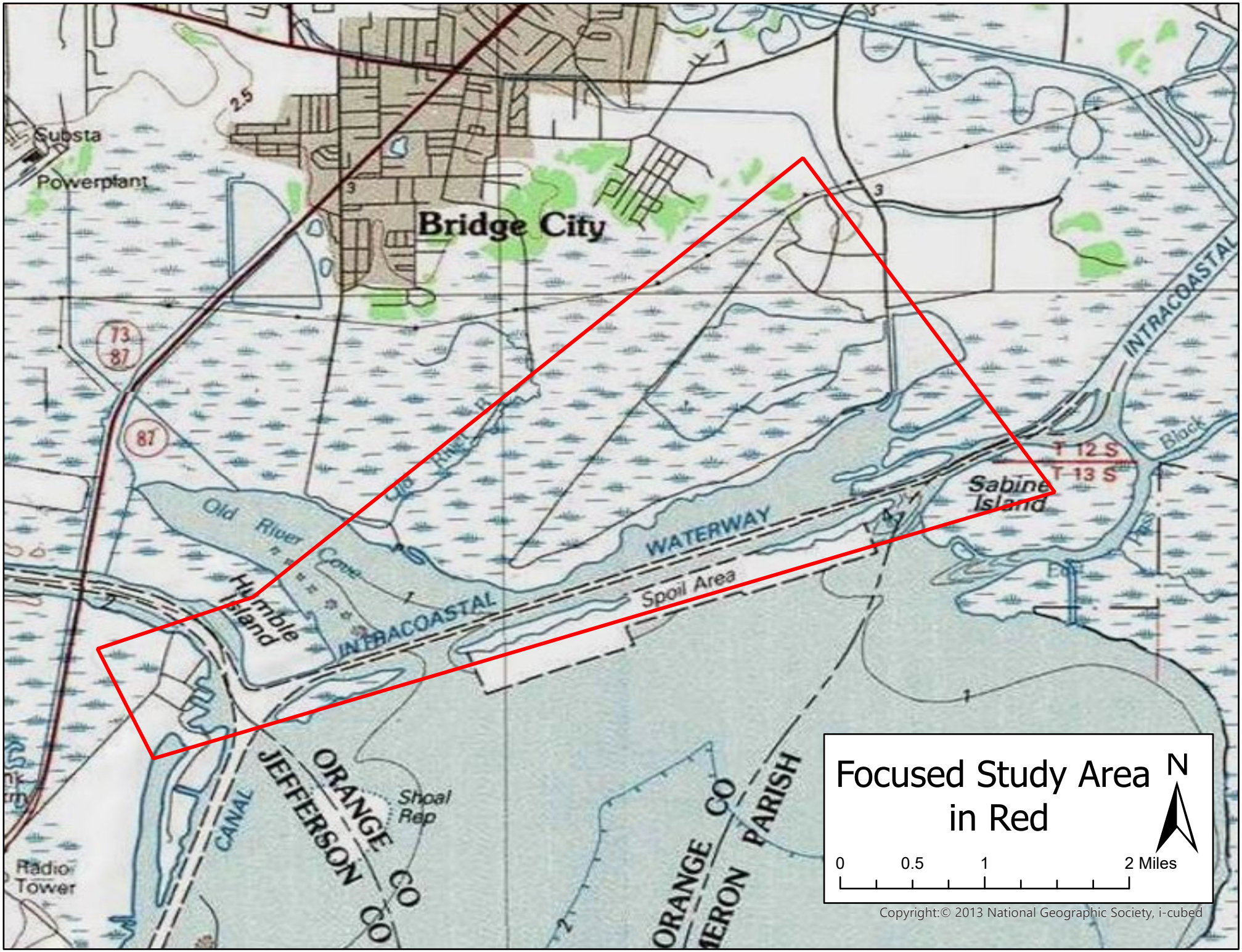
Amanda M. McGuire
Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosures



General Project Location

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021.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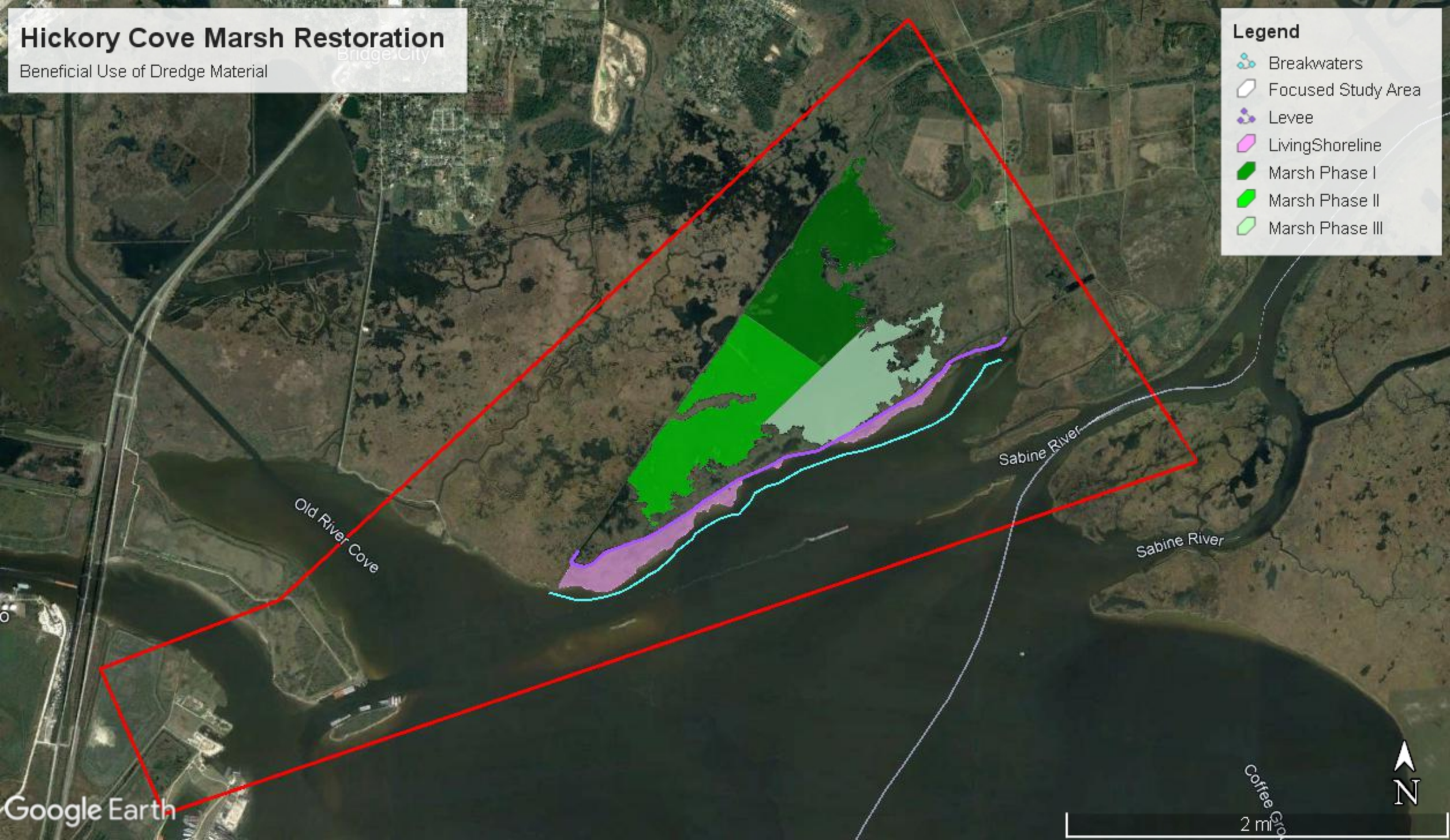
Hickory Cove Marsh Restoration
Beneficial Use of Dredge Material
Legend
Breakwaters
Focused Study Area
Levee
LivingShoreline
Marsh Phase I
Marsh Phase II
Marsh Phase III
Old River Cove
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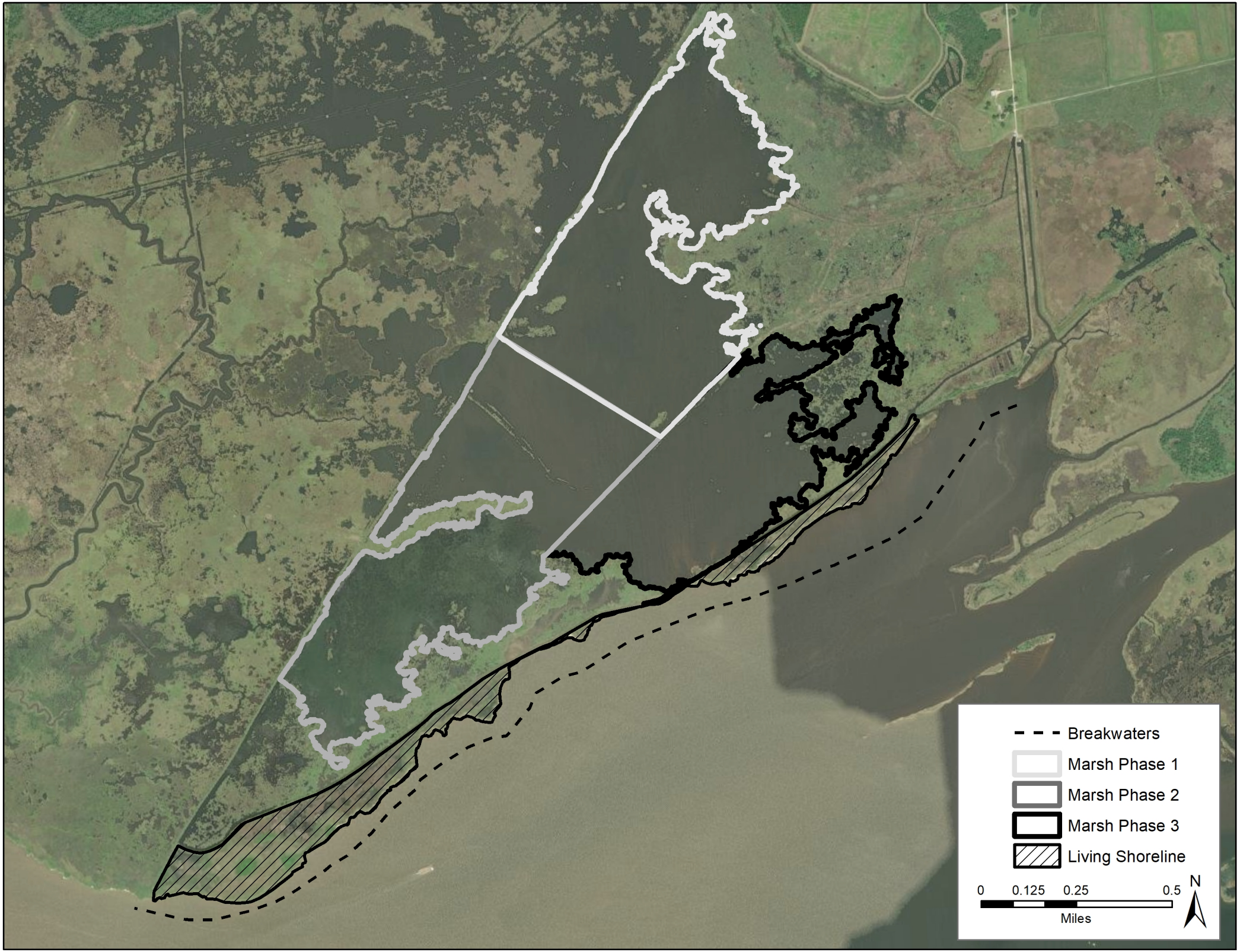
Breakwaters
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Marsh Phase 2
Marsh Phase 3
Living Shoreline
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Miles
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From: noreply@thc.state.tx.us
To: Rodgers, Jacqueline; reviews@thc.state.tx.us; Androy, Jerry L CIV USARMY CESWG (USA)
Subject: [Non-DoD Source] Section 106 Submission
Date: Monday, October 25, 2021 11:55:58 AM

Re: Project Review under Section 106 of the National Historic Preservation Act and/or the Antiquities Code of Texas
THC Tracking #202200866
Date: 10/25/2021
Hickory Cove Marsh Restoration
UTM 15N 421893E 3318528N
Bridge City,TX 77611

Description: Dredge from the Sabine-Neches Waterway will restore 650 acres of marsh and native plantings to restore 95 acres of shoreline. Existing levee repair and installation of a rock breakwater for erosion

Dear Jackie Rodgers:
Thank you for your submittal regarding the above-referenced project. This response represents the comments of the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission (THC), pursuant to review under Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas.

The review staff, led by Marie Archambeault, Amy Borgens, Caitlin Brashear, has completed its review and has made the following determinations based on the information submitted for review:

Archeology Comments

- An archeological survey is required. You may obtain lists of archeologists in Texas through the Council of Texas Archeologists and the Register of Professional Archaeologists. Please note that other qualified archeologists not included on these lists may be used. If this work will occur on land owned or controlled by a state agency or political subdivision of the state, a Texas Antiquities Permit must be obtained from this office prior to initiation of fieldwork. All fieldwork should meet the Archeological Survey Standards for Texas. A report of investigations is required and should be produced in conformance with the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation and submitted to this office for review. Reports for a Texas Antiquities Permit should also meet the Council of Texas Archeologists Guidelines for Cultural Resources Management Reports and the Texas Administrative Code. In addition, any buildings 45 years old or older that are located on or adjacent to the tract should be documented with photographs and included in the report. To facilitate review and make project information available through the Texas Archeological Sites Atlas, we appreciate emailing survey area shapefiles to

archeological_projects@thc.texas.gov concurrently with submission of the draft report. Please note that this is required for projects conducted under a Texas Antiquities Permit.
• THC/SHPO unable to complete review for the underwater project area at this time based on insufficient documentation. A supplemental review must be submitted, and the 30-day review period will begin upon receipt of adequate documentation.

We have the following comments: Additional information and images are needed regarding construction of the breakwater. Please describe the construction process and access to the project area. Will temporary barge channels be created? Include figures that show the specific location of the breakwater and discuss its materials, size, and attributes. Will there be an associated staging area for construction activities? Additionally, an archeological survey from 1970s does not follow modern survey standards and the project area should be re-surveyed using modern survey methods. Further, our records indicate that the previously recorded sites in the project area have an undetermined NRHP status.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this review process, and for your efforts to preserve the irreplaceable heritage of Texas. If the project changes, or if new historic properties are found, please contact the review staff. If you have any questions concerning our review or if we can be of further assistance, please email the following reviewers: marie.archambeault@thc.texas.gov, amy.borgens@thc.texas.gov, caitlin.brashear@thc.texas.gov.

This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system.

Sincerely,

for Mark Wolfe, State Historic Preservation Officer
Executive Director, Texas Historical Commission

Please do not respond to this email.

cc: Jerry.L.Androy@usace.army.mil

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Ms. Terri Parton
President
Wichita and Affiliated Tribes
Post Office Box 729
Anadarko, OK 73005

Dear Ms. Parton:

The U.S. Army Corps of Engineers (USACE), in partnership with the Orange County Navigation and Port District (non-federal sponsor for the project), is preparing a draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) for the Hickory Cove Marsh Restoration and Living Shoreline Project in Orange County, Texas, UTM 15N 421893E 3318528N. The study was authorized by Section 1122 of the Water Resources Development Act of 2016 which requires the USACE to establish a pilot program to carry out projects for the beneficial use of dredged material. The Hickory Cove Marsh Restoration and Living Shoreline Project was selected by the Office of the Assistant Secretary of the Army for Civil Works to be one of the pilot projects. This project includes the beneficial use of dredged maintenance material from the Sabine-Neches Waterway to restore approximately 650 acres of marsh within an existing 1200-acre impoundment and native plantings along 95 acres of adjacent coastline to create a living shoreline feature. The project also includes repairs to the existing containment levee and the installation of a rock breakwater adjacent to the shoreline to combat wave erosion (see enclosed maps). The marsh restoration is expected to require several dredge cycles to complete. The first dredge cycle is anticipated to begin in 2023 and will discharge 1.3 million cubic yards of maintenance dredged material to restore approximately 190 acres of marsh habitat.

Currently, the shoreline in the project area has eroded due to wave action and navigation traffic. Much of the shoreline has experienced significant loss, to the point that the containment levee surrounding the marsh has been breached. This has allowed estuary water to enter the marshes, where sediments are continually eroding and has converted approximately 80 percent of the project area to open water.

The study area was examined for any known historic properties using the Texas Historical Commission's (Atlas) database. This review found nine previous terrestrial cultural resource surveys and five maritime cultural resources surveys within the focused study area. The area for the proposed living shoreline has been surveyed in its

entirety; however, the areas proposed for the breakwater and the interior portions of the existing impoundment have not been previously surveyed.

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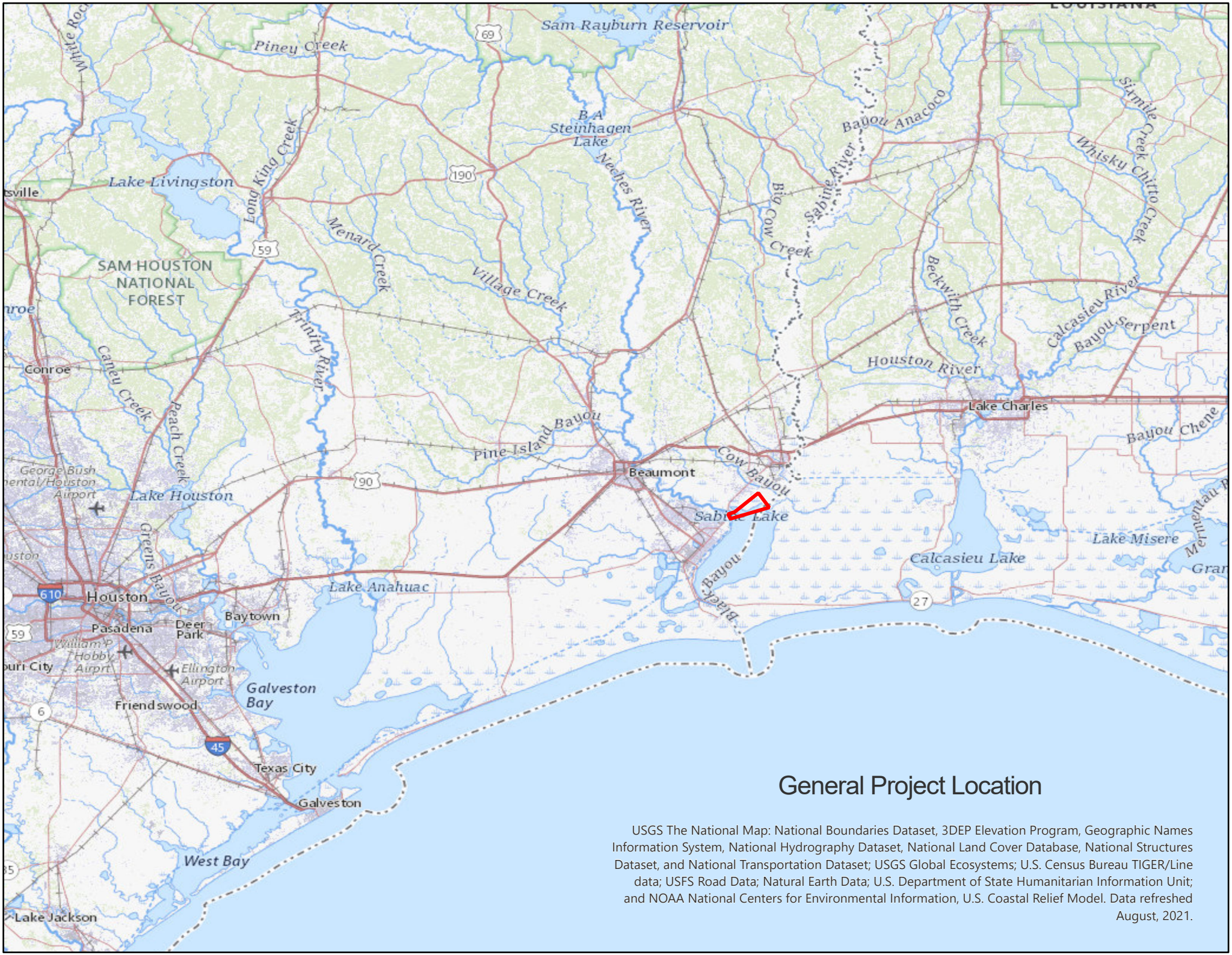
Sincerely,

Amanda McGuire

Amanda M. McGuire
Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosures



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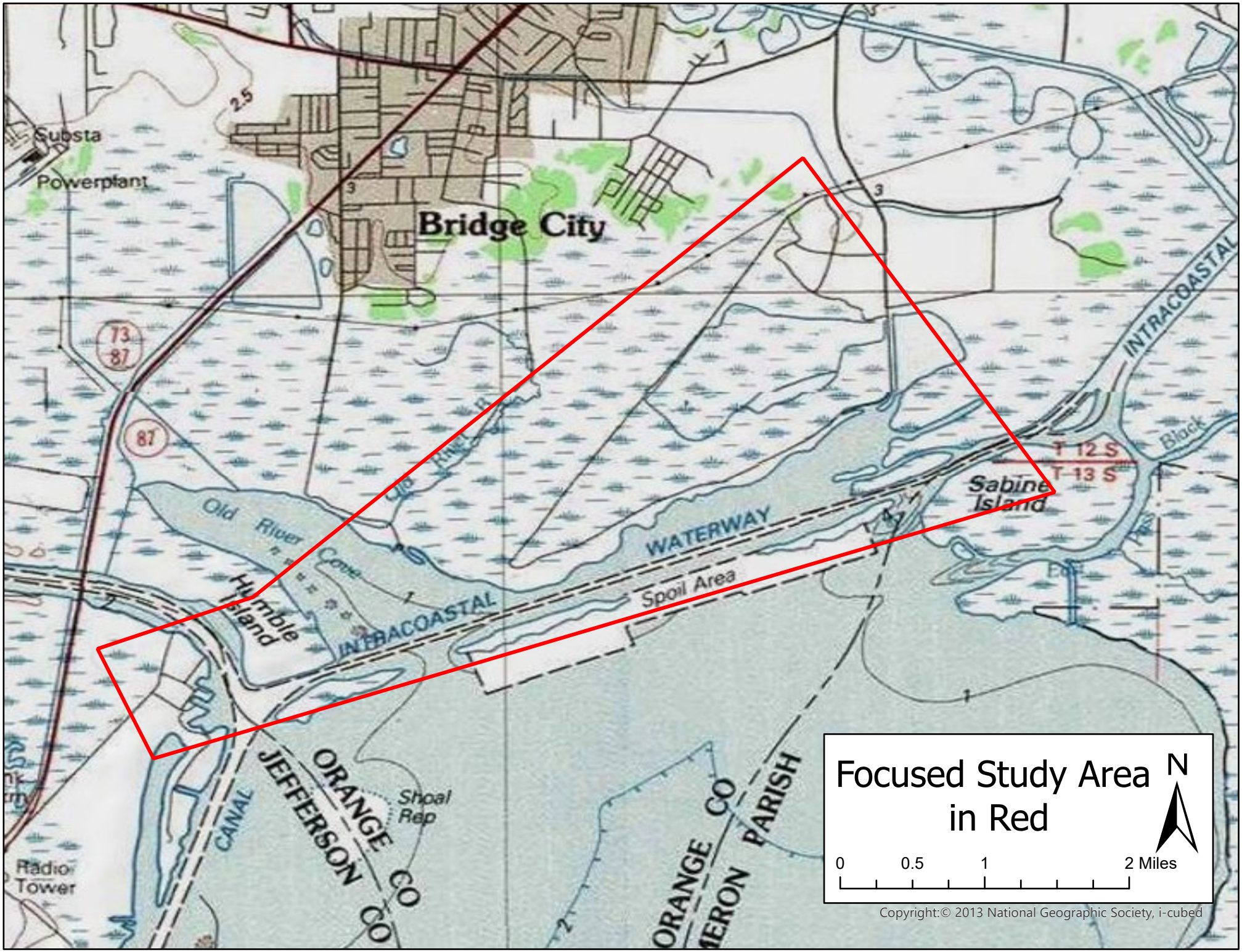
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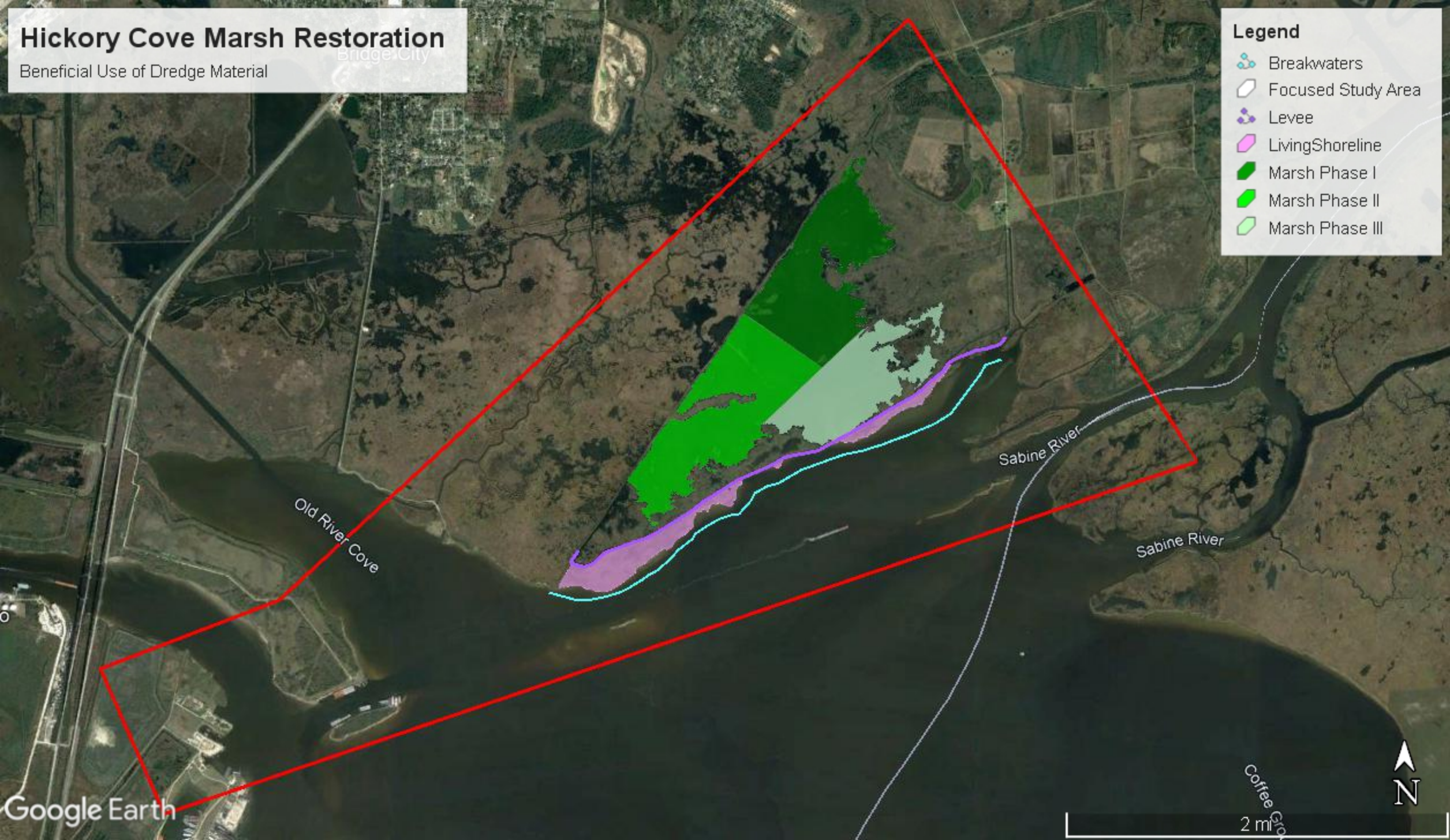
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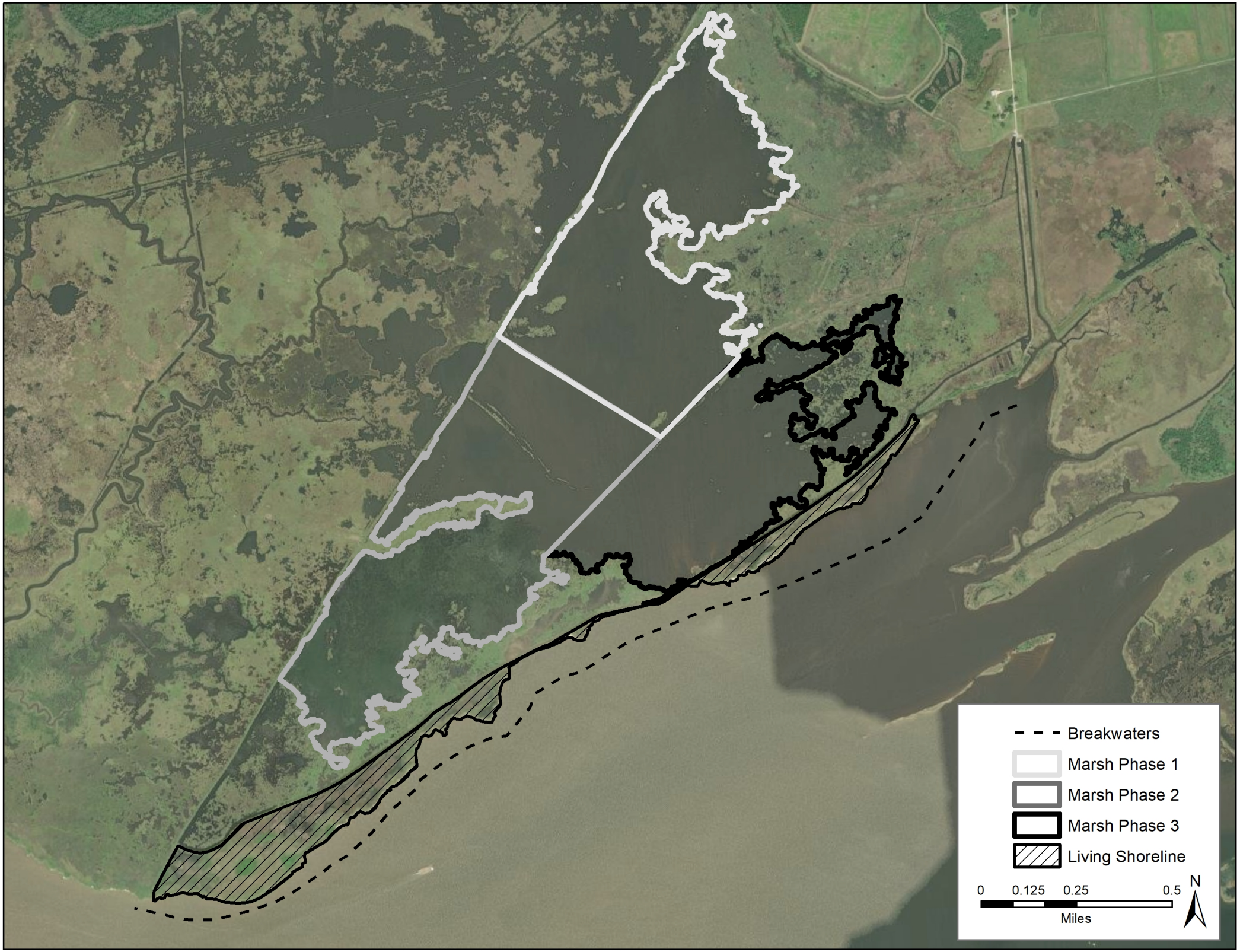
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From: Gary McAdams
To: Rodgers, Jacqueline
Subject: [Non-DoD Source] RE: Hickory Cove Marsh Restoration Project
Date: Tuesday, September 28, 2021 8:30:02 AM
Attachments: Counties Important to the Wichita final.docx

Good Morning Jackie,

Thank you for your offer of consultation. Orange County, TX is outside the Tribe's area of interest. Therefore, we do not wish to be a consulting party on the referenced project. I'm attaching a list of counties from several states within our area of interest for your future reference.

Gary McAdams
Cultural Program Planner/THPO
Wichita and Affiliated Tribes

From: Rodgers, Jacqueline <Jacqueline.Rodgers@usace.army.mil>
Sent: Monday, September 27, 2021 5:05 PM
To: Gary McAdams <gary.mcadams@wichitatribe.com>
Subject: Hickory Cove Marsh Restoration Project

Good afternoon,

Please find attached a Section 106 submission for consultation for the Hickory Cove marsh restoration project in Orange County, Texas. If you have any concerns or questions on the project, please reach out to me at the contact information listed below.

Thank you,

Jackie Rodgers
Archaeologist
Regional Planning & Environmental Center (RPEC)
Environmental Branch Compliance Section CESWF-PEE-C
Office: 918-669-4964
jacqueline.rodgers@usace.army.mil

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Ms. Nita Battise
Council Chairwoman
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, TX 77351

Dear Ms. Battise:

The U.S. Army Corps of Engineers (USACE), in partnership with the Orange County Navigation and Port District (non-federal sponsor for the project), is preparing a draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) for the Hickory Cove Marsh Restoration and Living Shoreline Project in Orange County, Texas, UTM 15N 421893E 3318528N. The study was authorized by Section 1122 of the Water Resources Development Act of 2016 which requires the USACE to establish a pilot program to carry out projects for the beneficial use of dredged material. The Hickory Cove Marsh Restoration and Living Shoreline Project was selected by the Office of the Assistant Secretary of the Army for Civil Works to be one of the pilot projects. This project includes the beneficial use of dredged maintenance material from the Sabine-Neches Waterway to restore approximately 650 acres of marsh within an existing 1200-acre impoundment and native plantings along 95 acres of adjacent coastline to create a living shoreline feature. The project also includes repairs to the existing containment levee and the installation of a rock breakwater adjacent to the shoreline to combat wave erosion (see enclosed maps). The marsh restoration is expected to require several dredge cycles to complete. The first dredge cycle is anticipated to begin in 2023 and will discharge 1.3 million cubic yards of maintenance dredged material to restore approximately 190 acres of marsh habitat.

Currently, the shoreline in the project area has eroded due to wave action and navigation traffic. Much of the shoreline has experienced significant loss, to the point that the containment levee surrounding the marsh has been breached. This has allowed estuary water to enter the marshes, where sediments are continually eroding and has converted approximately 80 percent of the project area to open water.

The study area was examined for any known historic properties using the Texas Historical Commission's (Atlas) database. This review found nine previous terrestrial cultural resource surveys and five maritime cultural resources surveys within the focused study area. The area for the proposed living shoreline has been surveyed in its

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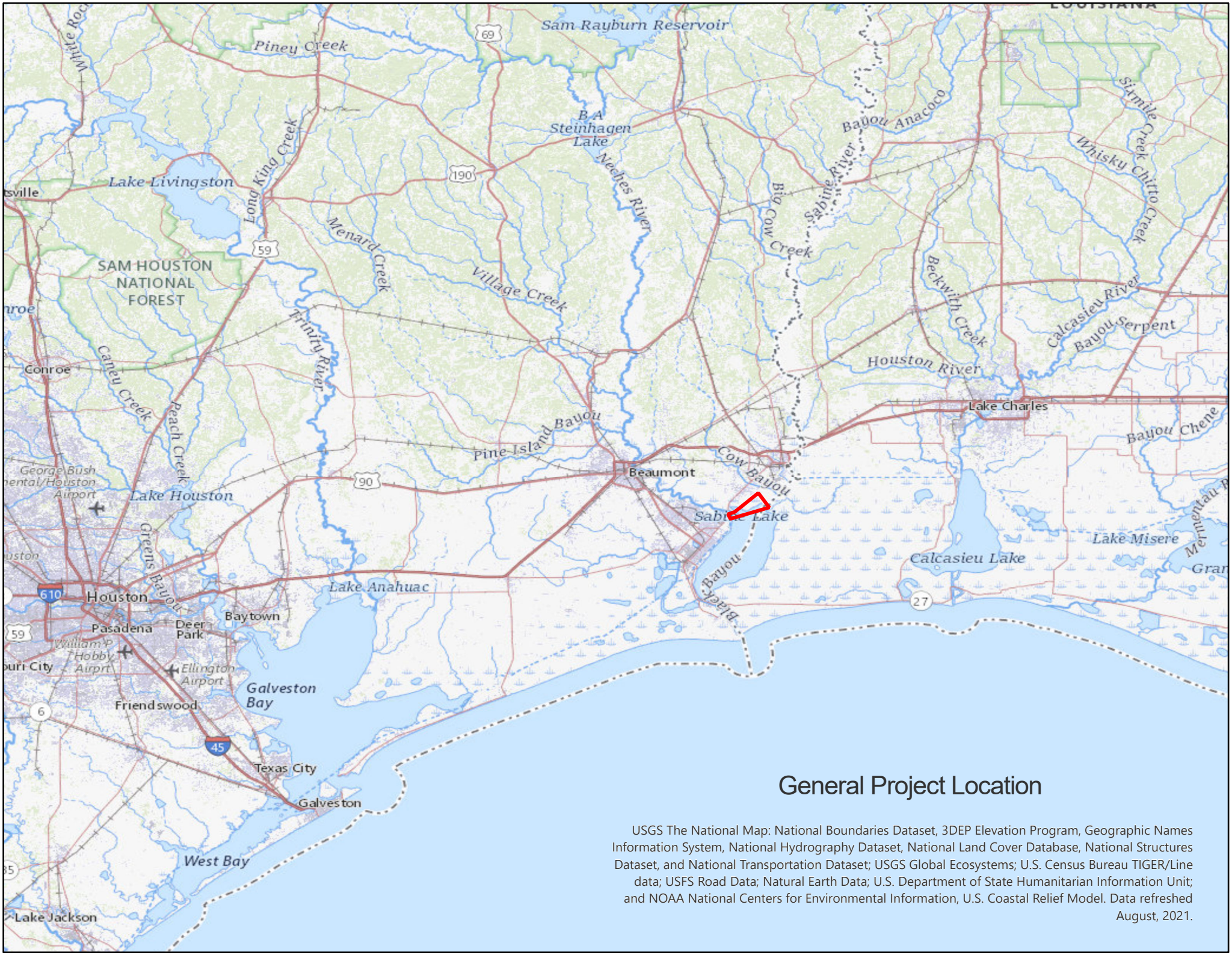

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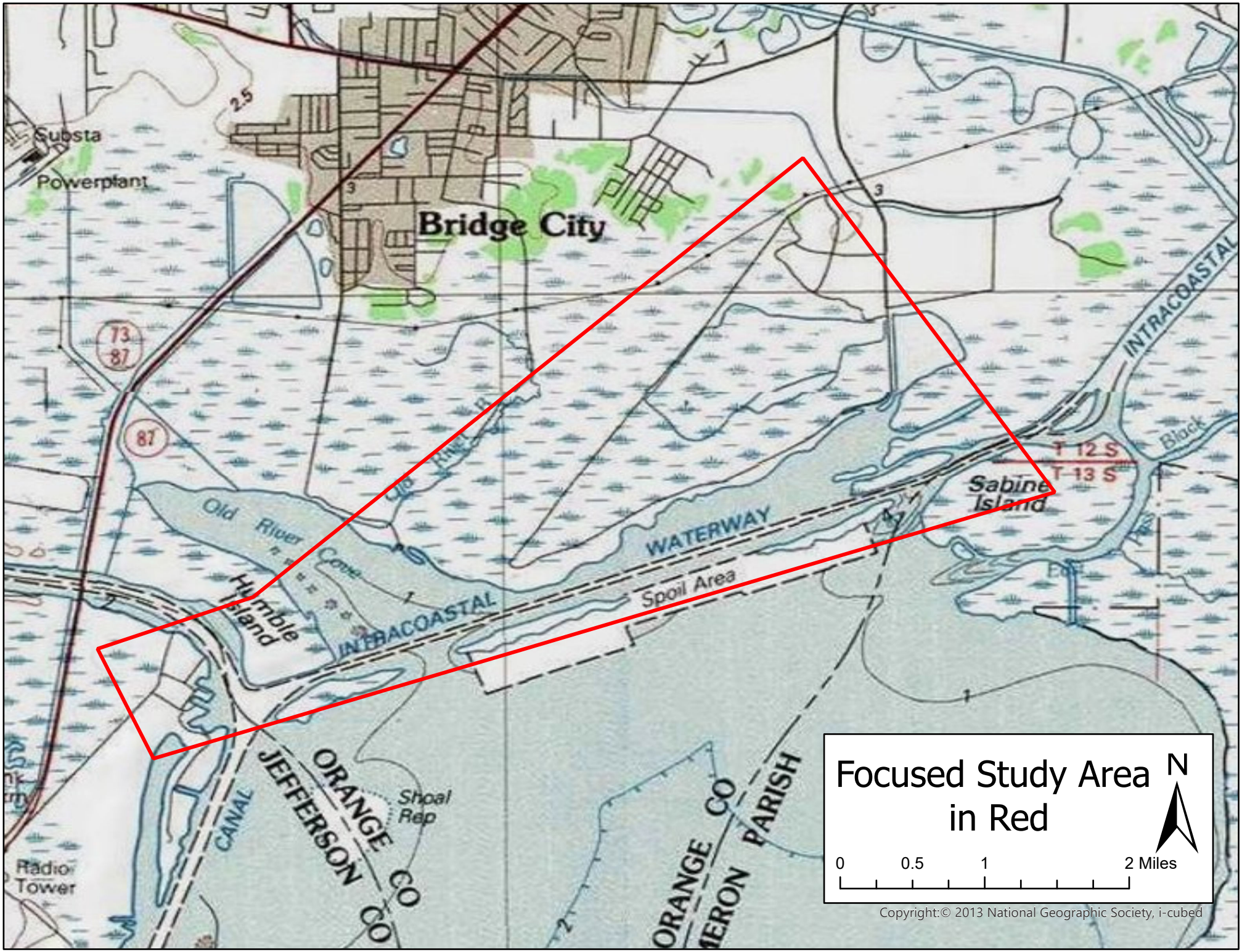
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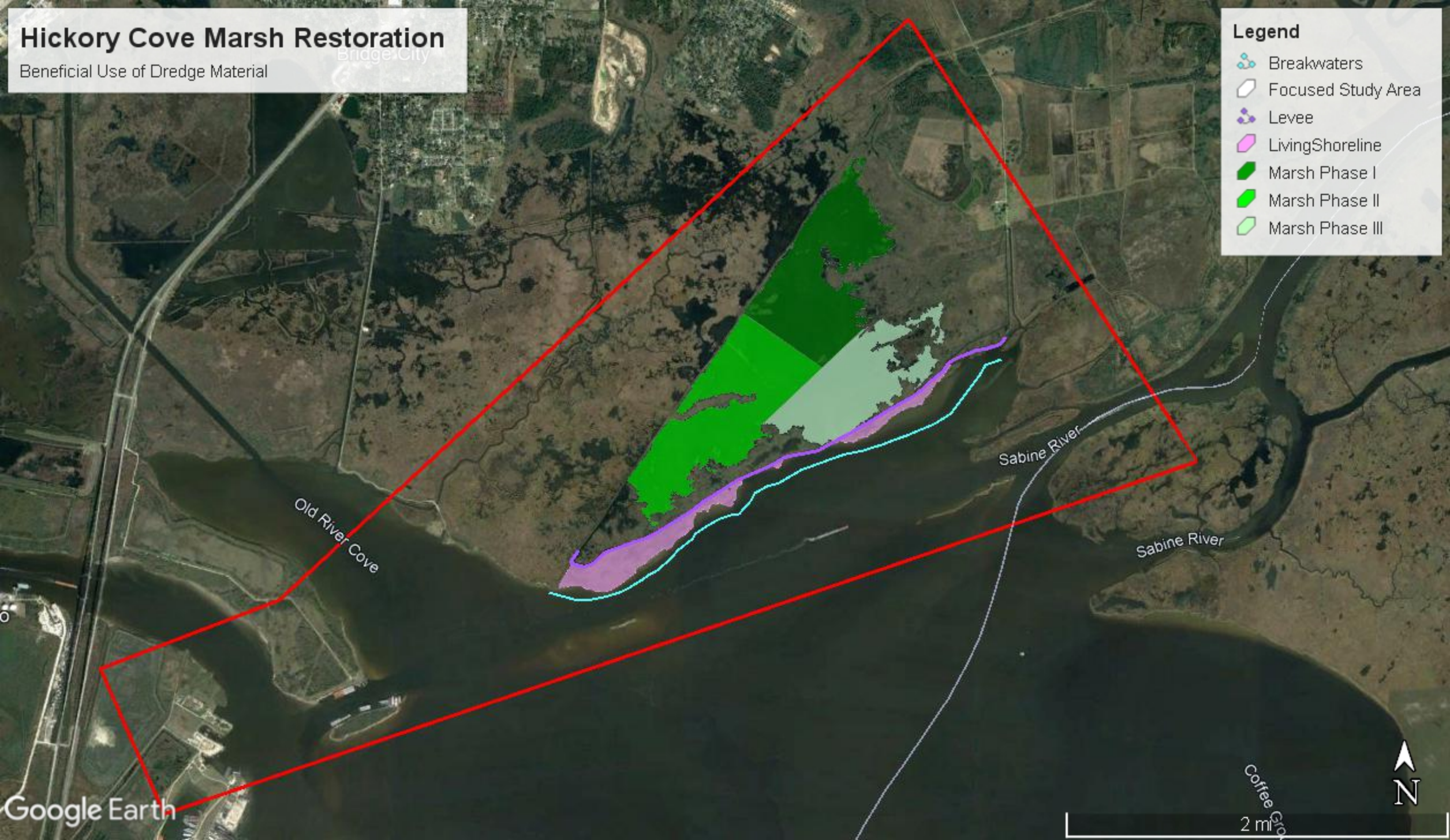
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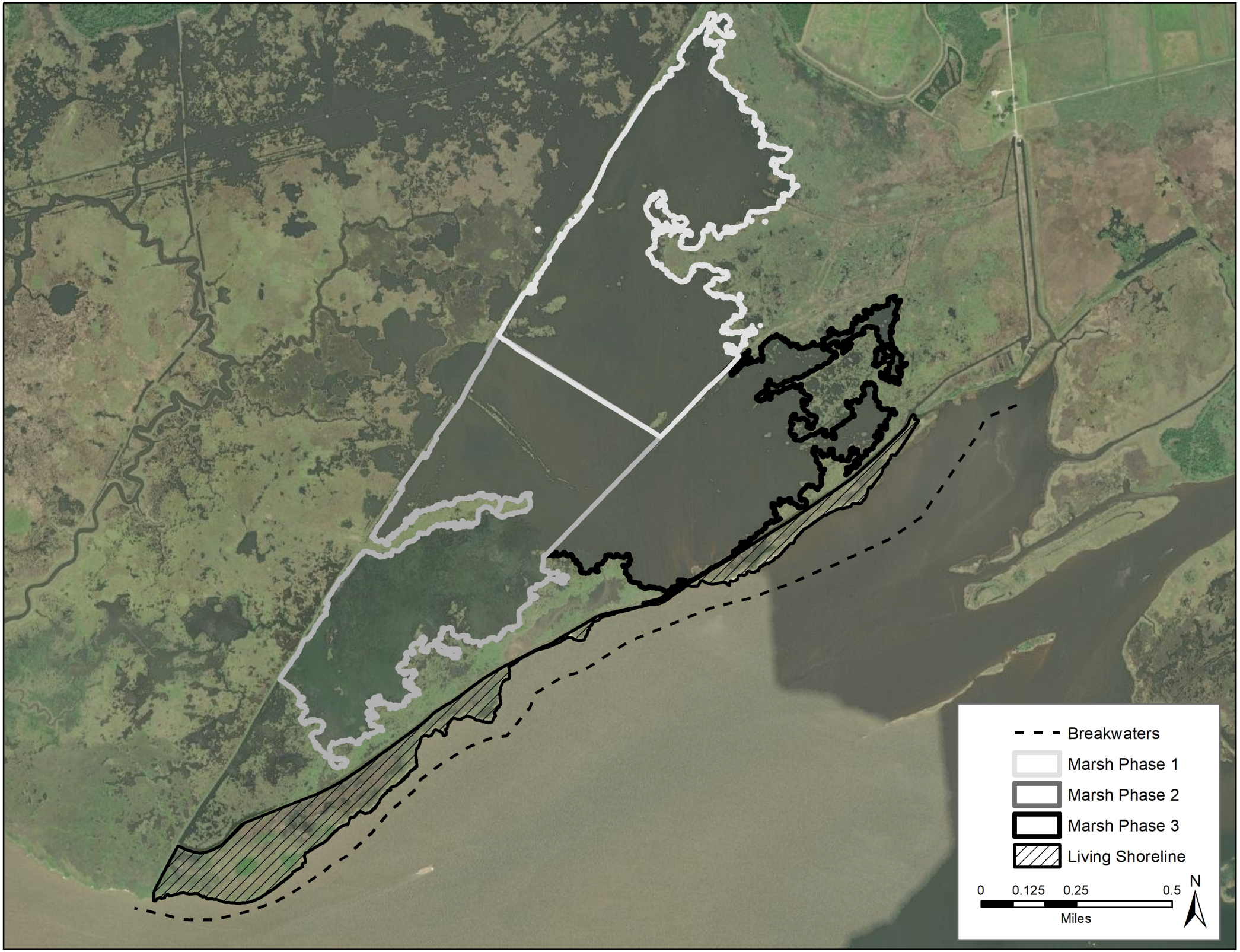
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DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Mr. Tarpie Yargee
Town King
Alabama-Quassarte Tribal Town
Post Office Box 187
Wetumka, OK 74883

Dear Mr. Yargee:

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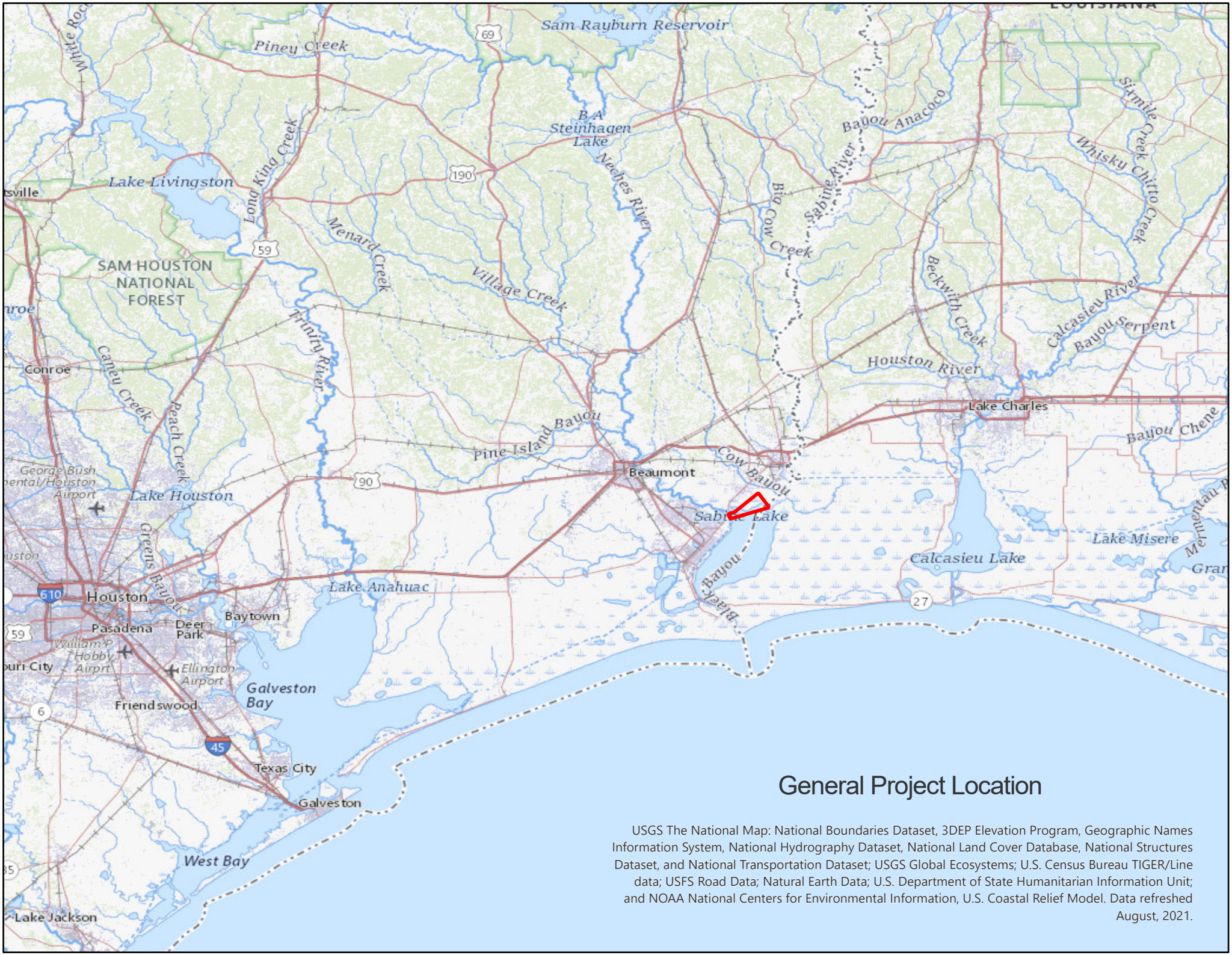

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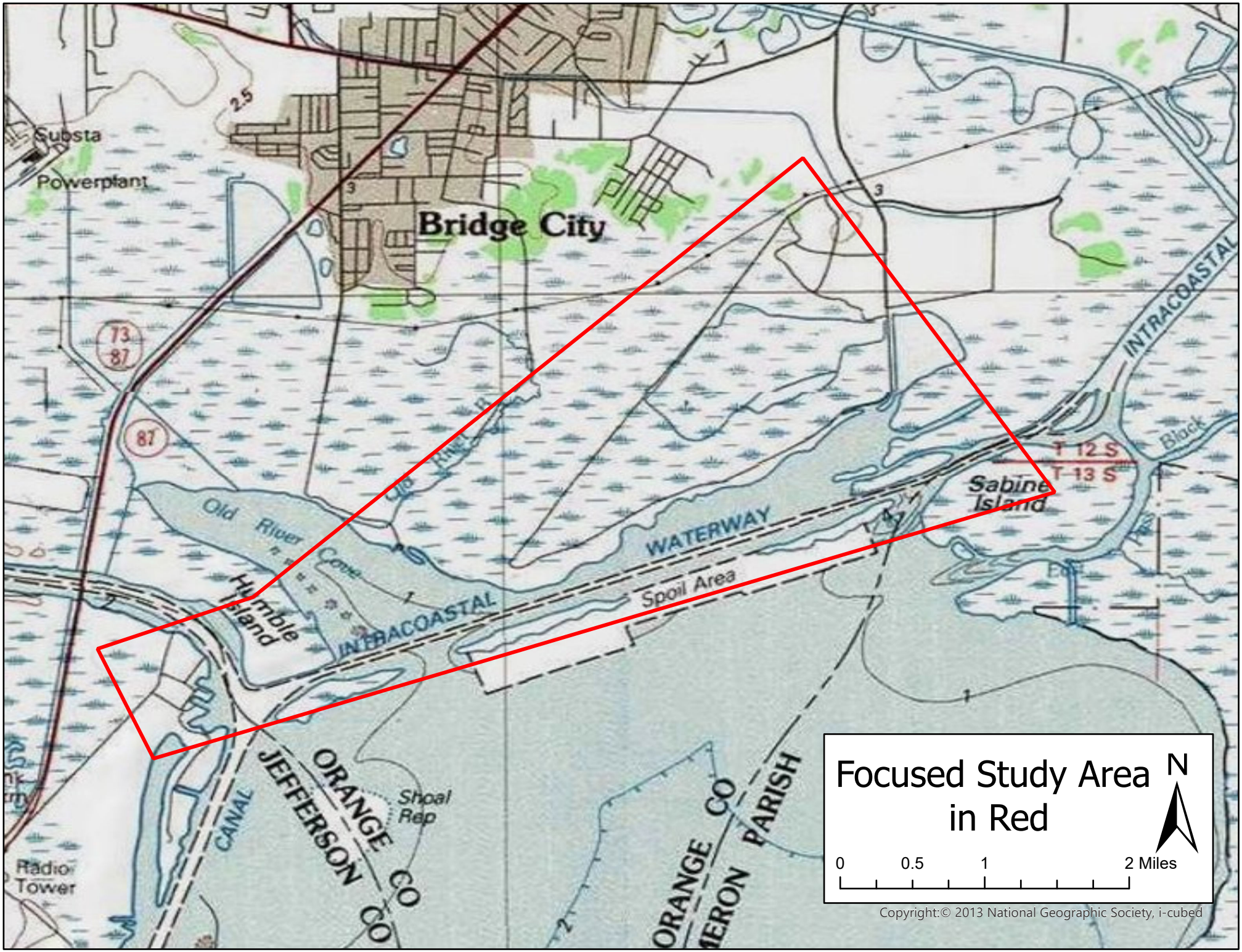
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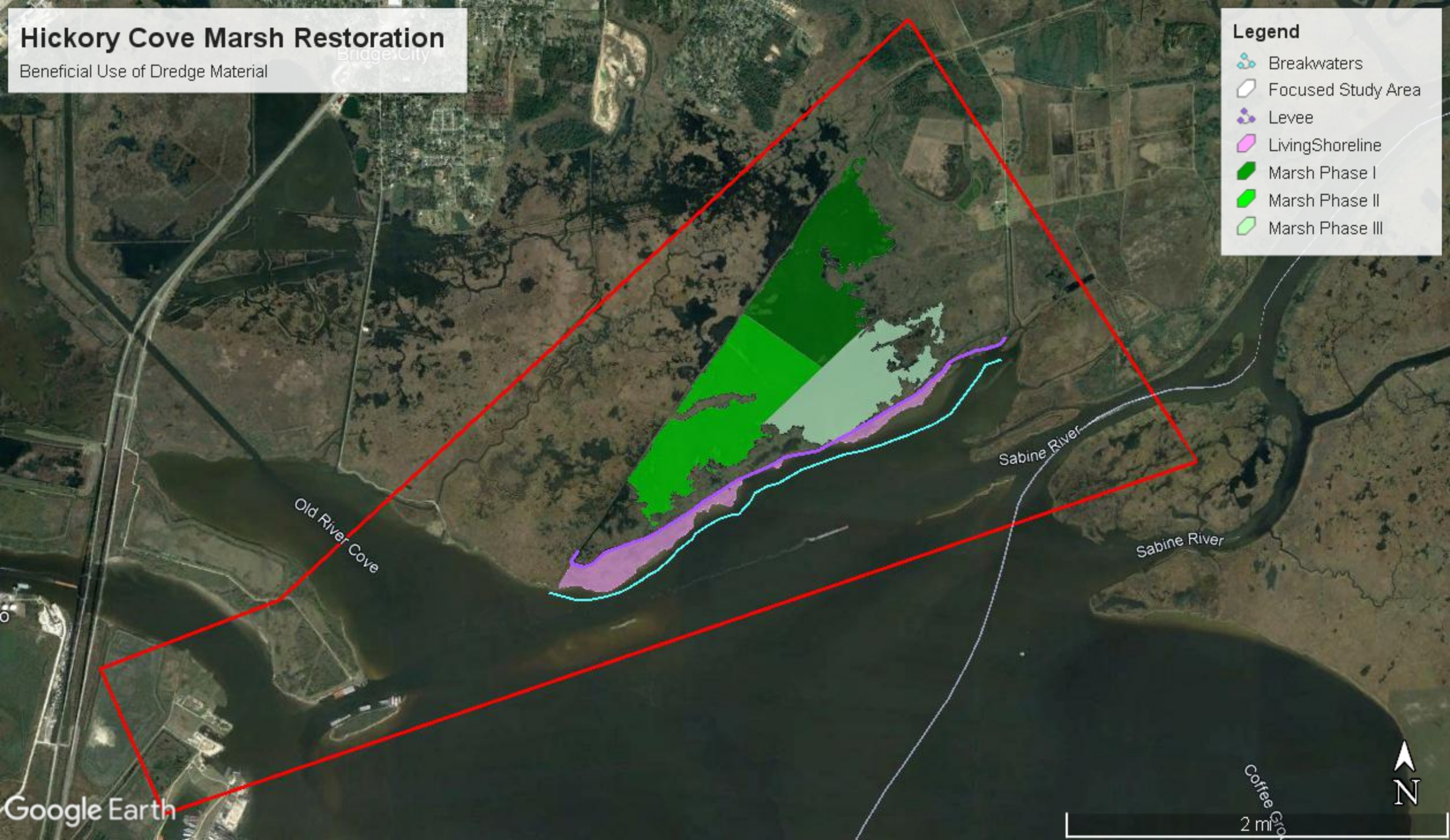
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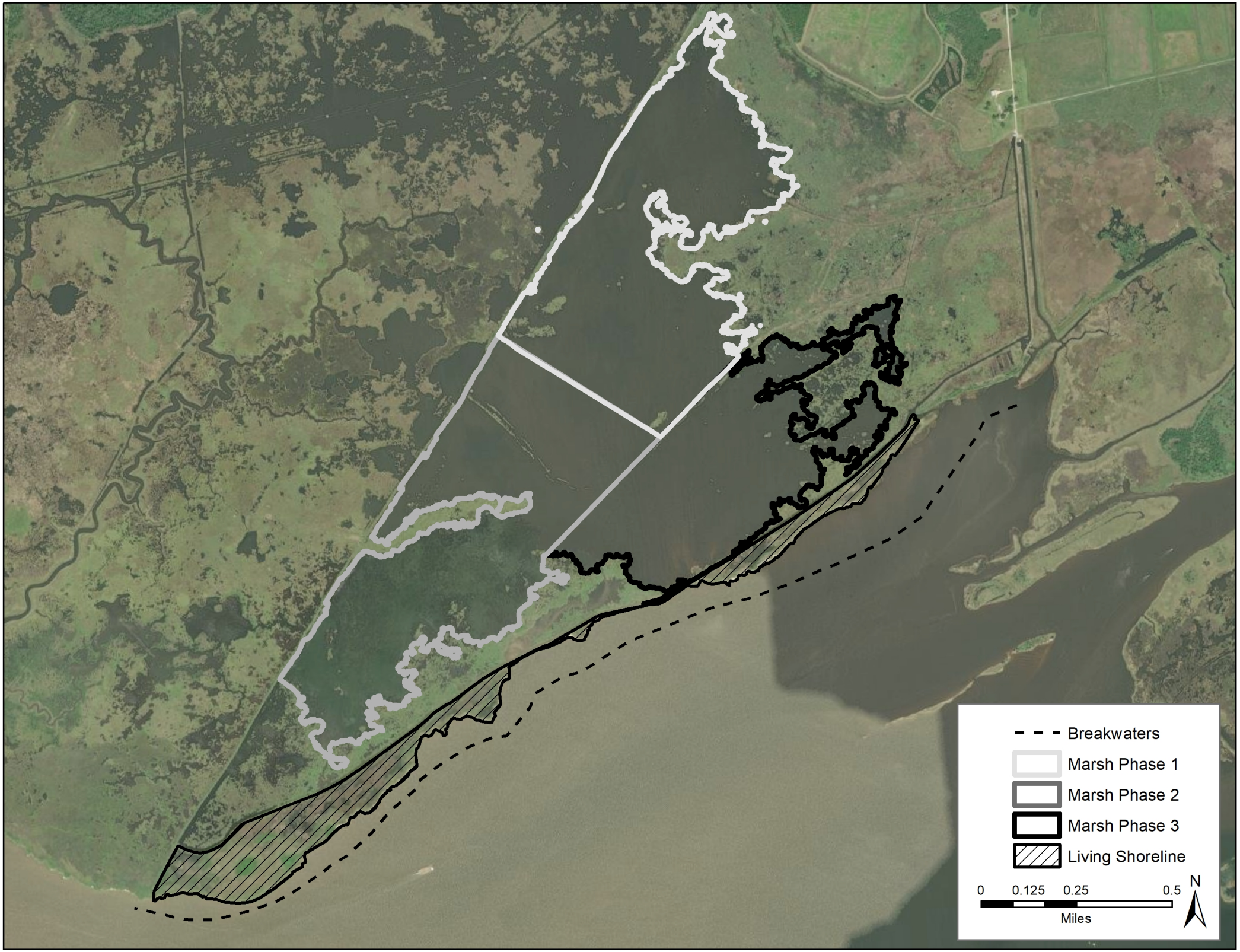
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DEPARTMENT OF THE ARMY
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P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Mr. Bobby Komardly
Chairman
Apache Tribe of Oklahoma
Post Office Box 1330
Anadarko, OK 73005

Dear Mr. Komardly:

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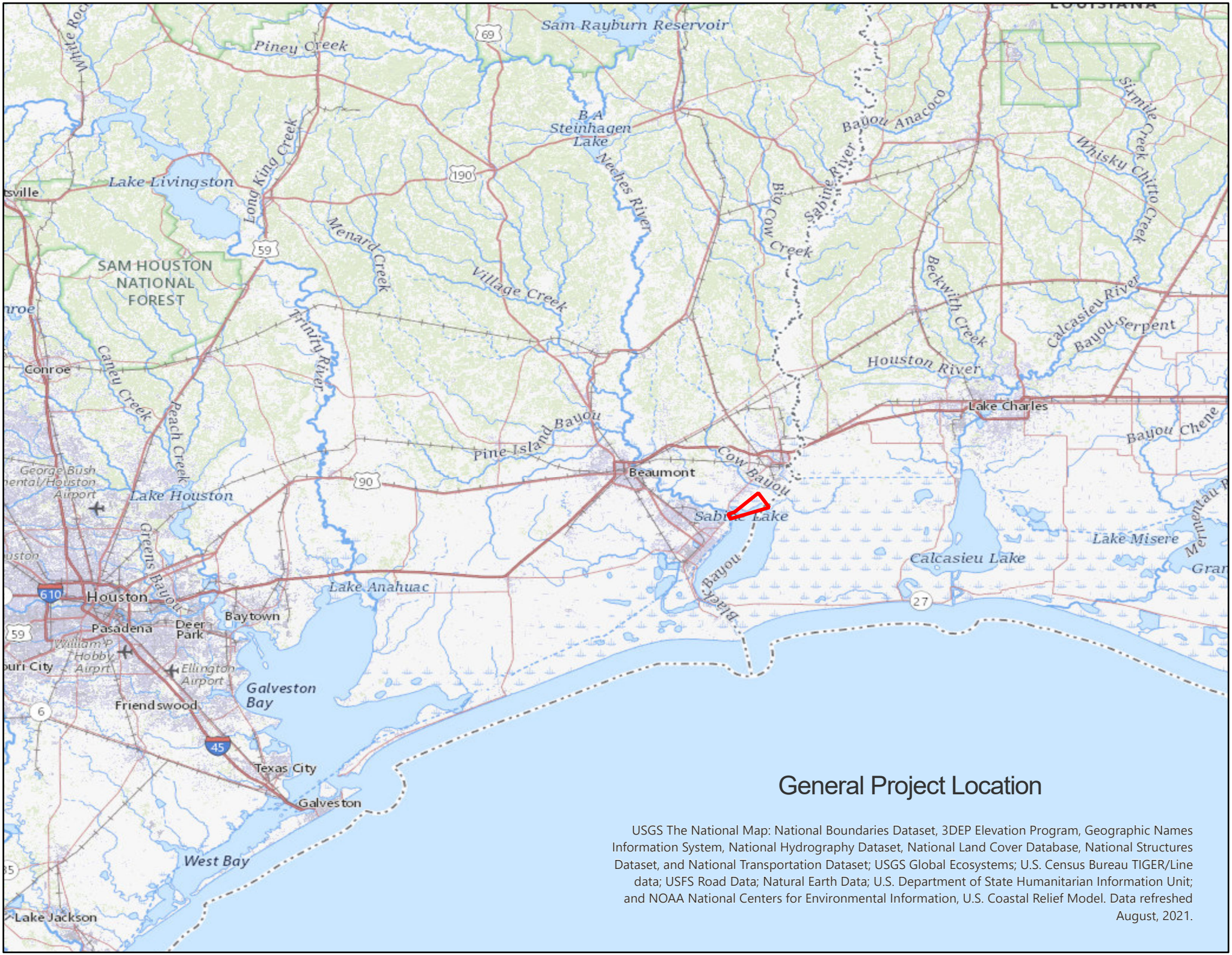
Sincerely,

Amanda McGuire

Amanda M. McGuire
Chief, Environmental Branch
Regional Planning and Environmental Center

Enclosures



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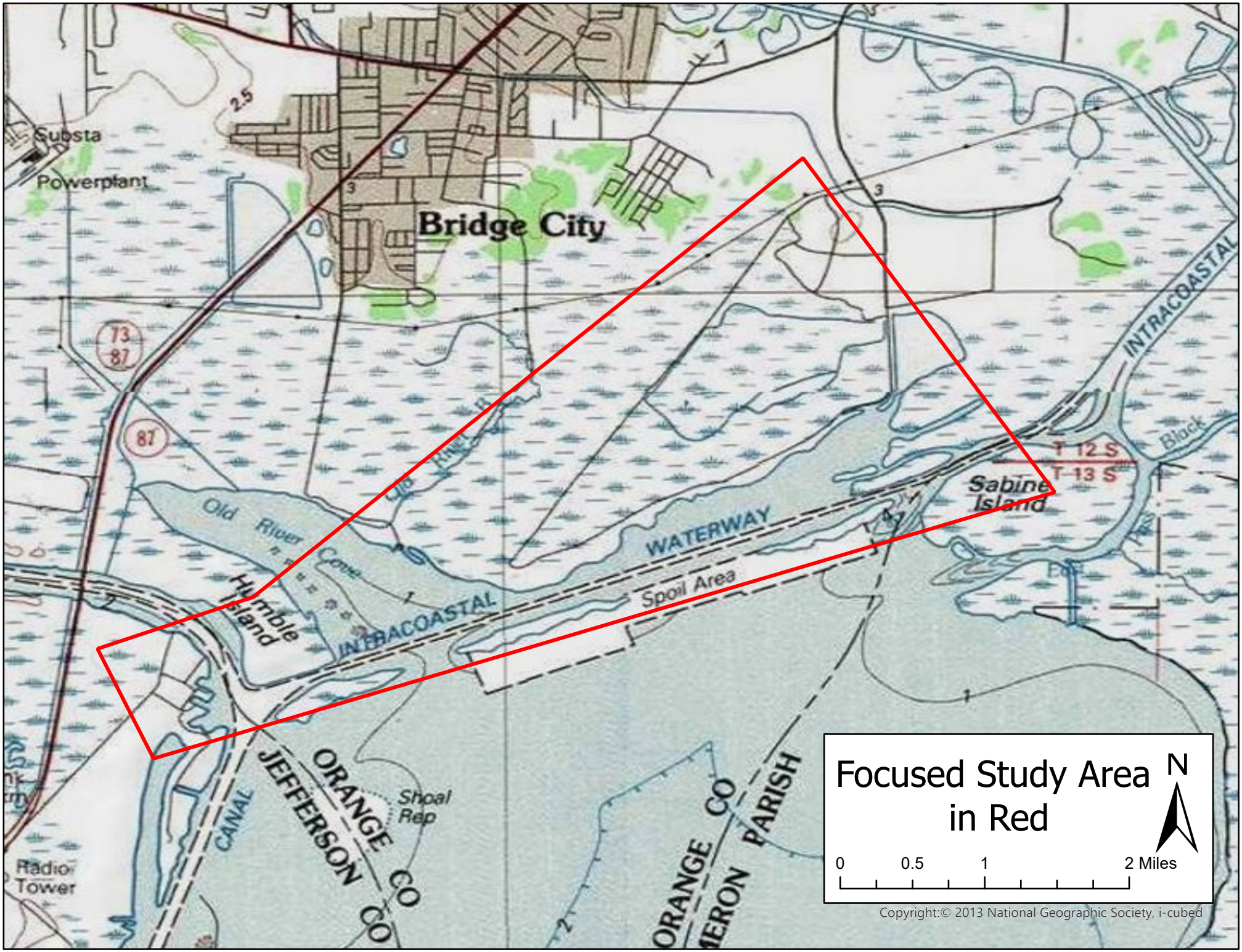
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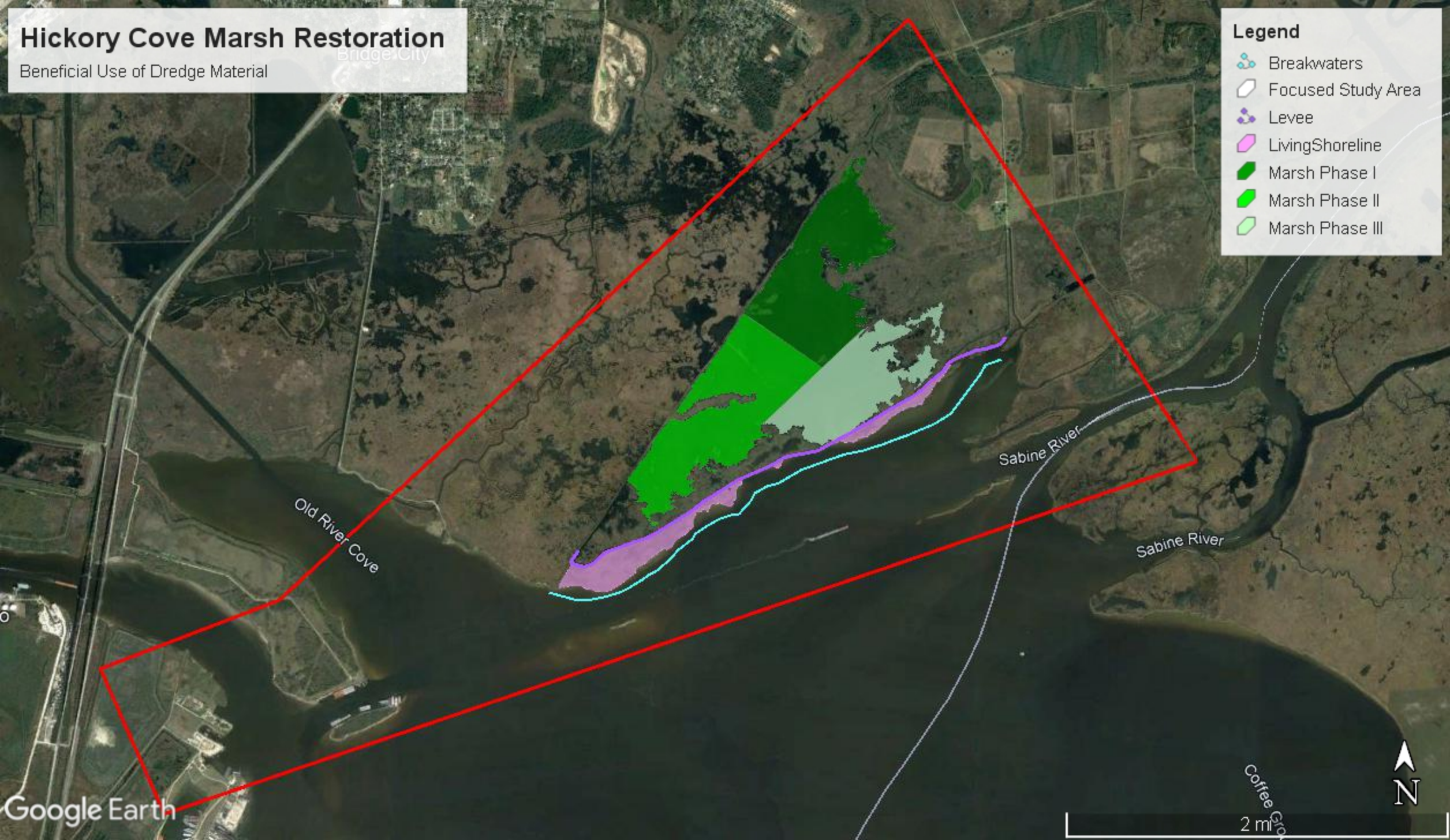
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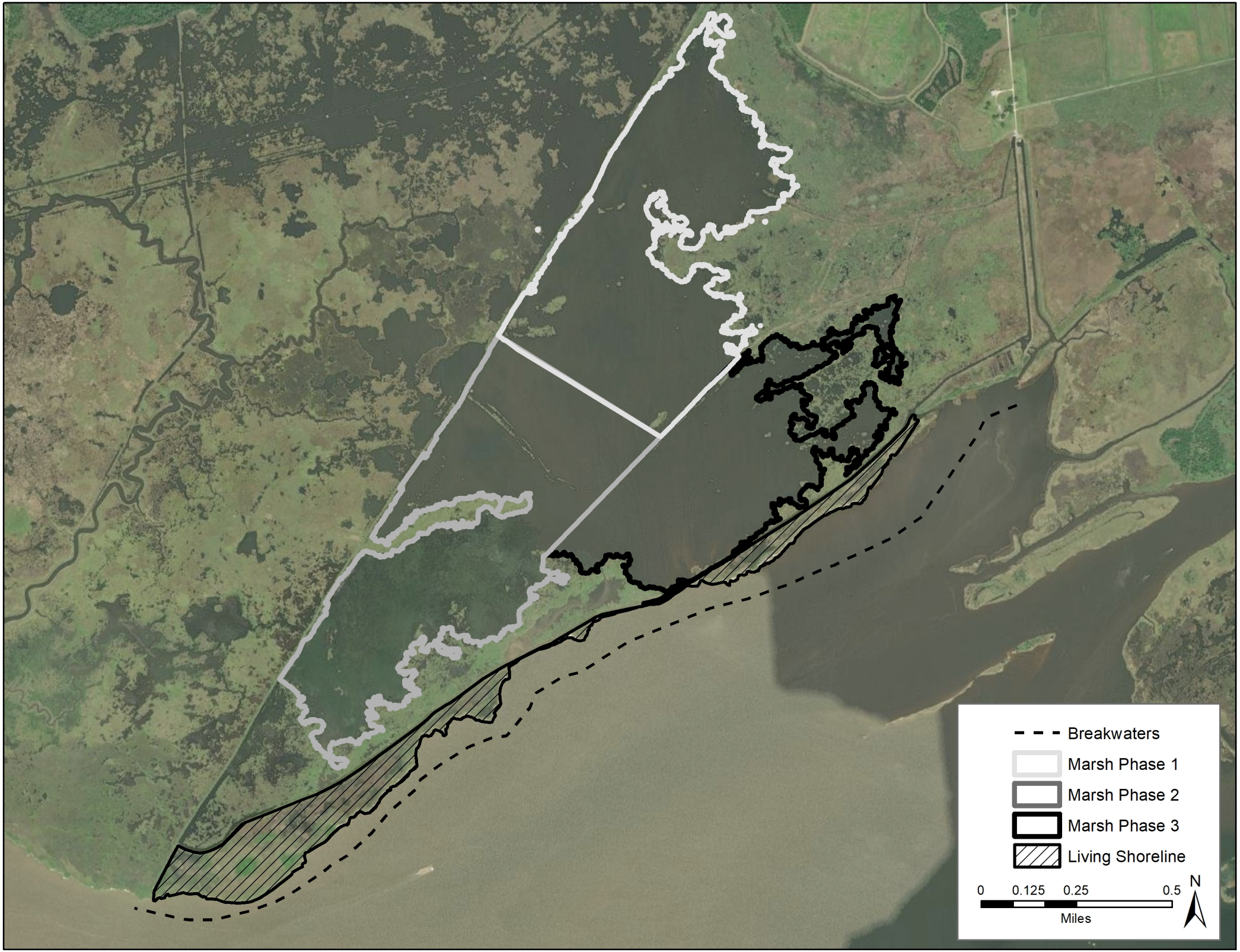
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DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Mr. David Sickey
Chairman
Coushatta Tribe of Louisiana
Post Office Box 10
Elton, Louisiana 70532

Dear Mr. Sickey:

The U.S. Army Corps of Engineers (USACE), in partnership with the Orange County Navigation and Port District (non-federal sponsor for the project), is preparing a draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) for the Hickory Cove Marsh Restoration and Living Shoreline Project in Orange County, Texas, UTM 15N 421893E 3318528N. The study was authorized by Section 1122 of the Water Resources Development Act of 2016 which requires the USACE to establish a pilot program to carry out projects for the beneficial use of dredged material. The Hickory Cove Marsh Restoration and Living Shoreline Project was selected by the Office of the Assistant Secretary of the Army for Civil Works to be one of the pilot projects. This project includes the beneficial use of dredged maintenance material from the Sabine-Neches Waterway to restore approximately 650 acres of marsh within an existing 1200-acre impoundment and native plantings along 95 acres of adjacent coastline to create a living shoreline feature. The project also includes repairs to the existing containment levee and the installation of a rock breakwater adjacent to the shoreline to combat wave erosion (see enclosed maps). The marsh restoration is expected to require several dredge cycles to complete. The first dredge cycle is anticipated to begin in 2023 and will discharge 1.3 million cubic yards of maintenance dredged material to restore approximately 190 acres of marsh habitat.

Currently, the shoreline in the project area has eroded due to wave action and navigation traffic. Much of the shoreline has experienced significant loss, to the point that the containment levee surrounding the marsh has been breached. This has allowed estuary water to enter the marshes, where sediments are continually eroding and has converted approximately 80 percent of the project area to open water.

The study area was examined for any known historic properties using the Texas Historical Commission's (Atlas) database. This review found nine previous terrestrial cultural resource surveys and five maritime cultural resources surveys within the focused study area. The area for the proposed living shoreline has been surveyed in its

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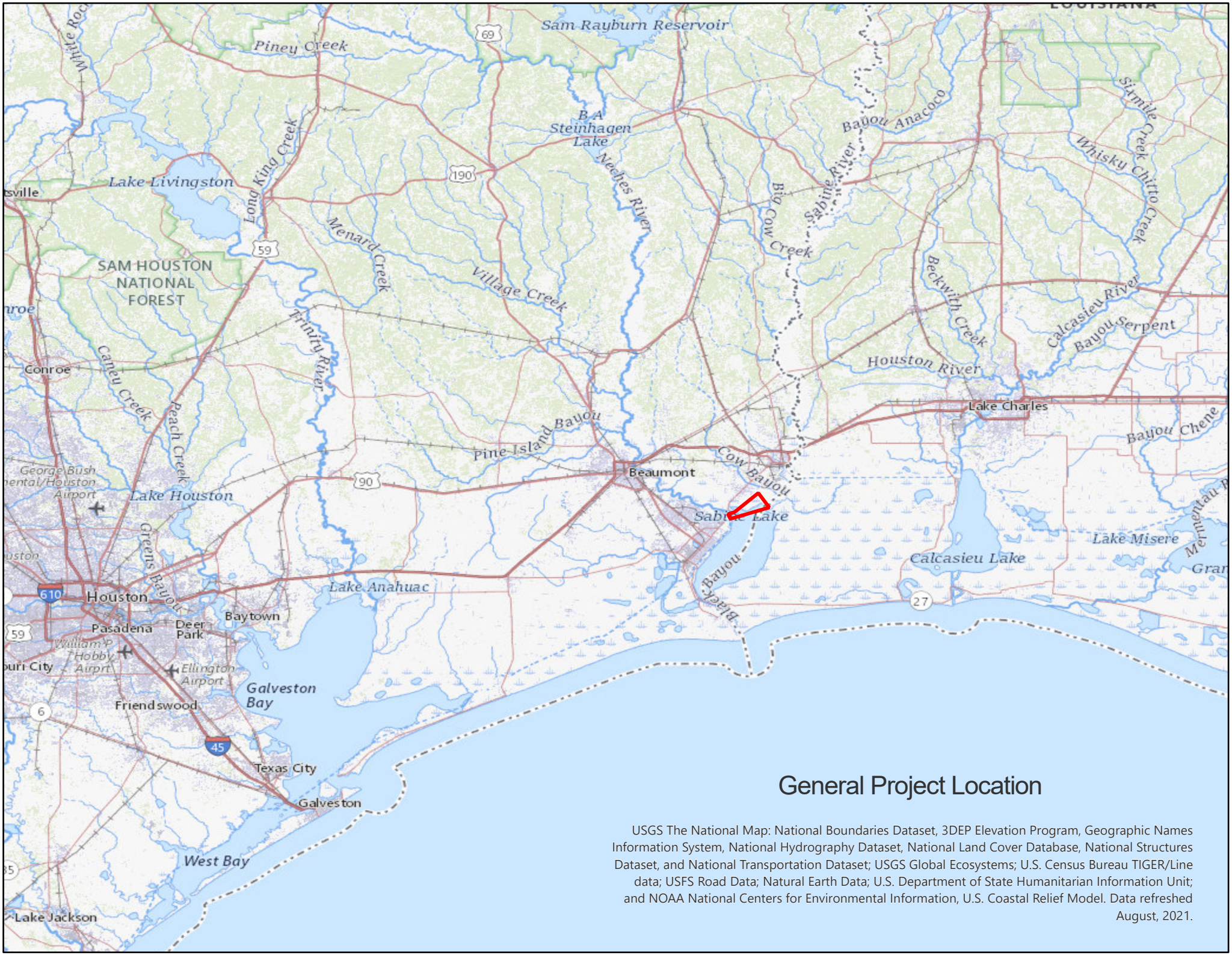

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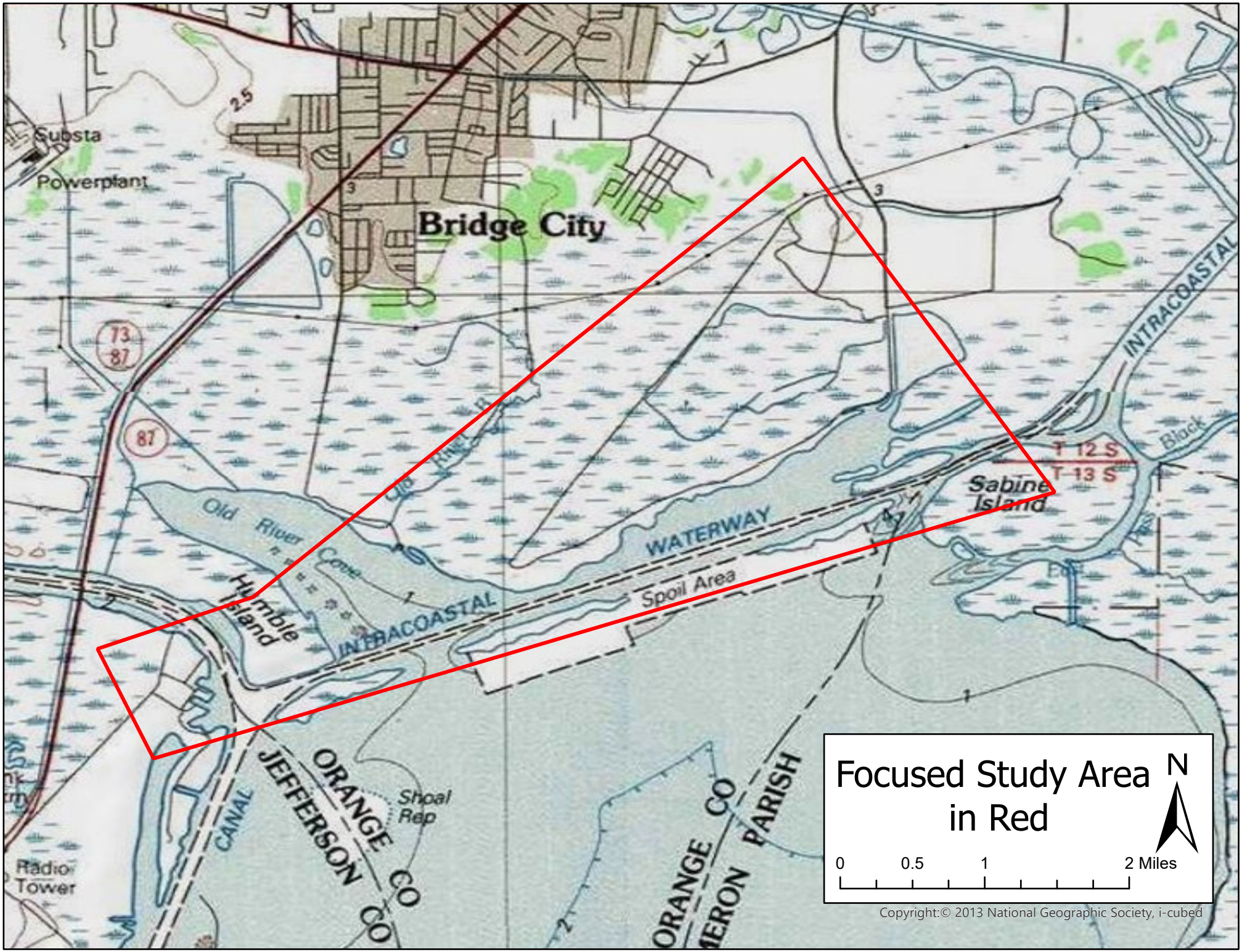
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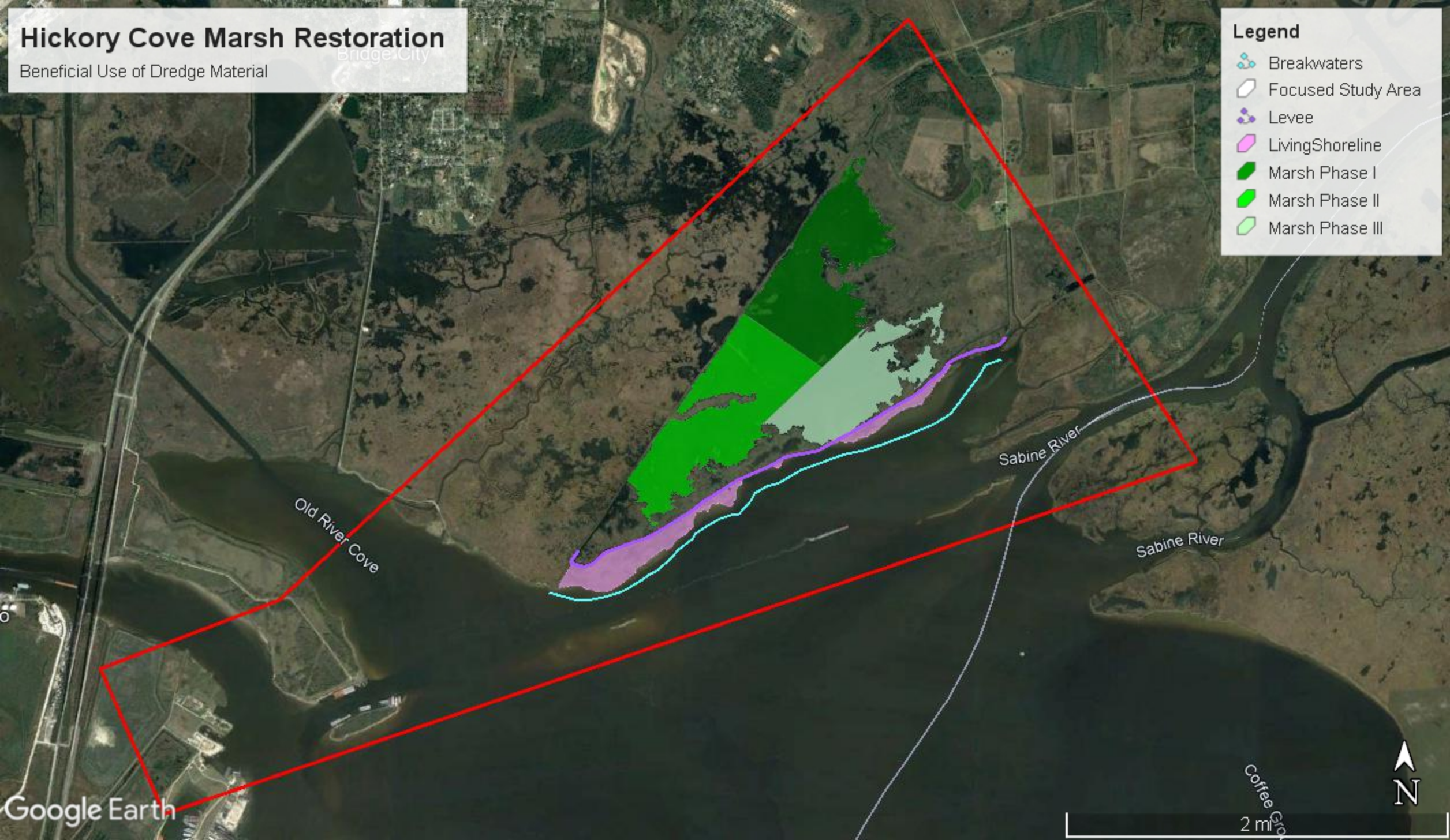
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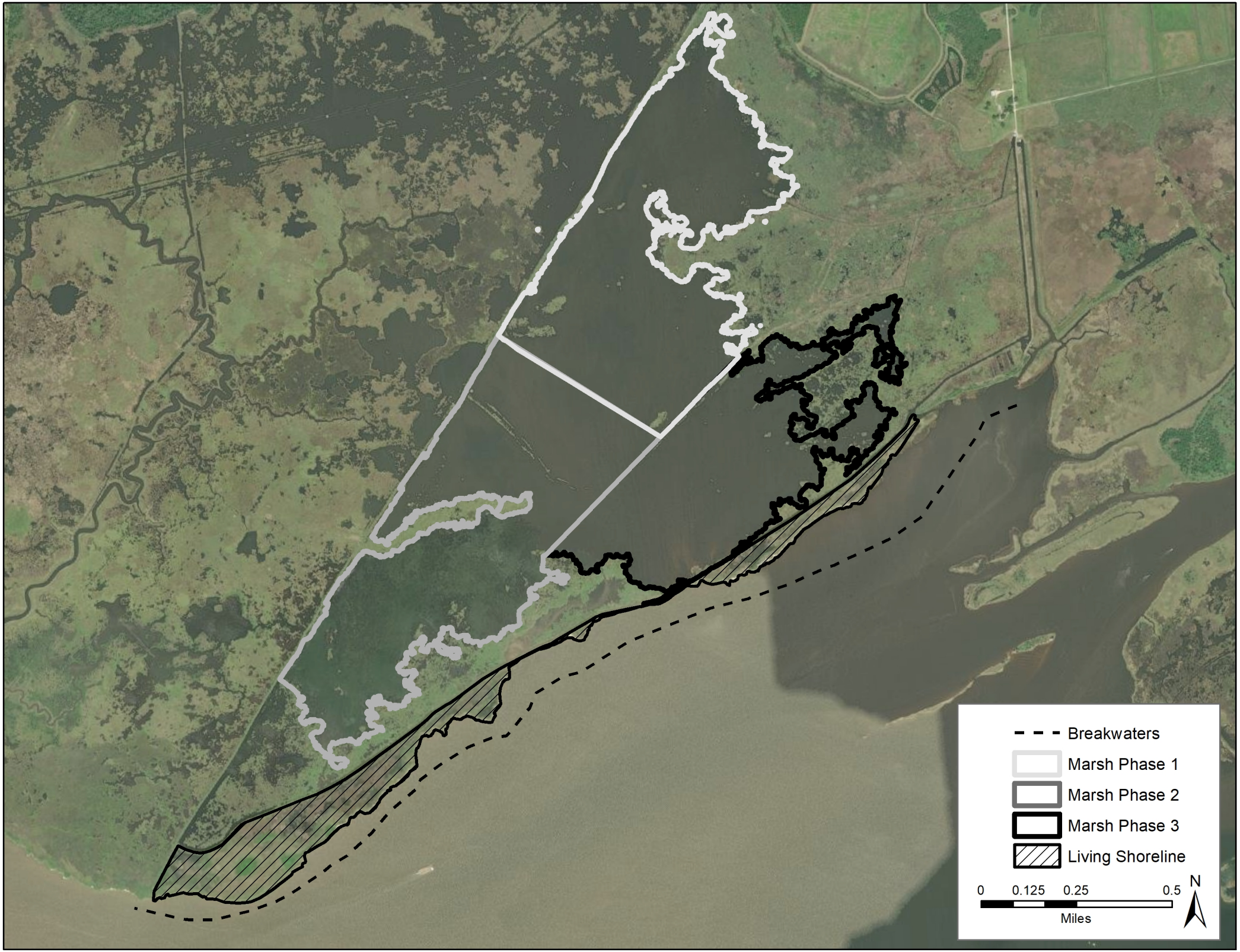
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DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Mr. Matthew M. Komalty
Chairman
Kiowa Indian Tribe of Oklahoma
Post Office Box 369
Carnegie, OK 73015

Dear Mr. Komalty:

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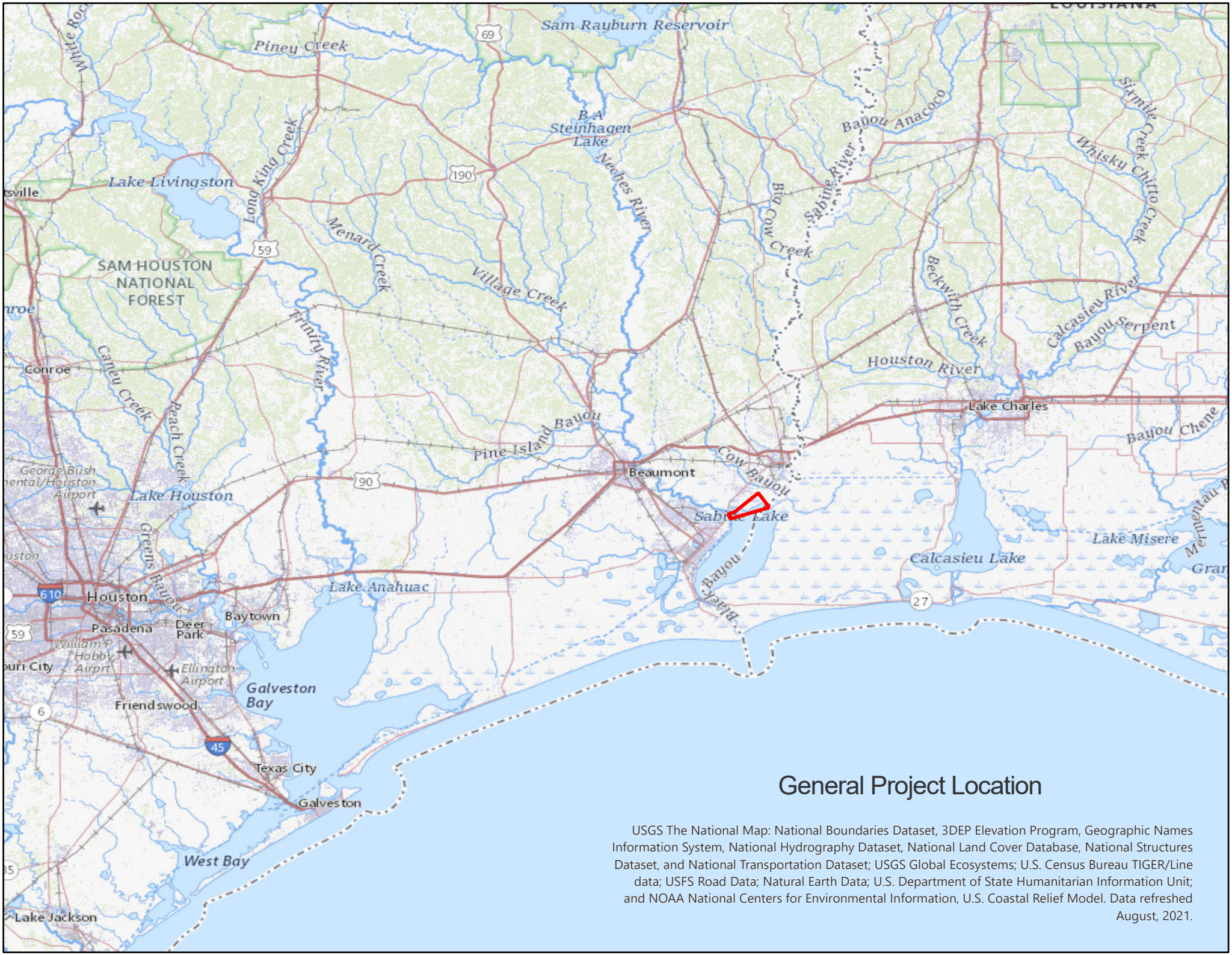

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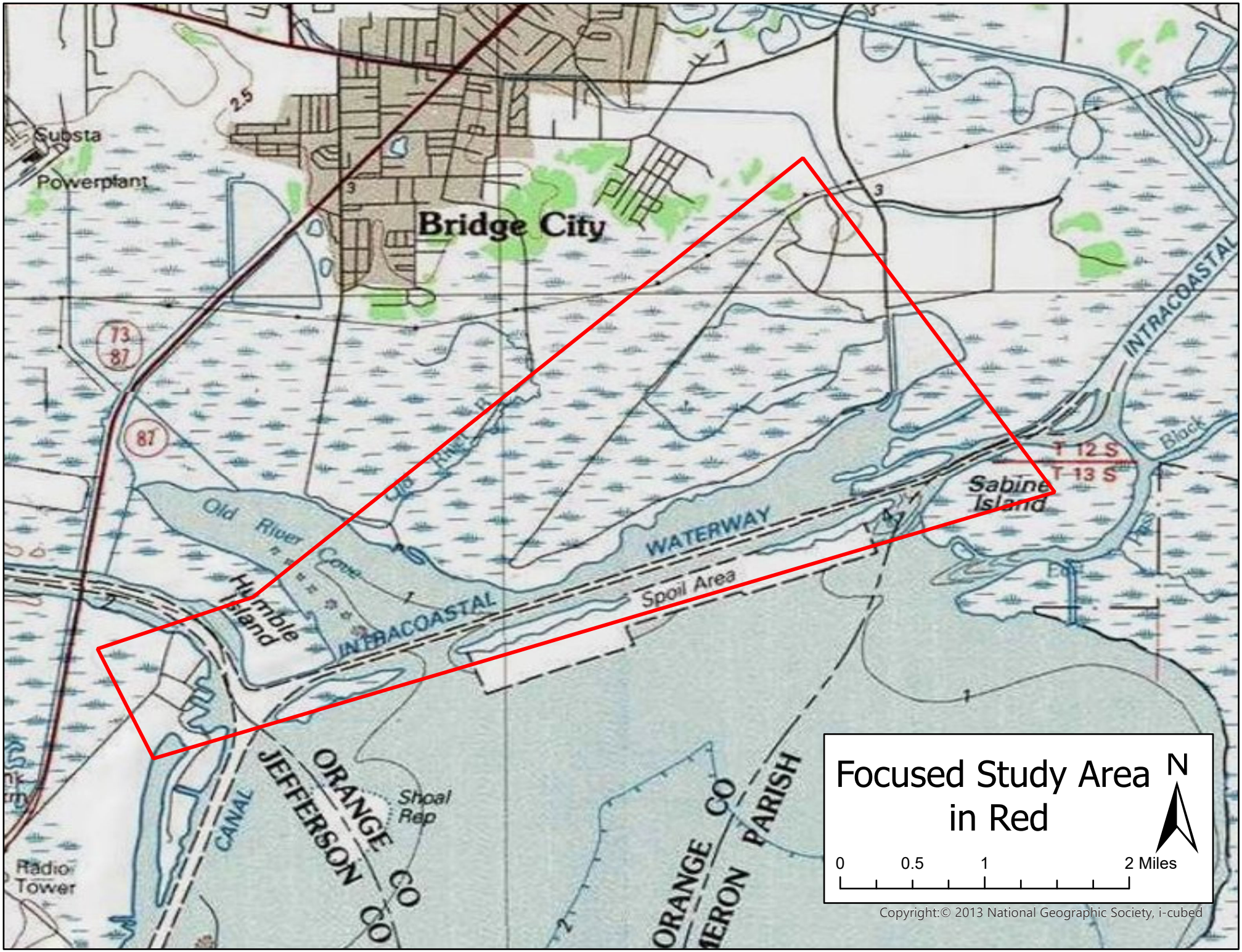
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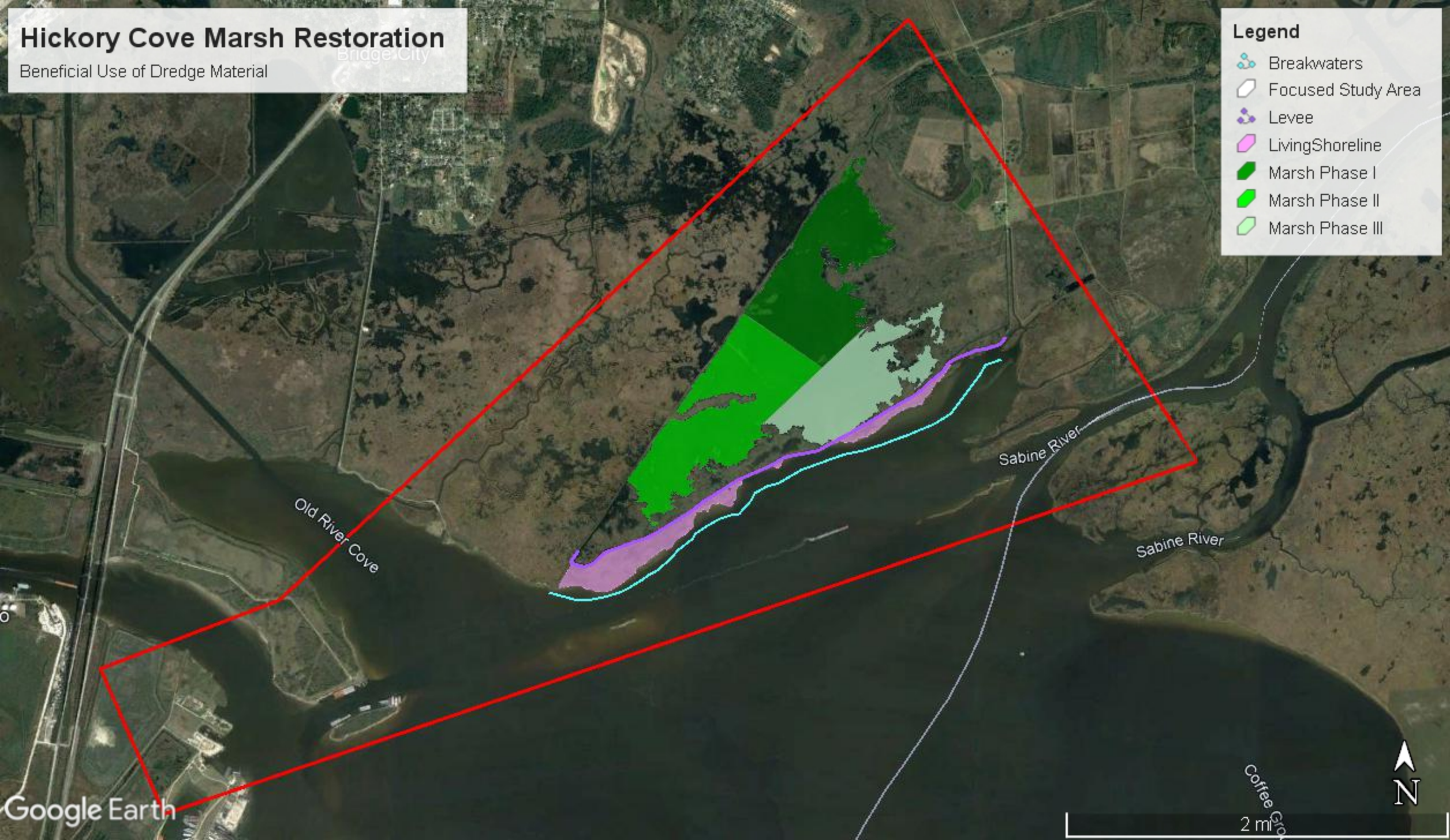
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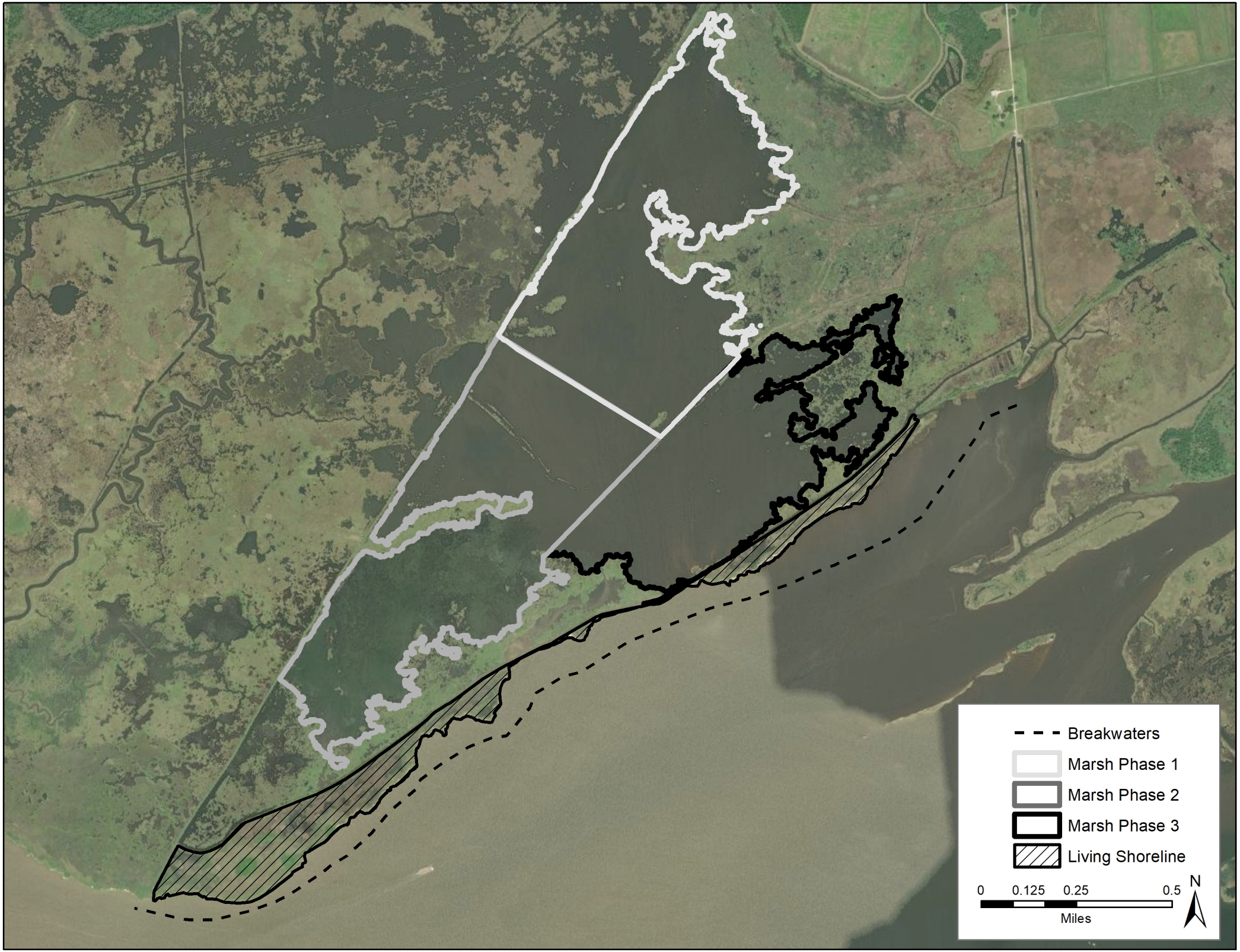
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P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 27, 2021

Subject: Hickory Cove Marsh Restoration and Living Shoreline Project Coordination

Mr. Russell Martin
President
Tonkawa Tribe of Oklahoma
1 Rush Buffalo Road
Tonkawa, OK 74653

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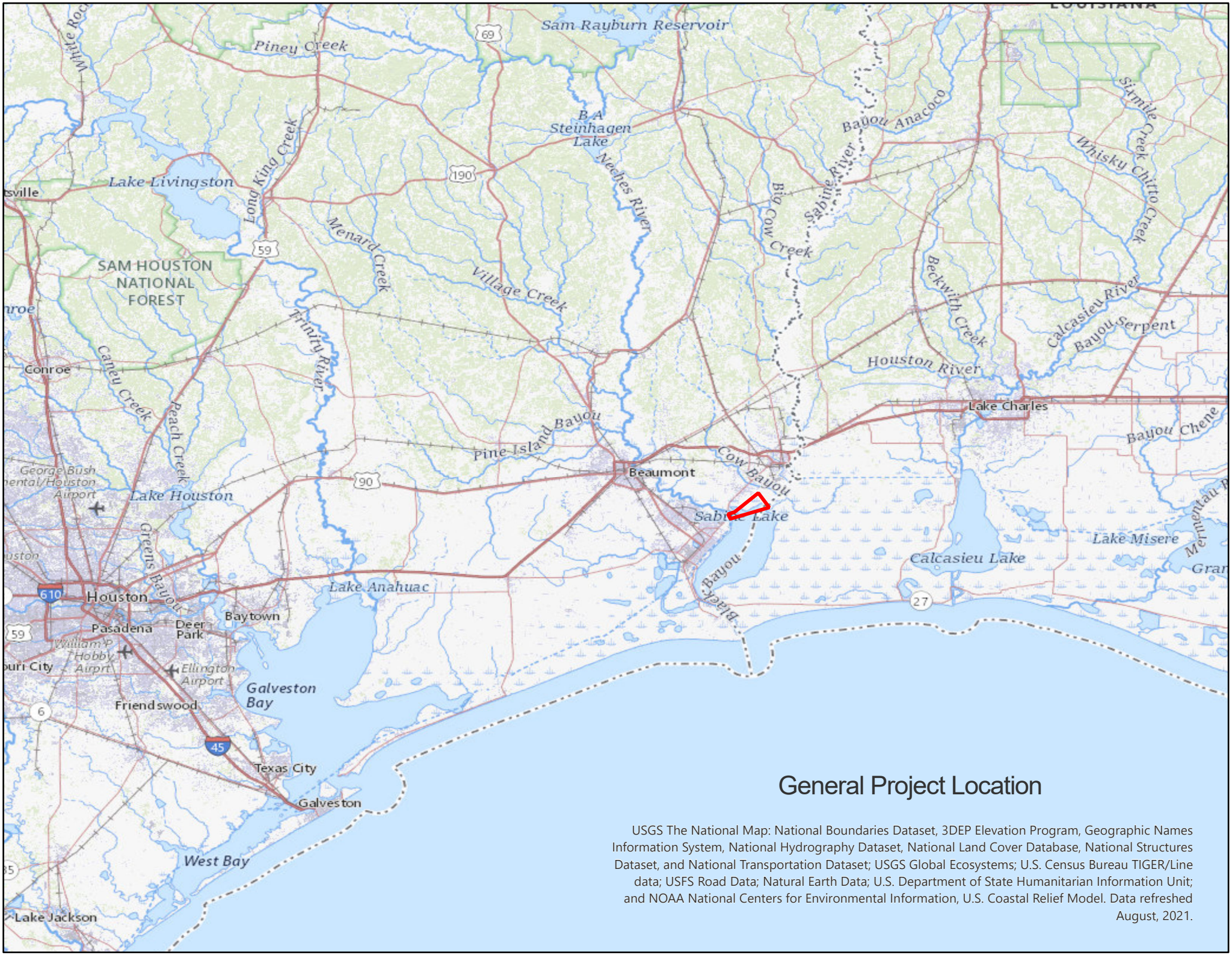
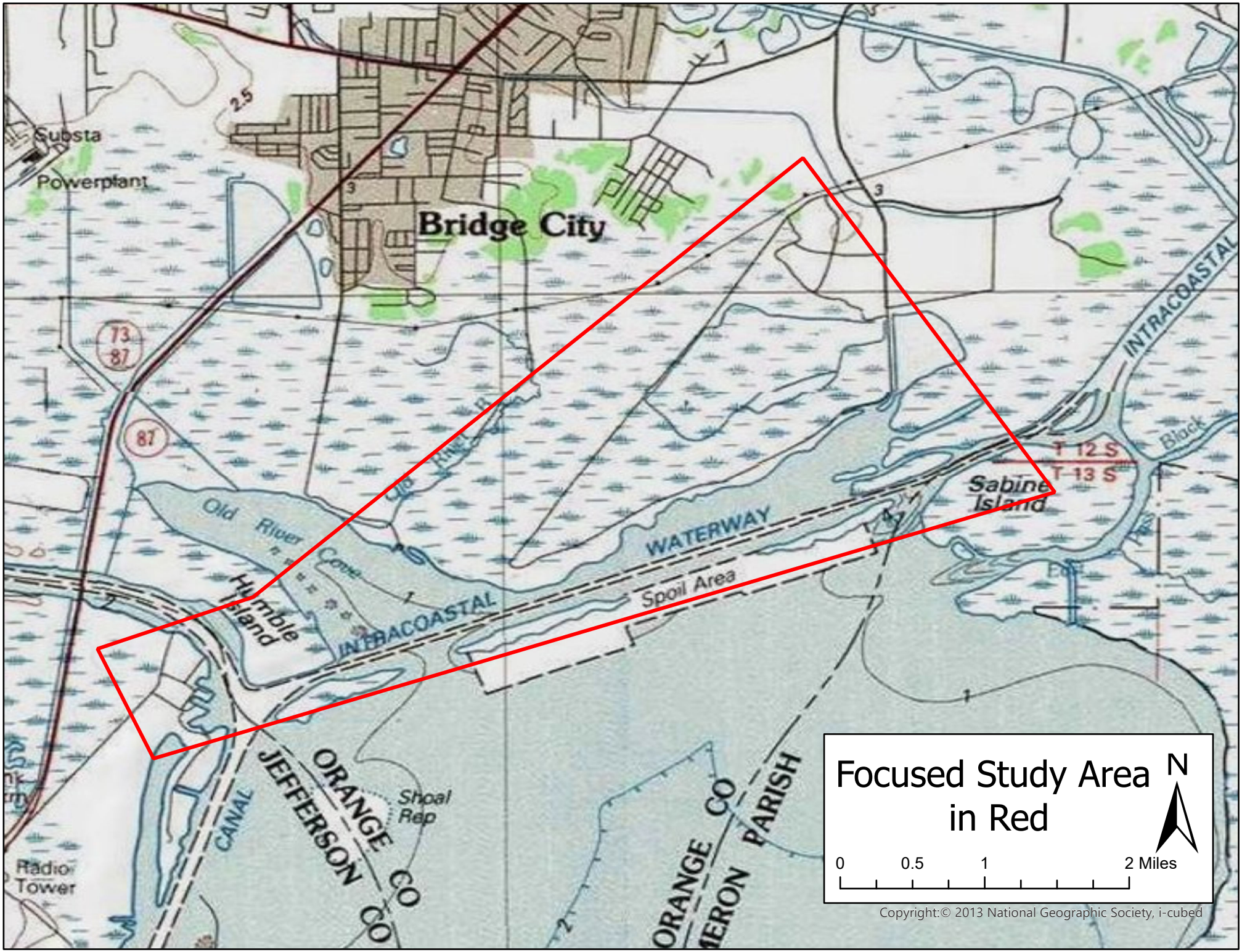
Enclosures



General Project Location

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021.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JEFFERSON CO
ORANGE CO
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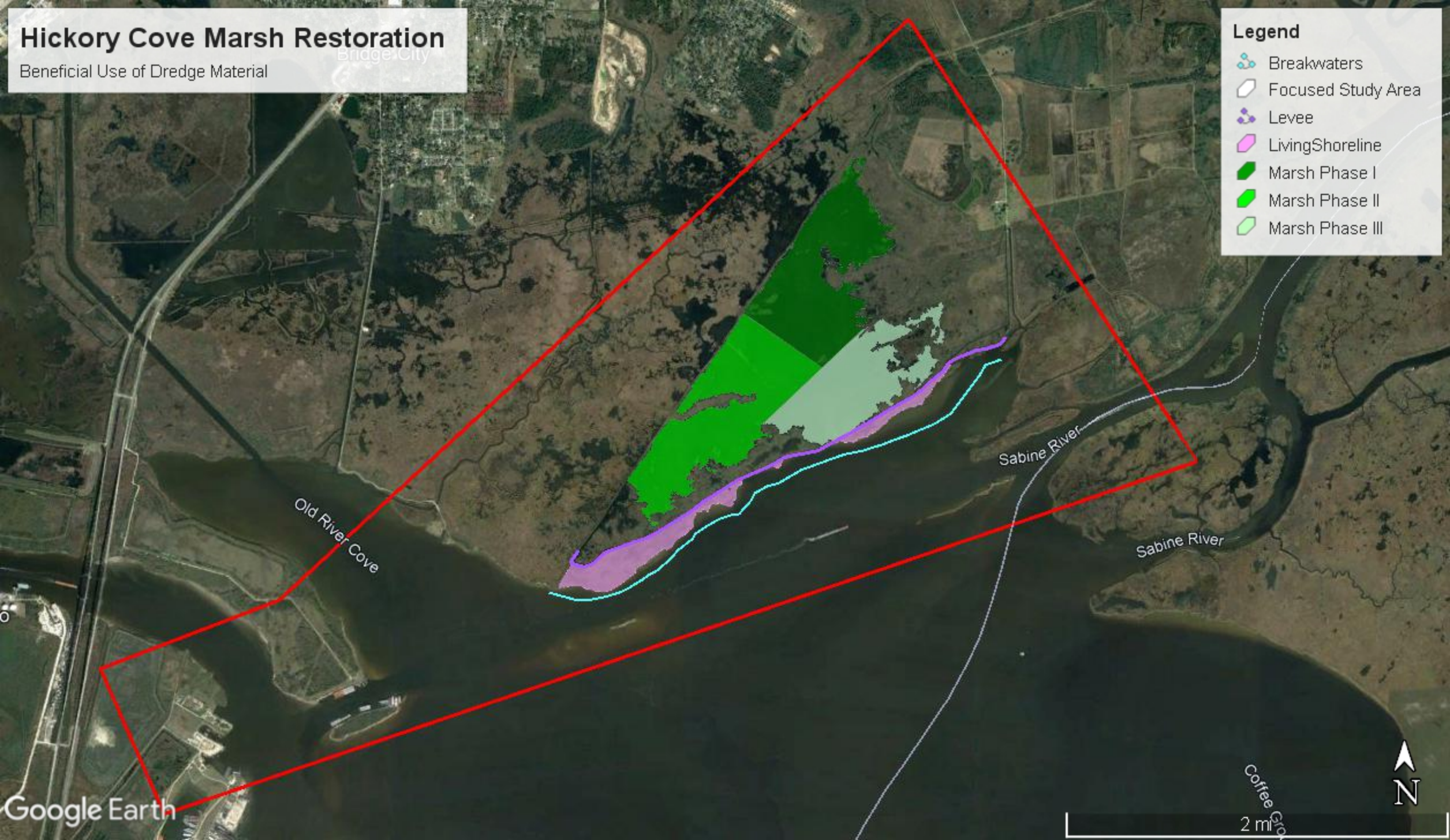
Hickory Cove Marsh Restoration
Beneficial Use of Dredge Material
Legend
Breakwaters
Focused Study Area
Levee
LivingShoreline
Marsh Phase I
Marsh Phase II
Marsh Phase III
Old River Cove
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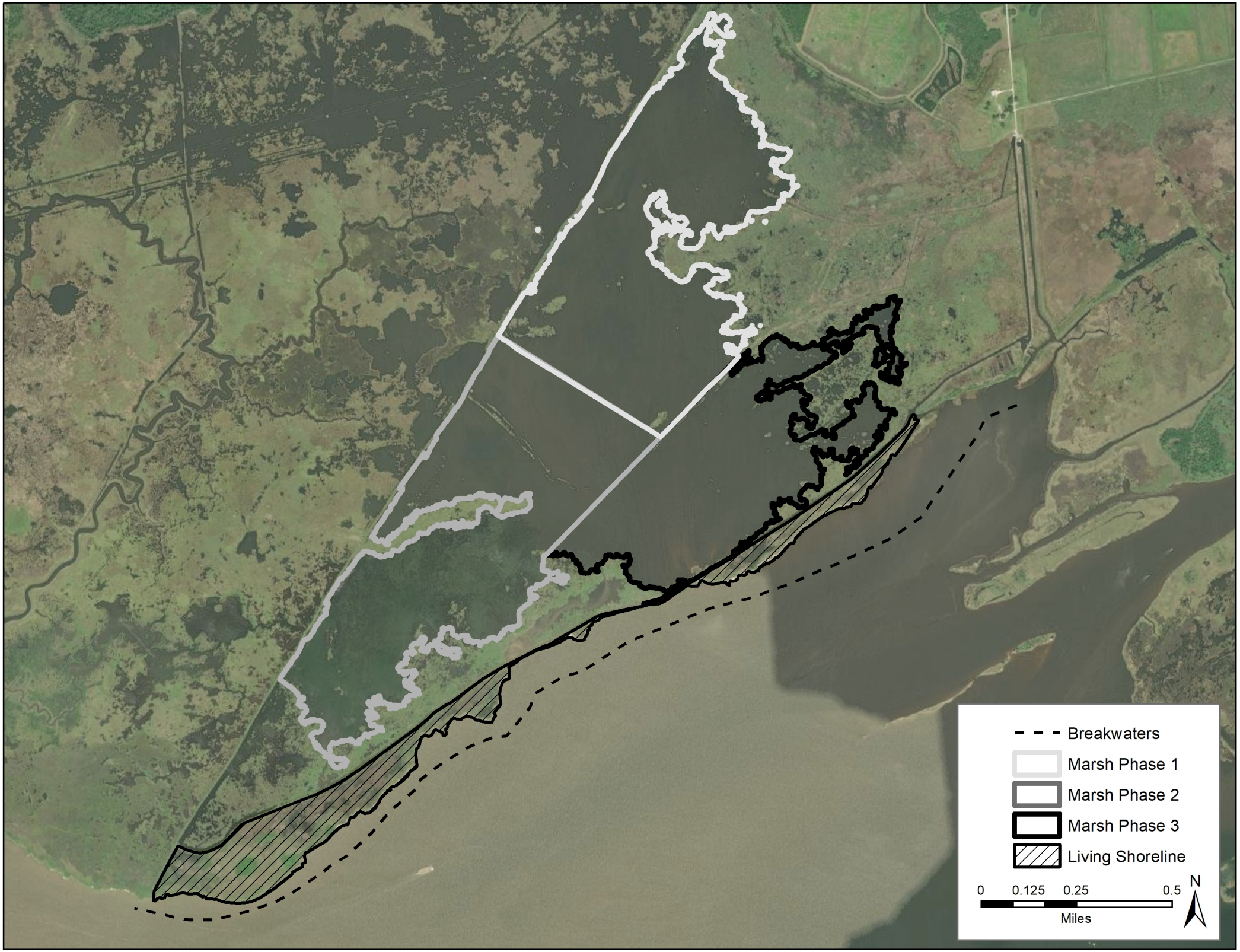
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Galveston District

Appendix B-6

Ecological Modeling

for

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

November 2021

WRDA Section 1122 Beneficial Use Pilot Project, Beneficial Use Placement for Marsh Restoration Using Navigation Channel Sediments Hickory Cove Marsh, Bridge City, Texas

Ecological Modeling

Prepared by:

United States Army Corps of Engineers
Regional Planning and Environmental Center

November 2021

US Army Corps of Engineers ®
Galveston District

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1.0 INTRODUCTION

This appendix provides documentation of the habitat evaluation and quantification process that was conducted for the project alternatives. Section 1122 of WRDA 2016 directed the Secretary of the Army to establish a pilot program consisting of 10 projects for the beneficial use of dredge material for specified purposes. The Hickory Cove Marsh Restoration and Living Shoreline Project was one of the selected pilot programs. The project is located in Bridge City, Orange County, Texas.

1.1 PROPOSED PROJECT

The Orange County Navigation and Port District (OCNPD) in collaboration with Ducks Unlimited submitted the project proposal which sought to utilize 1.5 million cubic yards of dredge material to restore 1,200 acres of marsh and establish a living shoreline adjacent and near the Sabine River Channel in Orange County, Texas. The proposal states that the section of the channel that would be utilized by this project is authorized to a dredge depth of -31 feet, but continuous shoaling and heavy deposition associated with storms like Hurricane Harvey have reduced the channel depth to -23 feet. The proposal also states that the beneficial use site would have a 3 million cubic yard capacity which could accept the 1.5 million cubic yards of material to meet the current maintenance requirement to re-establish the authorized channel depth and provide capacity for several future dredge cycles.

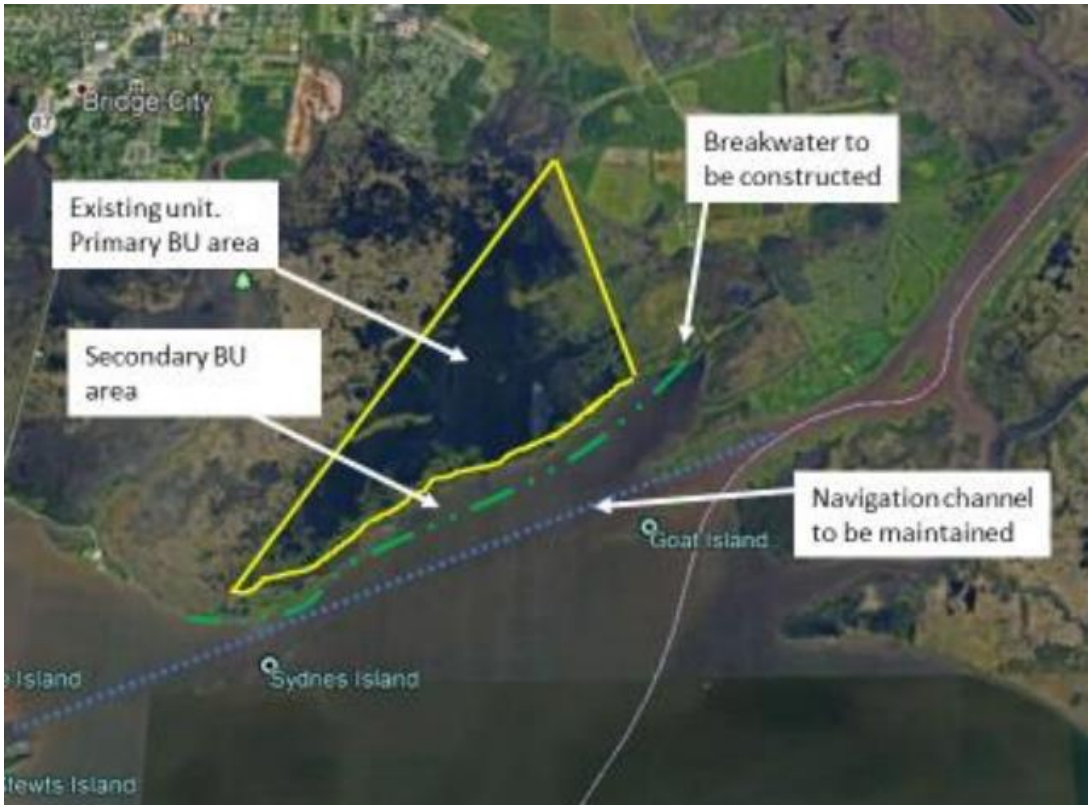

Figure 1-1. Map of project site taken from Proposal submitted by OCNPD.

1.2 CONSIDERATION FOR THE DEVELOPMENT OF ALTERNATIVES

To develop alternatives, the Product Delivery Team (PDT) evaluated the components of the proposal and information from the ongoing USACE work near the project location. The Programmatic Environmental Assessment for Selection of Recommended Projects (PEA 2018) states that the project will restore emergent marsh habitat important to migratory and resident waterfowl and provides an opportunity to remove sedimentation resulting from Hurricane Harvey, where maintenance dredging is currently not preformed due to a lack of placement areas. The proposal included the following project components: repairing an existing levee, installing approximately two miles of breakwater to create a living shoreline and stabilize the levee, site preparation (*e.g.* creating training berms), placing 1.5 million cubic yards of dredge material within the primary beneficial use area, and planting the site with native emergent plant species. The study team evaluated the proposal and came to several conclusions:

- **Proposed dredge depth and available sediment estimates:** Shoaling upstream from the project presented policy and funding challenges to allow dredging to the authorized depth of -31 feet. Recent surveys were consulted, and several channel depths were considered for evaluation with each scenario having an adjusted sediment volume available for marsh restoration. The depths and corresponding quantities are listed under the alternative descriptions below.

- **Reference site selection:** The Interagency Coordination Team (ICT) recommended using a reference location to identify target parameters for project success. General target parameters for marsh restoration projects on the Gulf Coast include target range for substrate elevation, plant species composition, and landscape composition (percentages of open water, marsh, or higher areas). The PDT the reference location recommended by the ICT, which is a completed marsh restoration project at the Lower Neches Wildlife Management Area (WMA), Old River Unit (Figure 1-2). The reference site is near the project area, used dredge material, to restore a similar amount of marsh as the proposal, and is considered a highly successful.

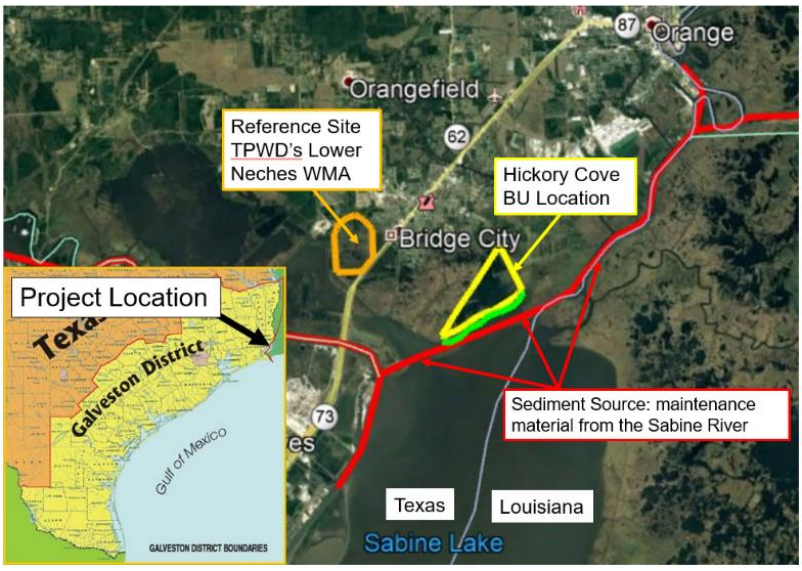

Figure 1-2. Map of Reference Site and Project Area.

- **Target elevations for marsh restoration:** The PDT reviewed information provided by the ICT and data gathered during the site visit to reference site. For the living shoreline portion of the project, *Spartina alterniflora* (smooth cordgrass) was selected as the target plant species and has an optimal substrate elevation between 0.0- to 0.5-foot North American Vertical Datum of 1988 (NAVD 88) in this region. For the portion of the project located in the impoundment, *Spartina patens* (marsh hay cordgrass) was selected as the target plant species and has an optimal substrate elevation between 0.5- to 1.2-foot NAVD 88 in this region. The Texas Parks and Wildlife Department (TPWD) provided the PDT with their analysis of the settlement rates of the beneficial use materials observed at the Lower Neches WMA, Old River Unit to help inform project design.

- **Landscape composition:** The ICT did not recommend additional considerations for landscape composition because the experience with beneficial use sites is that remnant ponds and channels will re-establish as the dredge material settles.

- **Existing Conditions:** During the site visit, the PDT conducted an elevation survey, and the boundaries of existing marsh were identified. Approximately 678 acres of open water are available for marsh restoration within the impoundment. There were several breaches in the observed in the containment levee surrounding the impoundment which allowed tidal flow into the interior portions of the impoundment. The open water areas within the impoundment were shallow (2-foot deep or less) and unvegetated. The water was highly turbid on the day of the site visit. Figure 1-3 is representative of the open water areas within the impoundment proposed for beneficial use. Section 3.1 describes the existing condition in more detail.

Figure 1-3. Picture inside the Hickory Impoundment taken on November 21, 2019.

1.2.1 Modeled Alternatives

The following alternatives were analyzed and modeled to determine the potential ecological lift or benefits of implementing the action.

- **No Action Alternative**
    - Under this scenario, no maintenance dredging or beneficial use would occur. The levee would not be repaired, and the living shoreline would not be constructed. Issues with fluctuating salinities, tidal forces, and relative sea level change would continue to convert marsh habitat to open water.
- **Alternative 1a**
    - Under this scenario the levee would be repaired, and 68 acres of palustrine emergent wetlands would be restored using approximately 500,000 cubic yards (cy) of dredge material to create suitable substrate elevations. The restored marsh would be planted with marsh hay cordgrass. The repaired levee is assumed to reduce the influence of relative sea level change (RSLC), salinity fluctuations, and tidal forces on existing and restored interior marshes (Figure 1-4).
    - This scenario does not include the breakwater in front of the repaired levee.
- **Alternative 1b**
    - Under this scenario the levee would be repaired, 126 acres of palustrine emergent wetlands would be restored using approximately 900,000 cy of dredge, and the unit would be planted with marsh hay cordgrass (Figure 1-4)
    - The assumptions applied to Alternative 1a also apply to this scenario.
- **Alternative 1c**
    - Under this scenario the levee would be repaired, 190 acres of palustrine emergent wetlands would be restored using approximately 1.3 million cy of dredge, and the unit would be planted with marsh hay cordgrass. (Figure 1-4)
    - The assumptions applied to Alternative 1a also apply to this scenario.

Figure 1-4. Alternatives 1a, 1b, and 1c

- **Alternative 2**
    - Under this scenario the levee would be repaired, 1.3 million cy of material would be used to restore 190 acres of palustrine emergent wetlands, and the unit would be planted with marsh hay cordgrass.
    - Alternative 2 also includes the construction of a breakwater, which is assumed to protect the repaired levee from erosion for the life of the project. Similar structures in the area and throughout Texas and Louisiana have protected shorelines and enhanced resilience to coastal storms (Figure 1-5

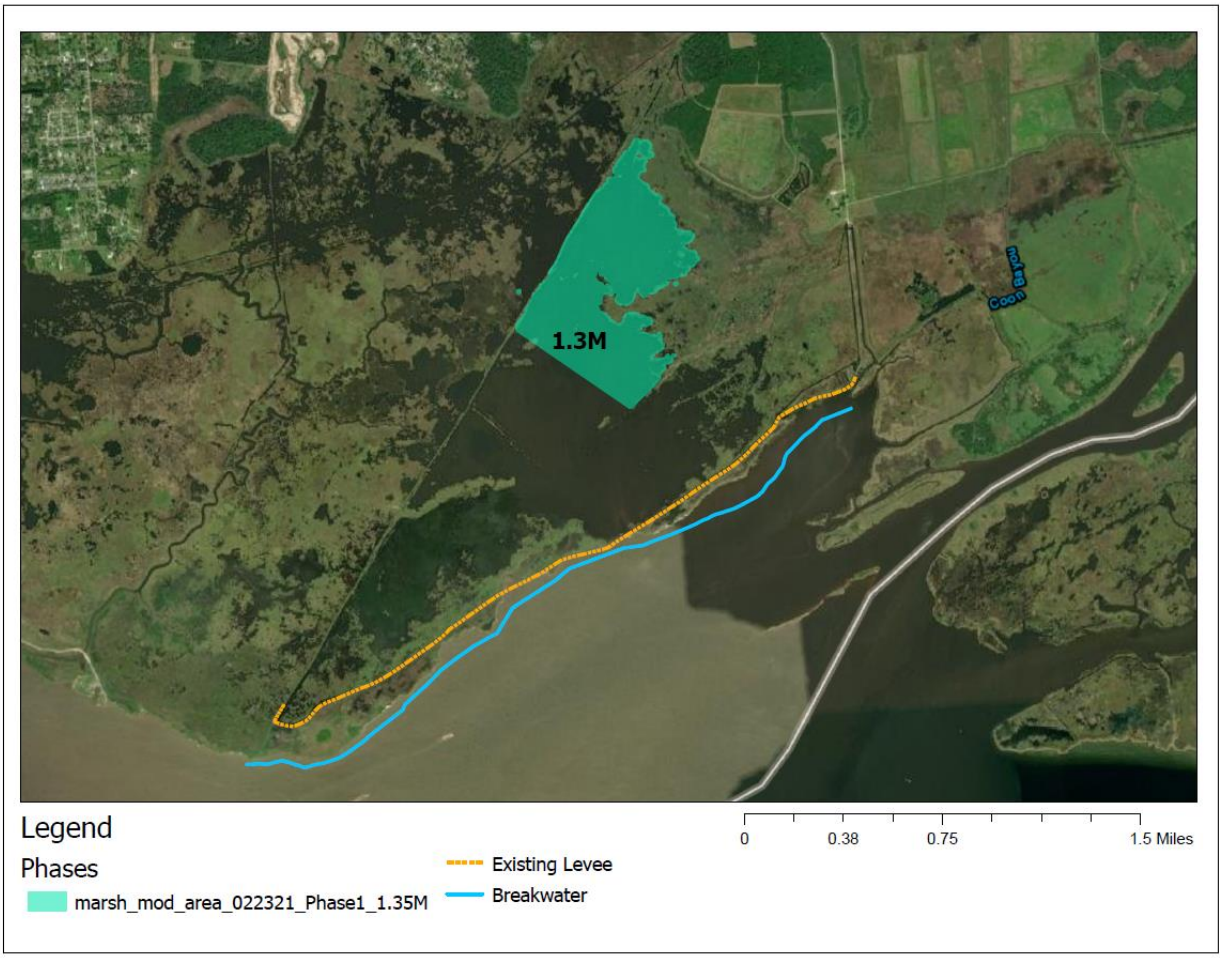

Figure 1-5. Alternative 2

- **Alternative 3**
    - Under this scenario the levee would be repaired, 1.3 million cy of material would be used to restore 190 acres of palustrine emergent wetlands, the unit would be planted with marsh hay cordgrass, and the breakwater would be constructed.
    - Alternative 3 also includes the creation of a 95-acre living shoreline between the repaired levee toe and the breakwater. Invasive plant species, primarily Chinese tallow (*Triadica sebifera*) would be removed from the levee and smooth cordgrass would be planted (Figure 1-6).

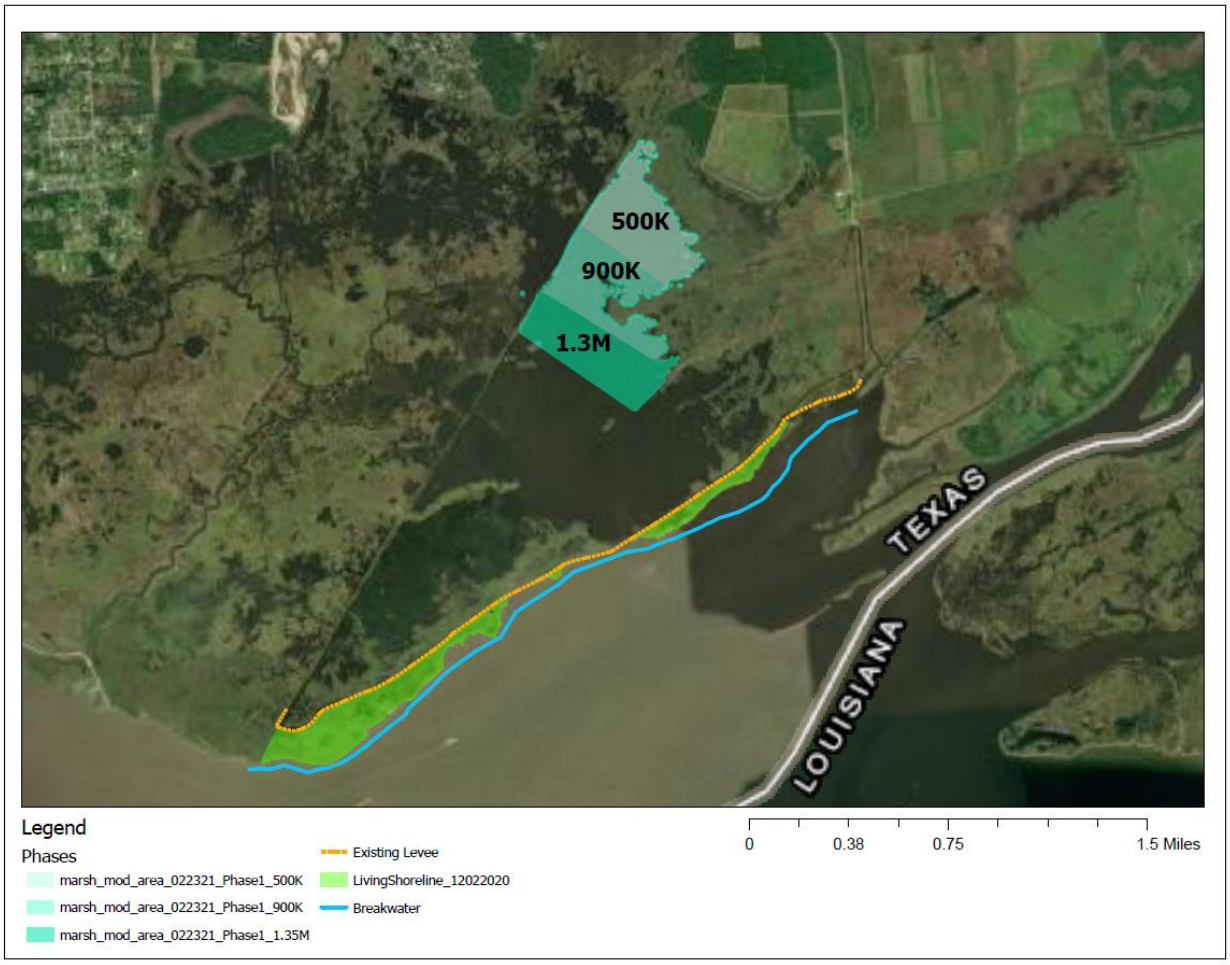

Figure 1-6. Alternative 3

2.0 ECOLOGICAL MODELING APPROACH

An Interagency Team comprised of State and Federal resource agencies was invited to participate in planning the restoration activities and to provide input on the ecological modeling strategies for the project. The team agreed that Habitat Evaluation Procedures (HEP) modeling using an USACE-certified species' model would be the best approach for the study. Several USACE-certified species' models were considered based on the range of each modeled species, existing and future cover types, and specific habitat requirements described by the models. Specifically, ecological models for the mottled duck (*Anus fulvigula*), Atlantic croaker (*Micropogonias undulatus*), Gulf Menhaden (*Brevoortia patronus*), and a general dabbling duck model were considered. The Interagency Team concurred with using the mottled duck model because several other ecological restoration projects in the region are focusing on restoring habitat that will aid in the recovery of the species (communications with TPWD, DU, and the Gulf Coast Joint Venture). Assumptions regarding the ecological modeling, the restoration measures, and stressors that led to the existing conditions at the project site were also discussed and documented by the team.

2.1 HABITAT EVALUATION PROCEDURE (HEP)

HEP involves 1) defining the study area, 2) delineating habitats (i.e. cover types) within the study area, 3) selecting HEP a model or models and/or evaluation species; and 4) characterizing the study area based on the results of the HEP. In this instance it also involved the evaluation of a nearby reference site.

HEP was developed by the US Fish and Wildlife Service (USFWS) in order to quantify the impacts of habitat changes resulting from land or water development projects (USFWS 1980). HEP is based on suitability models that provide a quantitative description of the habitat requirements for a species or group of species. HEP models use measurements of appropriate variables to rate the habitat on a scale from 0.0 (unsuitable) to 1.0 (optimal).

Habitat quality is estimated through the use of species models developed specifically for each habitat type(s). Each model consists of a 1) list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality and different variable values, and 3) a mathematical formula that combines the Suitability Index for each variable into a single value for habitat quality. The single value is referred to as the Habitat Suitability Index (HSI).

The Suitability Index graph is a graphic representation of how fish and wildlife habitat quality or "suitability" of a given habitat type is predicted to change as values of the given variable change. It also allows the model user to numerically describe, though the Suitability Index, the habitat quality of an area for any variable value. The Suitability Index ranges from 0 to 1.0, with 1.0 representing optimal condition for the variable in question.

After a Suitability Index has been developed, a mathematical formula that combines all Suitability Indices into a single HSI value is constructed. Because the Suitability Indices range from 0 to 1.0 the HSI also ranges from 0 to 1.0 and is a numerical representation of the overall or "composite" habitat quality of the particular habitat being evaluated. The HSI formula defines

the aggregation of Suitability Indices in a manner that is unique to each species depending on how the formula is constructed.

2.1.1.1 Relative Sea Level Change

The USACE guidance (USACE 2013, USACE 2014) specifies the procedures for incorporating climate change and RSLC into planning studies and environmental/engineering design projects. The proposed projects must consider measures that are formulated and evaluated for a wide range of possible future rates of RSLC. The guidance requires that alternatives be evaluated using either "low," "intermediate," or "high" rates of future RSLC, as defined below:

- **Low** – Low rates of local sea level change are determined by identifying the historical rate of local mean sea level change, which are best determined by local tide records.
- **Intermediate** – Intermediate rates of local sea level change are estimated using the modified Natural Research Council (NRC) Curve I, which is corrected for the local rate of vertical land movement.
- **High** – High rates of local sea level change are estimated using the modified NRC Curve III, which is corrected for the local rate of vertical land movement.

2.2 MOTTLED DUCK HSI

2.2.1 Variable Descriptions

- **V_1 – Percentage of unsubmerged substrate covered by rushes, bulrushes, or cattails.** Optimal nesting habitat is dominated by grasses and similarly structured vegetation.
- **V_2 – Percentage canopy cover of trees and shrubs on unsubmerged substrate.** Quality of nesting habitat decreases with increasing cover of woody vegetation; habitat with 30 percent (%) woody vegetation canopy cover is suitable.
- **V_3 – Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate.** Nesting habitat quality is related to height and density of grasses and similarly structured vegetation excluding bulrushes, rushes, and cattails.
    - Class 1. Not growing in clumps
    - Class 2. Growing in clumps; 0.25 to 0.50 meters (m) (0.82 to 1.64 feet [ft]) tall and or providing overhead cover to 1% to 15%.
    - Class 3. Growing in clumps; 0.50 to 0.75 m (1.64 to 2.46 ft) tall and or providing overhead cover to 16% to 79%.
    - Class 4. Growing in clumps with overlapping tops; >0.75 m (2.46 ft) tall and/or providing > 80% overhead cover

- Note: Calculate the percentage of total unsubmerged substrate area in each structure class (1, 2, 3, and 4). This percentage is expressed as a decimal, becomes the weighting factor (W) for each class. Calculate SI_{V_3} as follows:

$$SI_{V_3} = 0.1W_1 + 0.3W_2 + 0.6W_3 + 1.0W_4$$

- **V_4 – Percentage of continually submerged covered by woody or herbaceous emergent vegetation.** Optimal brood-rearing habitat is a submersed substrate supporting growth of emergent vegetation over 50% of its area.
- **V_5 – Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate.** Quality of emergent vegetation as escape cover is related to its height and density.
  - Class 1. < 0.3 m (< 1.0 ft) tall or too dense to allow passage of ducklings.
  - Class 2. > 0.3 m (> 1.0 ft) growing in mats or in sparse stands.
  - Class 3. 0.3 to 1.0 m (1.0 to 3.3 ft) tall and sufficiently dense to make passage difficult for a large predator (*e.g.* racoon).
  - Class 4. > 1.0 ft ((> 3.3 ft) tall and sufficiently dense to be almost impenetrable to a large predator but with openings and passageways for escape of ducklings.
  - Note: Calculate the percentage of total submerged substrate area in each structure class (1, 2, 3, 4). This percentage, expressed as a decimal, becomes the weighting factor (W) for each class. Calculate SI_{V_5} as follows:

$$SI_{V_5} = 0.0W_1 + 0.3W_2 + 0.6W_3 + 1.0W_4$$

- **V_6 – Percentage of Study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails).** Optimal reproductive habitat for mottled ducks consists of equal amounts of nesting and brood-rearing habitats.
- **V_7 – Percentage of continually submerged substrates with water depth less than 30.0 centimeters (cm) (11.8 inches) at low mean tide.** Depth of water is related to feeding efficiency of mottled duck hens and broods.
- **V_8 – Disturbance Level.** Irregular disturbance is detrimental to nesting mottled duck hens and hens with broods.
  - Class 1. Extreme: support heavy grazing or may be located within 300 m of exceedingly noisy or obtrusive industry, or other intense disturbances, such as runways. Free-ranging dogs, marsh-buggies, and motorcycles may be present.
  - Class 2. Moderate: within 25 m of roads, or within 300 m of light to moderate levels of disturbance, such as occupied dwellings, business, or light industry. Disturbances in the immediate vicinity should not be extreme, although infrequent but intense disturbances (marsh-buggies and motorcycles) may occur. Grazing should be light or absent from March to May.
  - Class 3. Minimal: at least 25 m (82 ft) from maintained roads or heavily used waterways, or at least 300 m (984 ft) from any place or structure regularly

occupied by people or dogs, or that emit machinery-caused noise at 300 m). Areas of minimal disturbance should not be subject to infrequent abrupt disturbances, such as airboats and off-road vehicles.

- Class 4. None

2.2.2 HSI Calculations:

- Nesting Hen Cover (NHC) = $(SI_{V_1} \times SI_{V_2} \times SI_{V_3})^{1/3}$
- Hen with Brood Cover (HBC) = $(SI_{V_4} \times SI_{V_5})^{1/2}$
- Cover Structure (CS) = NHC or HBC, whichever is lower
- Cover Ratio (CR) = SI_{V_6}
- Reproductive Cover Life Requisite (C) = $(CS^2 \times CR)^{1/3}$
- Food life requisite (F) = SI_{V_7}
- Other life Requisite (O) = SI_{V_8}

HSI = C, F, or O, whichever is lowest.

2.3 CALCULATION OF AVERAGE ANNUAL HABITAT UNITS

Individual species HSI scores were generated for each measure location using the species-specific spreadsheet calculators. The HSI scores were then multiplied by the acreages to calculate the Habitat Units (HUs). HUs represent a numerical combination of quality (i.e. Habitat Suitability Index) and quantity (acres) existing at any given point in time.

HUs represent a single point in time; however, the impacts of any of the proposed actions would occur over the entire planning horizon (50 years). To account for the value of change over time, when HSI scores are not available for each year of analysis, the cumulative HUs are calculated using a formula that requires only the target year (TY) and the area estimates (USFWS 1980). The following formula was used:

$$\int_0^T HU\ dt = (T_2 - T_1)\left[\left(\frac{A_1H_1 + A_2H_2}{3}\right) + \left(\frac{A_2H_1 + A_1H_2}{6}\right)\right]$$

Where:

$$\int_0^T HU\ dt = Cumulative\ HUs$$

T1= first target year of time interval

T2 = last target year of time interval

A1 = area of available habitat at beginning of time interval

A2= area of available habitat as the end of time interval

H1 = Habitat Suitability Index at the beginning of time interval

H2 = Habitat Suitability Index at the end of time interval

3 and 6 = constants derived from integration of HSI x Area for the interval between any two target years

This formula was developed to precisely calculate cumulative HUs when either HSI or area or both change over a time interval, which is common when dealing with the unevenness found in nature. HU gains or losses are annualized by summing the cumulative HUs calculated using the above equation across all target years in the period of analysis and dividing the total (cumulative HUs) by the number of years in the planning horizon (i.e. 50 years). This calculation results in the Average Annual Habitat Units (AAHUs) (USFWS 1980).

The impact of a project can be quantified by subtracting the FWP scenarios benefits/impacts from the FWOP benefits/impacts. The difference in AAHUs between the FWOP and the FWP represents the net impact attributable to the project in terms of habitat quantity and quality, where a positive number results in net benefits and a negative number results in net loss.

3.0 DATA AND ASSUMPTIONS

This section describes the methodology used to determine baseline, FWOP, and FWP conditions for the project area.

3.1 EXISTING CONDITIONS

The project area for this project includes a 1,200-acre, impoundment, known as the Hawk Club and a portion of Hickory Cove adjacent to the southeast boundary of the Hawk Club (Figure 1-1). The project area is north of and adjacent to Sabine Lake, between the confluences of both the Neches River and the Sabine River with Sabine Lake. Due to the proximity of the site to these riverine inputs and the Gulf of Mexico, this area is subject to drastic swings in salinity. Additionally, the tidal forces, river currents, boat wakes, and fetch from the prevailing southeast winds have caused extensive shoreline erosion in the region (Bureau of Economic Geology [BEG] 2017).

The primary BU placement area is approximately 1,200 acres in size and is bounded by a levee along the southeast side which has several breaches that allow for tidal exchange. As recently as 2005, the impoundment was comprised of palustrine emergent habitat with shallow ponds. Recent coastal storms like Hurricane Rita (2005), Hurricane Humberto (2007), Tropical Storm Eduardo (2008), Hurricane Gustav (2008), Hurricane Ike (2008), Hurricane Harvey (2018), and Hurricane Laura (2020), accelerated shoreline erosion causing repeated levee failures. The levee failures correspond with conversion of palustrine marsh habitat to estuarine open water habitat.

Presumably the habitat within the levee would have resembled adjacent palustrine habitat with dominant *S. patens* growing in thick clumps. Tremblay and Calnan (2009) conducted a regional analysis of wetland and aquatic habitat trends and report that the region containing the project area experienced a 58% loss of palustrine marsh habitat between 1956 and 2004 and that the majority was converted to estuarine open water habitat. The researchers (Tremblay and Calnan 2009) speculate that the shift in habitat was likely due to a combination of factors including: presence of fault lines, oil and gas industry caused subsidence, sea level rise, erosion, channelization, and canal construction.

3.1.1 Cover Type Mapping

The HEP model allows a numeric comparison of baseline conditions to each future condition and provides a combined quantitative and qualitative estimate of project-related benefits or impacts on ecosystem resources. To quantify the applicable habitat conditions within each project site, the HEP process requires that the cover types within each project footprint be quantified in terms of acres (quantity) and variables (quality) per each corresponding HSI model. The process of quantifying acres, referred to as “cover typing,” allows the user to define the differences between vegetative cover types and clearly delineate these distinctions on a map.

USGS data (Enwright et al. 2015), aerial imagery (Google Earth), and elevation data were used to evaluate and identify cover types within the project footprint and areas indirectly affected beyond the footprint. Other land cover datasets (such as USFWS National Wetland Inventory

[NWI], 2010 National Agriculture Imagery, and TPWD land cover) were considered for evaluation. However, it was determined by the ICT that the USGS land cover datasets would be most applicable because there are identified discrepancies in the other datasets that do not accurately reflect the existing conditions.

Based on the analysis, it was determined that 629 acres of existing marsh is present within the project boundaries and 856 acres (677 acres within and 180 acres outside the restoration units) is considered open water (Figure 3-1).

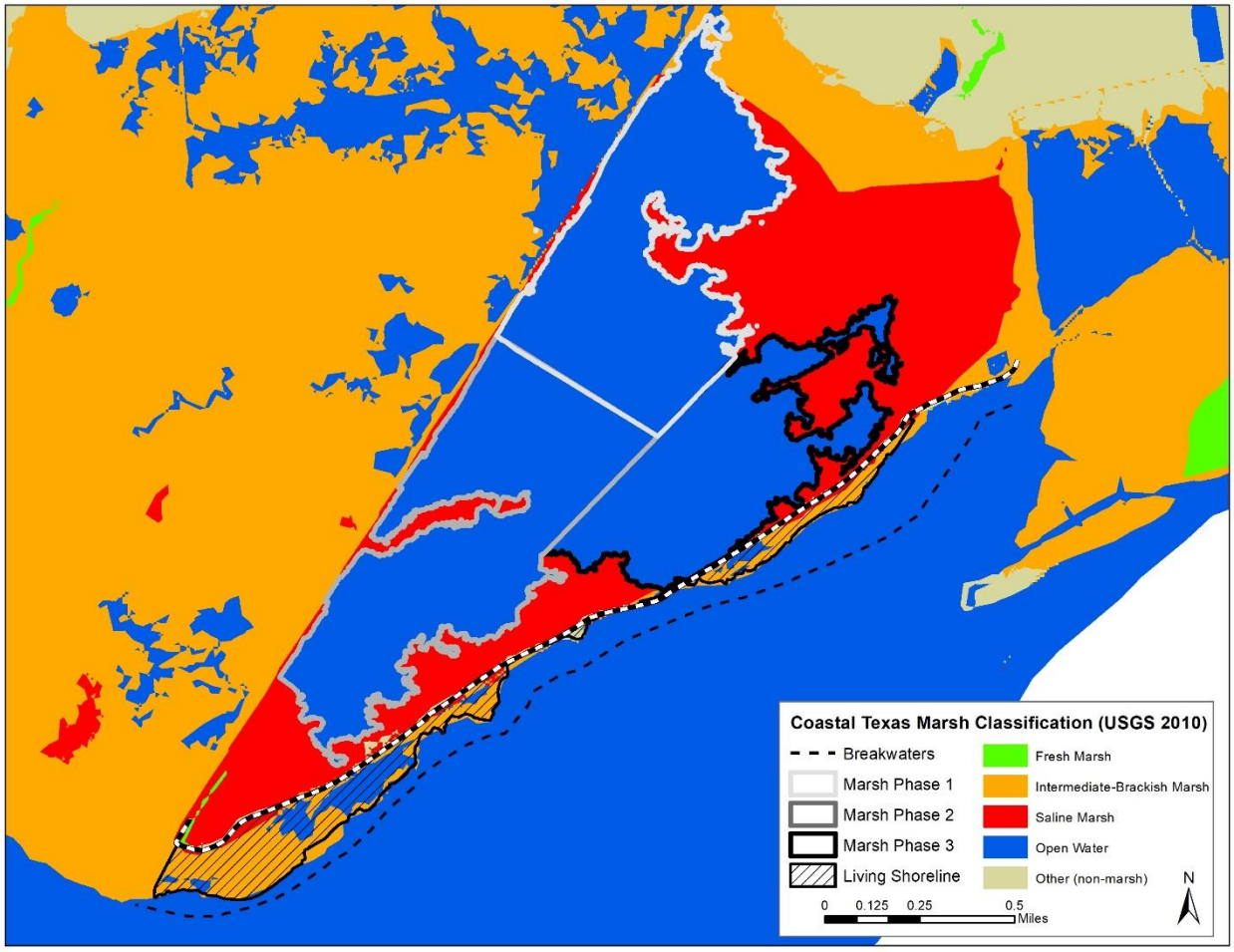

Figure 3-1. Existing habitat types within the project direct and indirect impact boundaries

3.1.2 Habitat Suitability

A site visit was conducted on November 21, 2019 by two USACE Biologists, three TPWD Biologists, and two USACE Geospatial Analysists who all contributed to defining the variable values of the Mottled Duck HSI for each data point. Elevation data and sample points were taken using the Mottled Duck HSI protocols (Table 3-3Table 3-1 and Figure 3-2). In the existing open water areas (Datapoint 3 and 4), the HSI score was 0.0, while in the existing marsh (Datapoint 1 and 2) had HSI scores of 0.37 and 0.32, respectively. For the FWOP conditions,

existing marsh was assumed to have an average HSI score of 0.35. Attachment A provides the variable data and calculations.

Table 3-1. Elevation Data, Coordinates, and General Information about the Data Points at the Project Site (Hickory Cove Marsh).

	Hickory Cove Datapoint 1	**Hickory Cove Datapoint 2**	**Hickory Cove Datapoint 3**	**Hickory Cove Datapoint 4**
Coordinates:	29.9951 -93.8152	29.9929 -93.8124	29.9956 -93.8148	29.9973 -93.8109
Elevation NAVD88 (ft)	0.4	1.0	-1.9	-0.5
Location	On the edge of existing marsh	On the edge of existing marsh	Open water	Open water
Field notes	Location near levee breach	Location on north edge of narrow marsh peninsula	No SAV, located on the east side of the project site	No SAV, located on the west side of the project site

Figure 3-2. Ecological Modeling Sample Locations in the Project Area.

3.2 FUTURE WITHOUT PROJECT (FWOP)

This scenario is synonymous with the without project alternative. Under the FWOP, RSLC and continued breaching of the levee influence future habitat types.

3.2.1 Cover Type Mapping

The National Oceanic and Atmospheric Administration (NOAA) Coastal Change Atlas Program (C-CAP) 2010 and Marsh Migration land cover datasets (NOAA, 2017b; pers. com. N. Herold [NOAA], 2017) were used to project future habitat cover types with RSLC. The ICT determined that the C-CAP data would be most acceptable for future projections because it provides future conditions that incorporate migration of plant communities due to RSLC and allow for consistency and repeatability of the model evaluations (NOAA 2017a, 2017c).

The data for the C-CAP/Marsh Migration is based on the NOAA RSLC curves which is slightly more aggressive that the USACE curves. In order to cross-walk the NOAA RSLC curves to the USACE RSLC curves, target years were selected to correspond to 0.5-foot changes in sea level as identified using the USACE intermediate curve for the project period of analysis (2023-2073). The year 2075 was assumed to be similar and close enough in time to be representative of conditions anticipated in 2073, the end of the 50-year period of analysis. Table 3-2 shows the predicted rate of marsh habitat conversion to open water that was developed using data output from NOAA's marsh migration viewer geospatial tool (Figure 3-3).

Table 3-2. Relative Sea Leave Change predictions using the USACE Intermediate Curve and the NOAA Marsh Migration Viewer.

NOAA Elevation (MHHW)	Correlated USACE Int Curve elevation (MHHW)	Corresponding year	Target Year (Predicted start 2023)	Percent Marsh Remaining	Area Marsh Remaining (acres)
0.0	1.30	2023	0	100%	629
+0.5	1.79	2042	19	25%	157
+1.0	2.31	2060	37	15%	94
+1.5	2.79	2075	52*	2%	12.58
+2.0	3.31	2090	67*	0%	0
*Beyond 50-year planning horizon					

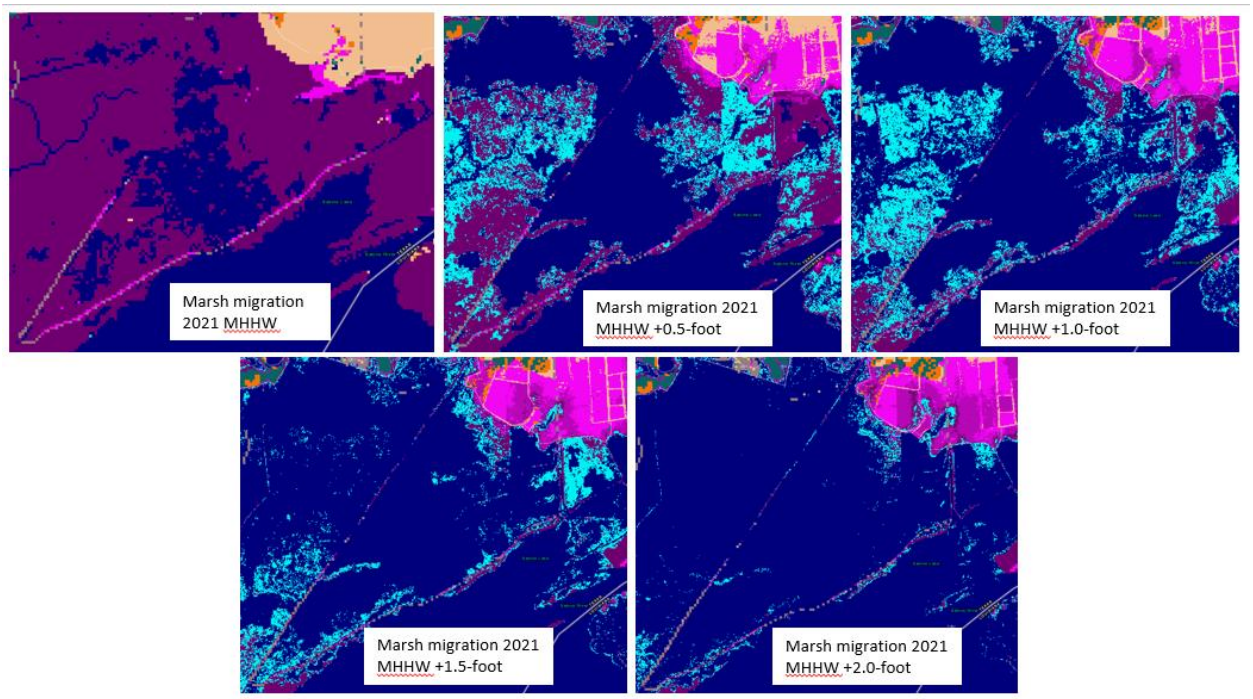

Figure 3-3. Data takes from the NOAA Sea Level Rise Marsh Migration Viewer geospatial tool.

3.3 FUTURE WITH PROJECT

The FWP condition involves the various modeled alternatives each expanding upon the previous to enhance the resiliency of the restored areas to future conditions.

3.3.1 Repair of Containment Levee

By repairing the existing containment levee, restored marsh would be protected from tidal inundation and saltwater intrusion. However, the length of protection is influenced on future breaching caused by erosion or RSLC.

Without erosion protection the repaired levee would be subject to future breaching about 10 years after initial construction, assuming an average erosion rate of existing shoreline of about 2.8 feet per year, as determined by Paine *et al.* (2016) for the Texas bay high bluff shorelines. The rate of marsh loss once the levee is breached was calculated using Google Earth imagery was assumed to follow the historic marsh loss observed in 2005 when the levee first failed (Table 3-4 and Figure 3-4).

Table 3-3. Estimates of Marsh Losses Following 2005 Levee Failure

	Aerial Imagery Year			
	2005	**2010**	**2013**	**2015**
Percent Marsh Remaining	100%	50%	30%	0%

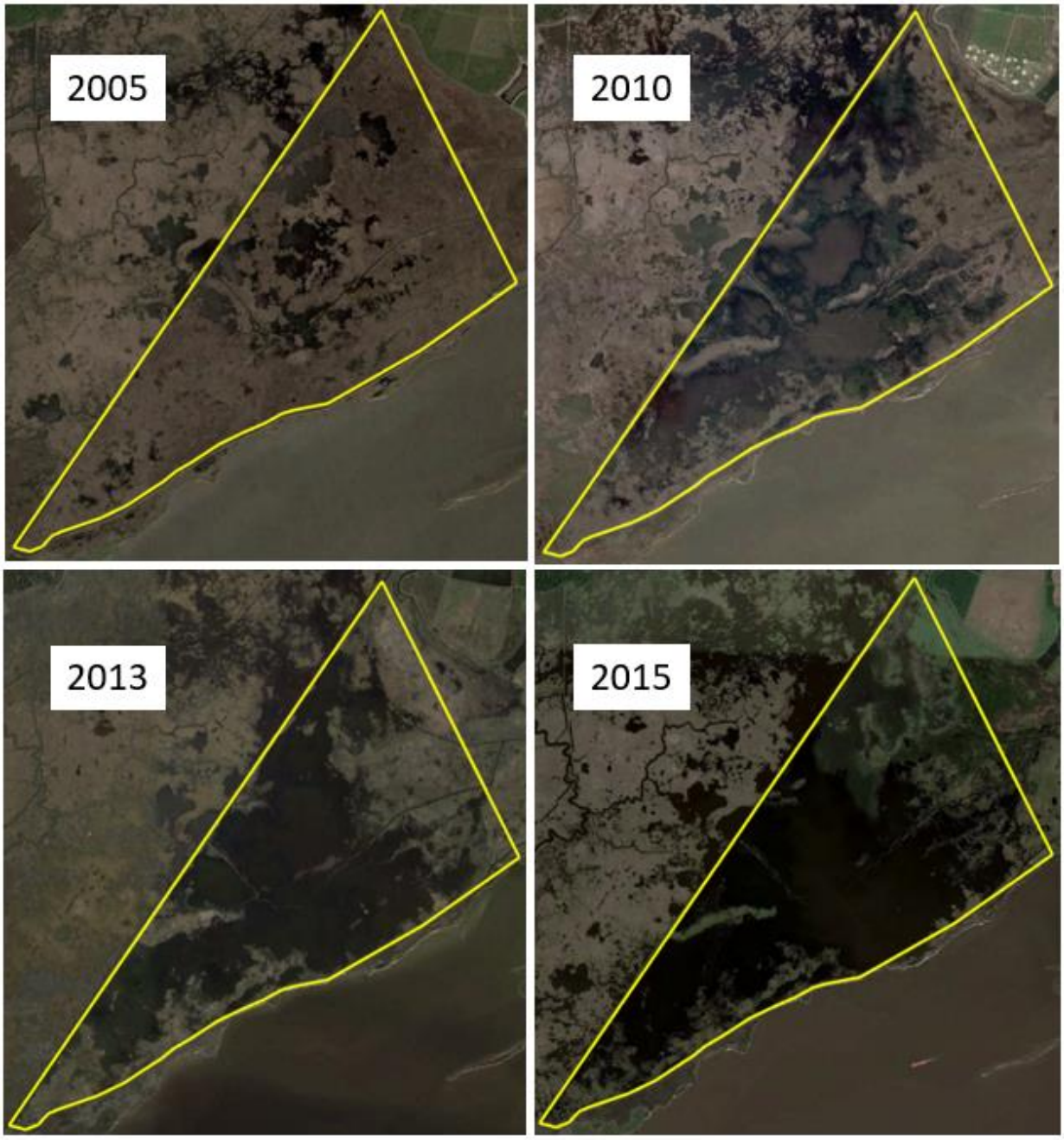

Figure 3-4. Google Earth Aerial Imagery showing progressive marsh loss at Hickory Cove after levee failure from several coastal storms (Hurricane Rita in 2005, Hurricane Humberto in 2007, Hurricane Gustav in 2008, and Hurricane Ike again in 2008).

3.3.2 Restored Marsh Areas

The ICT recommended using the Lower Neches WMA Old River Unit as a reference location to identify target parameters (e.g. substrate elevation, plant species composition, ratio of open water to marsh to higher areas) for project success and as a means to project habitat quality post-construction.

Data was taken within the restored area to represent successfully restored marsh and outside but near the restored area for comparison to the existing conditions at the project site. During the site visit, location data, and elevation data were recorded at four locations (Table 3-4 and Figure 3-5). The restored sample points (LNDP1 and LNDP2) both had an HSI score of 0.6 and the areas outside the restoration units (LNDP3 and LNDP4) had an HSI score of 0.0. Attachment A provides the variable data and calculations.

Table 3-4. Elevation Data, Coordinates, and General Information about the Data Points at the Reference Site (Old River Unit of the Lower Neches WMA).

	Lower Neches Datapoint 1 (LNDP1)	**Lower Neches Datapoint 2 (LNDP2)**	**Lower Neches Datapoint 3 (LNDP3)**	**Lower Neches Datapoint 4 (LNDP4)**
Coordinates:	3593633.477 E 13949521.985 N	3595488.105 E 13954788.432 N	3592931.107 E 13949035.47 N	3592137.307 E 13948849.28 N
Elevation NAVD88 (ft)	0.179	0.435	-1.951	0.212
Restored/not restored	restored	restored	not restored	not restored
Field notes description	edge of restored marsh	internal portion of restored marsh	open water	Degrading area outside of restoration

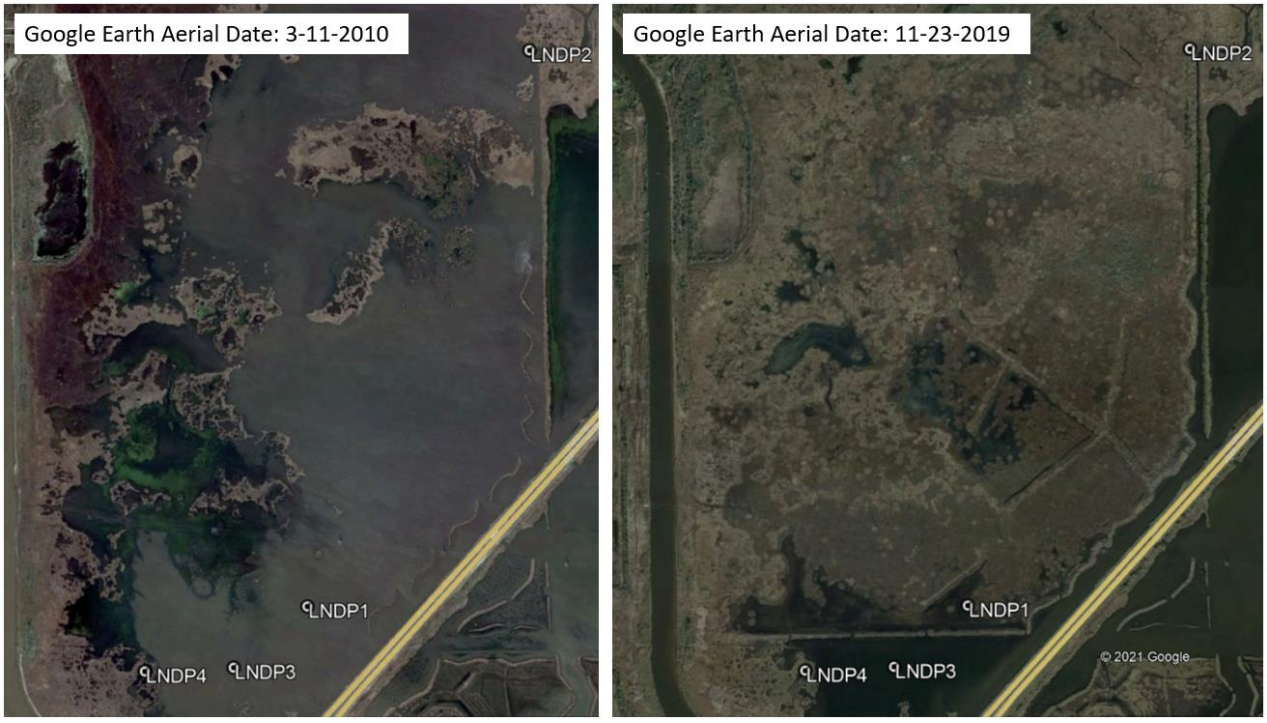

Figure 3-5. Modeling sample locations at the Lower Neches Wildlife Management Area Old River Unit

Aerial imagery from Google Earth was used to estimate the time required for necessary plant communities to establish after dredging restores the appropriate substrate elevations and to achieve a 0.6 suitability score (Table 3-5 and Figure 3-6). It is estimated that it will take 3 years to achieve dense vegetation over 100% of the restored area. These estimates were compared to the settlement rate data provided by TPWD to ensure the conclusions were consistent.

Table 3-5. Target Years for Restoration Success

Imagery Date	Corresponding Target Year	Percentage of restored area containing dense emergent vegetation
March 11, 2010	0	0%
November 10, 2011	1	0%
February 28, 2013	2	60%
October 3, 2014	3	100%

3.3.3 Breakwater Influence

Several studies (Vona *et al.* 2020) have documented the ability of breakwaters to protect shorelines from the effects of wave energy and the ability of those structures to increase sedimentation rates. These findings are consistent with similar nearby projects (McFaddin NWR and JD Murphree WMA), where breakwaters installed along the GIWW accreted marsh habitat between the breakwater and the living shoreline.

For this ecological modeling, the results of two studies (Vona *et al.* 2020 and Feagin and Yeager 2007) were used to estimate the potential effect of the proposed breakwater to increase accretion rates which would dampen the elevation change from RSLC. Vona *et al.* (2020) reported potential increases in sediment deposition into the marsh behind the breakwater averaging 20-40%, proportional to the slope and distance of the breakwater from the shoreline. Feagin and Yeager (2007) used radio isotope analysis and reported that an area with some faulting displacement had an accretion rate on 0.2 cm yr^{-1}. To estimate the increase in accretion expected to occur between the proposed breakwater and the existing shoreline (location of the living shoreline), a 30% (midpoint between 20-40%) increase in accretion (above the assumed baseline 0.2 cm yr^{-1}) was used and resulted in a FWP estimate of 0.26 cm yr^{-1} which was rounded up to approximately 0.1 ft yr^{-1}.

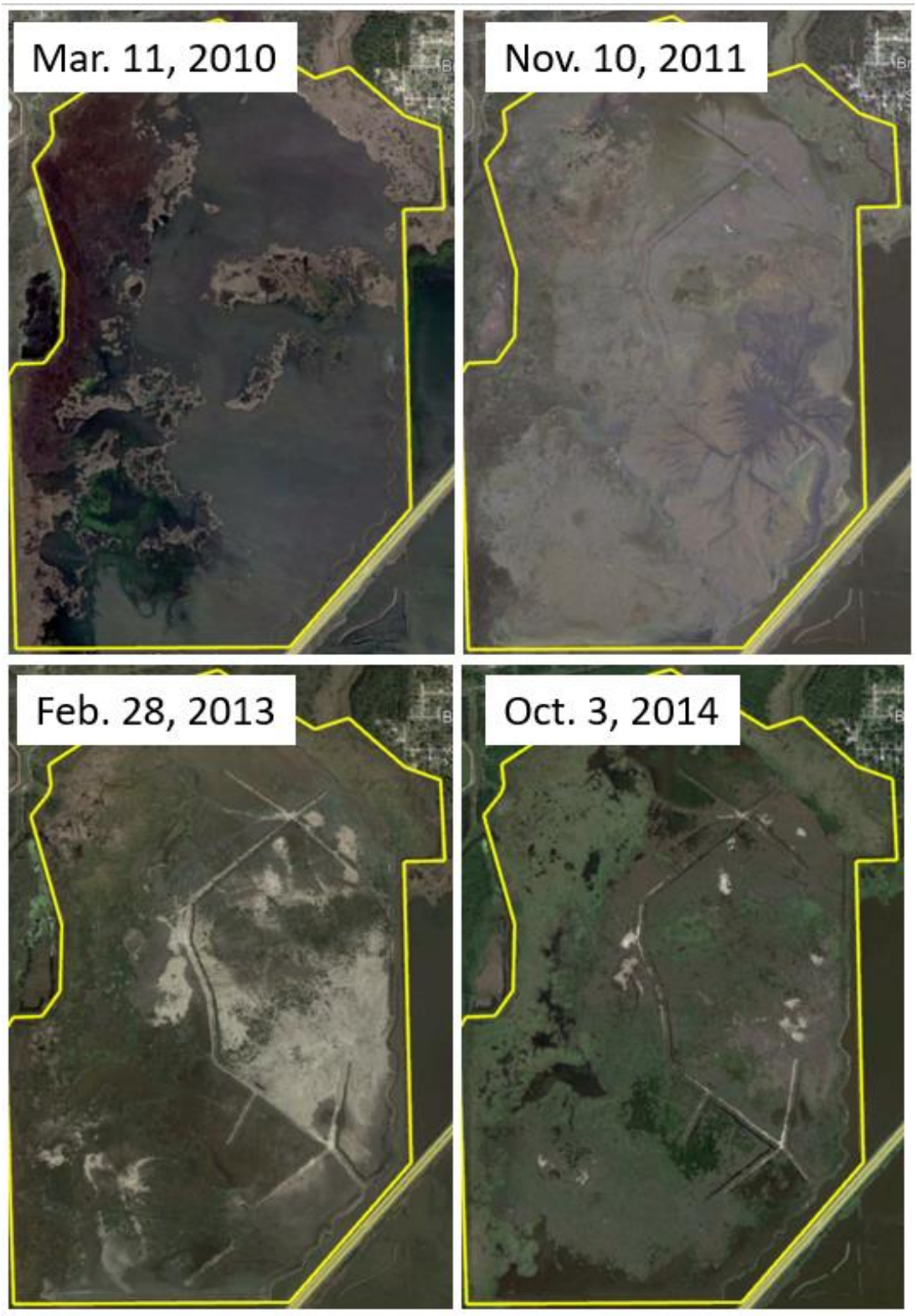

Figure 3-6. Google Earth Imagery depicting recovery of plant communities at the Lower Neches Wildlife Management Area

Table 3-6. FWP Vegetated Surface Area Projections for the Living Shoreline with Breakwater

Target Year	Years Post-Construction	Elevation Change (ft)			Acreage of Living Shoreline within *S. alterniflora* preferred elevation range* Elevations given for T_0 in NAVD 88			
		w/ RSLC	w/ breakwater	w/ accretion	-0.5 ft	0 ft	0.5 ft	Remaining Living Shoreline
2023	0	0	0.0	0	31.7	31.7	31.7	95.1
2042	19	0.5	0.2	0.3	0	31.7	31.7	63.4
2060	37	1.0	0.4	0.6	0	15.8**	31.7	47.5
2075	52*	1.5	0.5	1	0	0	31.7	31.7

* The slope of the living shoreline was assumed to be uniform and the proportion of the area by elevation was estimated to be 25% by half foot increment (31.7 acres =1/3 of ~95 acres)
**-0.6-foot NAVD 88 is within 1/10 of a foot of the acceptable elevation range for *S. alterniflora* so 50% was assumed to remain and 50% was assumed lost.
*** -0.5 to +1-foot NAVD 88 is the presumed acceptable range for *S. alterniflora* with 0.0 to 0.5-foot NAVD 88 considered optimal (*Comm. with TPWD*).

4.0 MODELING RESULTS

As expected, each incremental alternative resulted in more AAHUs, which is reflective of the resiliency provided by the added measures. Alternatives would be expected to produce between 70.5 and 291.7 AAHUs. Table 4-1 shows the net change in AAHUs broken down by measure, as compared to Table 4-2 which shows the net change by alternatives in comparison to the FWOP condition for existing marsh and restored areas.

Table 4-1. Summary of net change in AAHUs anticipated with implementation of each alternative

Alternative	AAHUs					
	Levee Repair W/O Breakwater	Levee Repair W/ Breakwater	BU W/O Breakwater	BU W/ Breakwater	Living Shoreline	Total
1a (68 acres)	61.1	_	9.4	_	_	70.5
1b (126 acres)	61.1	_	17.4	_	_	78.5
1c (190 acres)	61.1	_	26.2	_	_	87.3
2 (190 acres)	_	147.2	_	109.4	_	256.4
3 (190 acres)	_	147.2	_	109.4	35.1	291.7

Table 4-2. Net change in AAHUs

Alt	FWOP (AAHUs)			FWP (AAHUs)			Net Change (AAHUs)		
	Existing Marsh	Restored Area*	Total	Existing Marsh	Restored Area	Total	Existing Marsh	Restored Area	Total
1a	73.0	0.00	73.0	134.1	9.4	143.5	61.1	9.4	70.5
1b	73.0	0.00	73.0	134.1	17.4	151.5	61.1	17.4	78.5
1c	73.0	0.00	73.0	134.1	26.2	160.3	61.1	26.2	87.3
2	73.0	0.00	73.0	220.2	109.4	329.6	147.2	109.4	256.6
3	73.0	0.00	73.0	220.2	144.5+	329.6	147.2	144.5+	291.7

* Restored Area is synonymous with the FWOP existing open water area

\+ This includes the benefits to the existing shoreline and not just the marshes in the interior.

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ATTACHMENT A

Modeling Spreadsheets

Lower Neches Wildlife Management Area (ER Reference Site for Future With Project Conditions Projections)

Site Name= Lower Neches DP1

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	0	1
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Growing in clumps; 0.5m to 0.75m (1.64' to 2.46') and/	0.6
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	30	0.666
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	0.3m to 1.0m (1.0' to 3.3') tall and sufficiently dense to	0.6
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	40	1
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	100	1
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.8435763
Hen with Brood Cover=	0.6321392
Cover Structure=	0.6321392
Cover Ratio=	1
Reproductive Cover=	0.7367859
Food=	1
Other=	0.6
Mottled Duck HSI=	**0.6**

Site Name= Lower Neches DP2

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	50	0.5
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Growing in clumps with overtopping tops; >0.75m (2	1
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	20	0.444
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	0.3m to 1.0m (1.0' to 3.3') tall and sufficiently dense	0.6
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	40	1
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	100	1
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.7938839
Hen with Brood Cover=	0.5161395
Cover Structure=	0.5161395
Cover Ratio=	1
Reproductive Cover=	0.6437287
Food=	1
Other=	0.6
Mottled Duck HSI=	**0.6**

Lower Neches Wildlife Management Area (ER Reference Site for No Action Condition Projections)

Site Name= Lower Neches DP3

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	0	1
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Not growing in clumps	0.1
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	0	0
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	<0.3m (<1.0') tall or too dense to allow passage of duck	0
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	10	0.25
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	20	0.2
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.4645153
Hen with Brood Cover=	0
Cover Structure=	0
Cover Ratio=	0.25
Reproductive Cover=	0
Food=	0.2
Other=	0.6
Mottled Duck HSI=	**0**

Site Name= Lower Neches DP4

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	10	0.9
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Growing in clumps; 025m to 0.5m (o.82' to 1.64') ta	0.3
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	20	0.444
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	<0.3m (<1.0') tall or too dense to allow passage of d	0
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	10	0.25
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	75	0.75
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.6466126
Hen with Brood Cover=	0
Cover Structure=	0
Cover Ratio=	0.25
Reproductive Cover=	0
Food=	0.75
Other=	0.6
Mottled Duck HSI=	**0**

Hickory Cove -- Existing Marsh (Existing Condition)

Site Name= Hickory Cove Marsh DP1

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	0	1
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Growing in clumps; 025m to 0.5m (o.82' to 1.64') tall a	0.3
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	30	0.666
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	>=0.3m (>=1.0') growing in mats or in sparse stands	0.3
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	10	0.25
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	50	0.5
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.6697017
Hen with Brood Cover=	0.4469899
Cover Structure=	0.4469899
Cover Ratio=	0.25
Reproductive Cover=	0.3686484
Food=	0.5
Other=	0.6
Mottled Duck HSI=	**0.3686484**

Site Name= Hickory Cove Marsh DP2

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	0	1
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Growing in clumps; 025m to 0.5m (o.82' to 1.64') ta	0.3
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	20	0.444
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	>=0.3m (>=1.0') growing in mats or in sparse stands	0.3
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	10	0.25
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	50	0.5
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.6697017
Hen with Brood Cover=	0.3649658
Cover Structure=	0.3649658
Cover Ratio=	0.25
Reproductive Cover=	0.3220875
Food=	0.5
Other=	0.6
Mottled Duck HSI=	**0.3220875**

Hickory Cove -- Existing Open Water (Existing Condition)

Site Name= Hickory Cove Marsh DP3

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	0	1
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Not growing in clumps	0.1
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	0	0
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	<0.3m (<1.0') tall or too dense to allow passage of duck	0
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	0	0
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	75	0.75
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.4645153
Hen with Brood Cover=	0
Cover Structure=	0
Cover Ratio=	0
Reproductive Cover=	0
Food=	0.75
Other=	0.6
Mottled Duck HSI=	**0**

Site Name= Hickory Cove Marsh DP4

	Variable	Data Entry Column	Suitability Index
1	Percentage of unsubmerged substrate coverd by rushes, bulrushes, or cattails	0	1
2	Percentage canopy cover of trees and shrubs on unsubmerged substrate	0	1
3	Structure of herbaceous vegetation (excluding rushes, bulrushes, and cattails) on unsubmerged substrate	Not growing in clumps	0.1
4	Percentage of continually submerged substrate covered by woody or herbaceous vegetation	0	0
5	Structure of woody or herbaceous emergent vegetation growing in continually submerged substrate	<0.3m (<1.0') tall or too dense to allow passage of d	0
6	Percentage of study area that is land (substrate not submerged and not supporting growth of rushes, bulrushes, or cattails)	0	0
7	Percentage of continually submerged substrates with water depth less than 30.0 cm (11.8") at low mean tide	50	0.5
8	Disturbance level	Minimal	0.6

Nesting Hen Cover=	0.4645153
Hen with Brood Cover=	0
Cover Structure=	0
Cover Ratio=	0
Reproductive Cover=	0
Food=	0.5
Other=	0.6
Mottled Duck HSI=	**0**

Alternative 1A

Existing Marsh

Condition: Future Without Project

(Existing Containment Levee Continues to Breach)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	157	0.35	54.95	2613.45
37	94	0.35	32.90	790.65
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	73.0

Condition: Future With Project

(Existing Containment Levee Restored)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	629	0.35	220.15	4182.85
37	94	0.35	32.90	2277.45
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	134.1

Model Assumptions:

Existing Marsh Acres: 629 acres

TY10= Levee Failure

TY19= +0.5 ft RSLR, converts 25% of existing marsh to open water

TY37= +1.0 ft RSLR, converts 85% of existing marsh to open water

TY50= +1.5 ft RSLR, converts 98% of existing marsh to open water

Existing Open Water

Condition: Future Without Project

(Existing Containment Levee Continues to Breach, No Marsh Restoration)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.60	0.00	0.00
2	0	0.60	0.00	0.00
3	0	0.60	0.00	0.00
15	0	0.60	0.00	0.00
18	0	0.60	0.00	0.00
20	0	0.60	0.00	0.00
50	0	0.60	0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	0.0

Condition: Future With Project

(Existing Containment Levee Restored and Dredged Material Placed in Open Water to Restore Marsh)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	41	0.60	24.48	8.16
3	68	0.60	40.80	32.64
15	34	0.60	20.40	367.20
18	20	0.60	12.24	48.96
20	0	0.60	0.00	12.24
50	0	0.60	0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	9.4

FWP Model Assumptions:

Marsh Acres Restored: 68 acres

TY2= 60% of marsh successfully restored (based on ref site)

TY3= 100% of marsh successfully restored (based on ref site)

TY10= Levee Failure

TY15= 50% of restored marsh remaining (34 acres)

TY18= 30% of restored marsh remaining (20.4 acres)

TY20= 0% of restored marsh remaining

Alt 1A -- Net Change in AAHUs

	Existing Marsh	Existing Open Water	Total
Future With Project AAHUs	134.1	9.4	143.5
Future Without Project AAHUs	73.0	0.0	73.0
Net Change	61.1	9.4	70.5

Alternative 1B

Existing Marsh

Condition: Future Without Project

(Existing Containment Levee Continues to Breach)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	157	0.35	54.95	2613.45
37	94	0.35	32.90	790.65
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	**50**		**AAHUs=**	**73.0**

Condition: Future With Project

(Existing Containment Levee Restored)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	629	0.35	220.15	4182.85
37	94	0.35	32.90	2277.45
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	**50**		**AAHUs=**	**134.1**

Model Assumptions:

Existing Marsh Acres: 629 acres

TY10= Levee Failure

TY19= +0.5 ft RSLR, converts 25% of existing marsh to open water

TY37= +1.0 ft RSLR, converts 85% of existing marsh to open water

TY50= +1.5 ft RSLR, converts 98% of existing marsh to open water

Existing Open Water

Condition: Future Without Project

(Existing Containment Levee Continues to Breach, No Marsh

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	0	0.60	0.00	0.00
3	0	0.60	0.00	0.00
15	0	0.60	0.00	0.00
18	0	0.60	0.00	0.00
20	0	0.60	0.00	0.00
50	0	0.00	0.00	0.00
			0.00	0.00
Max TY=	**50**		**AAHUs=**	**0.0**

Condition: Future With Project

(Existing Containment Levee Restored and Dredged Material Placed in Open Water to Restore Marsh)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	76	0.60	45.36	15.12
3	126	0.60	75.60	60.48
15	63	0.60	37.80	680.40
18	38	0.60	22.68	90.72
20	0	0.60	0.00	22.68
50	0	0.00	0.00	0.00
			0.00	0.00
Max TY=	**50**		**AAHUs=**	**17.4**

FWP Model Assumptions:

Marsh Acres Restored: 126 acres

TY2= 60% of marsh successfully restored (based on ref site)

TY3= 100% of marsh successfully restored (based on ref site)

TY10= Levee Failure

TY15= 50% of restored marsh remaining

TY18= 30% of restored marsh remaining

TY20= 0% of restored marsh remaining

Alt 1B -- Net Change in AAHUs

	Existing Marsh	Existing Open Water	Total
Future With Project AAHUs	134.1	17.4	151.5
Future Without Project AAHUs	73.0	0.0	73.0
Net Change	61.1	17.4	78.5

Alternative 1C

Existing Marsh

Condition: Future Without Project

(Existing Containment Levee Continues to Breach)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	157	0.35	54.95	2613.45
37	94	0.35	32.90	790.65
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	73.0

Condition: Future With Project

(Existing Containment Levee Restored)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	629	0.35	220.15	4182.85
37	94	0.35	32.90	2277.45
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	134.1

Model Assumptions:

Existing Marsh Acres: 629 acres

TY10= Levee Failure

TY19= +0.5 ft RSLR, converts 25% of existing marsh to open water

TY37= +1.0 ft RSLR, converts 85% of existing marsh to open water

TY50= +1.5 ft RSLR, converts 98% of existing marsh to open water

Existing Open Water

Condition: Future Without Project

(Existing Containment Levee Continues to Breach, No Marsh Restoration)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	0	0.60	0.00	0.00
3	0	0.60	0.00	0.00
15	0	0.60	0.00	0.00
18	0	0.60	0.00	0.00
20	0	0.60	0.00	0.00
50	0	0.00	0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	0.0

Condition: Future With Project

(Existing Containment Levee Restored and Dredged Material Placed in Open Water to Restore Marsh)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	114	0.60	68.40	22.80
3	190	0.60	114.00	91.20
15	95	0.60	57.00	1026.00
18	57	0.60	34.20	136.80
20	0	0.60	0.00	34.20
50	0	0.00	0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	26.2

FWP Model Assumptions:

Marsh Acres Restored: 190 acres

TY2= 60% of marsh successfully restored (based on ref site)

TY3= 100% of marsh successfully restored (based on ref site)

TY10= Levee Failure

TY15= 50% of restored marsh remaining

TY18= 30% of restored marsh remaining

TY20= 0% of restored marsh remaining

Alt 1C -- Net Change in AAHUs

	Existing Marsh	Existing Open Water	Total
Future With Project AAHUs	134.1	26.2	160.3
Future Without Project AAHUs	73.0	0.0	73.0
Net Change	61.1	26.2	87.3

Alternative 2

Existing Marsh

Condition: Future Without Project
(Existing Containment Levee Continues to Breach)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	157	0.35	54.95	2613.45
37	94	0.35	32.90	790.65
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	73.0

Condition: Future With Project
(Existing Containment Levee Restored and Protected by a Breakwater)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	629	0.35	220.15	4182.85
37	629	0.35	220.15	3962.70
50	629	0.35	220.15	2861.95
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	220.2

FWP Model Assumptions:
Existing Marsh Acres: 629 acres
No Levee Failure
Levee assumed of sufficient height to protect against SLR

Existing Open Water

Condition: Future Without Project
(Existing Containment Levee Continues to Breach, No Marsh Restoration)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	190	0.00	0.00	
1	190	0.00	0.00	0.00
2	190	0.00	0.00	0.00
3	190	0.00	0.00	0.00
19	190	0.00	0.00	0.00
37	190	0.00	0.00	0.00
50	190	0.00	0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	0.0

Condition: Future With Project
(Existing Containment Levee Restored, Breakwaters Constructed, and Dredged Material Placed in Open Water to Restore Marsh)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	114	0.60	68.40	22.80
3	190	0.60	114.00	91.20
19	190	0.60	114.00	1824.00
37	190	0.60	114.00	2052.00
50	190	0.60	114.00	1482.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	109.4

FWP Model Assumptions:
Marsh Acres Restored: 190 acres
TY2= 60% of marsh successfully restored (based on ref site)
TY3= 100% of marsh successfully restored (based on ref site)
No Levee Failure

Alt 2 -- Net Change in AAHUs

	Existing Marsh	Existing Open Water	Total
Future With Project AAHUs	220.2	109.4	329.6
Future Without Project AAHUs	73.0	0.0	73.0
Net Change	147.2	109.4	256.6

Alternative 3

Existing Marsh

Condition: Future Without Project
(Existing Containment Levee Continues to Breach)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	157	0.35	54.95	2613.45
37	94	0.35	32.90	790.65
50	13	0.35	4.55	243.43
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	73.0

Condition: Future With Project
(Existing Containment Levee Restored and Protected by a Breakwater)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	629	0.35	220.15	
19	629	0.35	220.15	4182.85
37	629	0.35	220.15	3962.70
50	629	0.35	220.15	2861.95
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	220.2

FWP Model Assumptions:
Existing Marsh Acres: 629 acres
No Levee Failure

Existing Open Water

Condition: Future Without Project
(Existing Containment Levee Continues to Breach, No Marsh Restoration)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	190	0.00	0.00	
1	190	0.00	0.00	0.00
2	190	0.00	0.00	0.00
3	190	0.00	0.00	0.00
19	190	0.00	0.00	0.00
37	190	0.00	0.00	0.00
50	190	0.00	0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	0.0

Condition: Future With Project
(Existing Containment Levee Restored, Breakwaters Constructed, and Dredged Material Placed in Open Water to Restore Marsh)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	114	0.60	68.40	22.80
3	190	0.60	114.00	91.20
19	190	0.60	114.00	1824.00
37	190	0.60	114.00	2052.00
50	190	0.60	114.00	1482.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	109.4

FWP Model Assumptions:
Marsh Acres Restored: 190 acres
TY2= 60% of marsh successfully restored (based on ref site)
TY3= 100% of marsh successfully restored (based on ref site)
No Levee Failure

Existing Shoreline

Condition: Future Without Project
(Existing shoreline continues to erode)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	0	0.00	0.00	
1	0	0.00	0.00	0.00
2	0	0.00	0.00	0.00
3	0	0.00	0.00	0.00
19	0	0.00	0.00	0.00
37	0	0.00	0.00	0.00
50	0	0.00	0.00	0.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	0.0

Condition: Future With Project
(Living shoreline constructed along the existing shoreline on the exterior of the containment levee)

TY	Acres	HSI	Total HUs	Cumulative HUs
0	95	0.00	0.00	
1	95	0.00	0.00	0.00
2	95	0.60	57.00	28.50
3	95	0.60	57.00	57.00
19	63	0.60	37.80	758.40
37	48	0.60	28.80	599.40
50	32	0.60	19.20	312.00
			0.00	0.00
			0.00	0.00
Max TY=	50		AAHUs=	35.1

Model Assumptions:
Restored Marsh Acres: 95 acres
TY19= +0.5 ft RSLR, converts 25% of existing marsh to open water
TY37= +1.0 ft RSLR, converts 85% of existing marsh to open water
TY50= +1.5 ft RSLR, converts 98% of existing marsh to open water

Alt 3 -- Net Change in AAHUs

	Existing Marsh	Existing Open Water	Existing Shoreline	Total
Future With Project AAHUs	220.2	109.4	35.1	364.7
Future Without Project AAHUs	73.0	0.0	0.0	73.0
Net Change	147.2	109.4	35.1	291.7