Permittee Responsible Mitigation Plan

Laguna Madre Permittee Responsible Mitigation

Los Fresnos, Cameron County, Texas

Prepared For:

Ecosystem Investment Partners

EIP IV Credit Co, LLC
5550 Newbury St, Suite B
Baltimore, Maryland

Prepared by:

AMBIOTEC GROUP

Ambiotec Environmental Consultants, Inc.
1101 E Harrison Ave
Harlingen, Texas

March 2022

Table of Contents

TABLES

FIGURES

APPENDICES

SUPPORTING DOCUMENTATION

Hydrologic Modeling of Laguna Madre Wetland Mitigation Bank

1.0 INTRODUCTION

1.1 Overview

This Permittee Responsible Mitigation Plan ("PRMP"), hereafter referred to as the "Project", outlines mitigation measures that applicant/permittee, Texas LNG Brownsville, LLC, propose to mitigate unavoidable wetland impacts resulting from the proposed construction of a liquified natural gas (LNG) terminal facility ("Terminal") at the Port of Brownsville (U.S. Army Corps of Engineers Permit # SWG-2015-00175). This mitigation plan was prepared in accordance with the U.S. Army Corps of Engineers ("USACE") compensatory mitigation regulations relating to losses of aquatic resources, as codified in 33 CFR § 332.

Due to limitations in available acreage at the Terminal, on-site compensatory mitigation measures were deemed insufficient to meet the Project needs; therefore, an offsite[1] in-kind[2], and a small amount of offsite out-of-kind permittee responsible mitigation approach was determined to be the most environmentally preferable. Since the Laguna Madre Permittee Responsible Mitigation ("LMPRM") is located within the same river basin (the Nueces-Rio Grande Coastal Basin) as the Terminal site, and is characterized by similar geologic influences and ecological composition, the site was selected as the most practicable alternative to meet the requirements of 33 CFR § 332. As the mitigation provider, EIP IV Credit Co., LLC (EIP) would construct, monitor, and manage the established wetland preserve for a period of five years in the manner presented herein, as well as place a permanent conservation easement over the LMPRM and act as Long Term Steward.

Under the proposed activities associated with constructing the LMPRM, an approximately 117-acre tidal mudflat would be established[3] within the footprint of a preexisting commercial aquaculture farm impoundment complex to offset permanent losses of tidal mudflats and palustrine emergent marsh (PEM) at the Terminal (see **Section 1.2 – Terminal Impacts**). Additional buffer acreage is also being included to better protect the proposed mitigation site long term. Cumulatively, 154.74 acres will be included in this mitigation plan to offset a total of 42.9 acres of permanent wetland impacts at the Terminal. The entirety of the 154.74 acres will be placed under a permanent conservation servitude. Since existing resources within the LMPRM have been altered by man-made structures (i.e., drainage canals, berms, aquaculture stock ponds, piping, weirs, and roadways), existing habitats at the LMRPM are considered to be degraded. Thus, implementation of the LMPRM would not only offset losses in aquatic resources at the Terminal, but provide topographical variations and tidal connectivity necessary to facilitate restoration of the highly modified coastal habitat within the LMPRM, and ultimately, ensure a substantial increase in ecological productivity and biodiversity at the LMPRM. This too is quantified in **Section 6.0** below as it pertains to additional establishment, rehabilitation, enhancement, and preservation of existing wetlands and buffer areas at the LMPRM.

1. As defined in 33 CFR § 332.2, *off-site* means "an area that is neither located on the same parcel of land as the impact site, nor on a parcel of land contiguous to the parcel containing the impact site."
2. As defined in 33 CFR § 332.2, *in-kind* means "a resource of a similar structural and functional type to the impacted resource."
3. As defined in 33 CFR § 332.2, *establishment* means "the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area and functions."

1.2 Proposed Impacts Under SWG-2015-00175

Under the proposed SWG-2015-00175 project, a Liquified Natural Gas Terminal and Lateral Pipeline (LP) are proposed for construction. Construction of the Terminal would result in permanent impacts to 41.8 acres of tidal mudflats and 1.1 acres of PEM. Construction of the Terminal is also anticipated to result in temporary impacts to an additional 1.8 acres of tidal mudflats and 0.5-acre of PEM in association with a temporary construction basin and equipment/material laydown areas. All permanent impacts associated with the Terminal will be mitigated under this proposed LMPRM, all temporary impacts will be addressed via a separate Habitat Restoration Plan (HRP). No permanent impacts are proposed by the construction of the LP, and as with the Terminal all temporary impacts associated with the LP (61.5 acres) will be addressed in a separate HRP. A summary of all impacts is provided in **Table 1** below. A breakdown of proposed mitigation types and quantities are also outlined in **Section 2.1** and **Section 6.0**. Temporary impacts listed in **Table 1** below are based on design evaluated for the April 1, 2020 SWG-2015-00175 LP impacts and should the LP be re-aligned in the future, any resulting changes to temporary impacts would be addressed in the separate HRP.

Table 1. SWG-2015-00175 Project Impacts

Terminal & LP Impacts			
Impact Type	**Impact Habitat Type**	**Mitigation Source**	**Mitigation Type**
Terminal Permanent			
41.8 acres	Tidal Flats	LMPRM	In-Kind
1.1 acres	PEM	LMPRM	Out of Kind
Terminal Temporary			
1.8 acres	Tidal Flats	Separate HRP	Monitor/report
0.5 acres	PEM	Separate HRP	Monitor/report
LP Permanent			
0.0 acres	NA	NA	NA
LP Temporary			
11.8 acres	E2EM	Separate HRP	Monitor/report
49.7 acres	PEM	Separate HRP	Monitor/report

1.3 LMPRM Location and Existing Conditions

The LMPRM is comprised of an approximately 154.74-acre subset of a larger 506-acre tract located near the eastern terminus of Schafer Rd in Los Fresnos, Cameron County, Texas. In general, conditions at the LMPRM consist of previously disturbed coastal lands associated with the former occupancy and use of the site as a commercial aquaculture farm. The entirety of the LMPRM site is located within the 100-year floodplain associated with the Lower Laguna Madre (LLM). With exception of the Port Isabel-Cameron County Airport and the Port Isabel Detention Center located to the west-northwest of the LMPRM, the

general site setting is characterized by rural, coastal lands. The Laguna Atascosa Wildlife Refuge (LANWR) and other protected tracts are located adjacent to the northern and southern boundaries of the site, while the LLM bay abuts the LMPRM's eastern boundary. The western adjoining property consists of aquaculture stock ponds that have been incorporated into the LANWR system to provide foraging areas for avifaunal species during periods of inundation. A map of the LMPRM is provided in **Figure 1**.

1.4 Property Ownership

The property was acquired by EIP IV Shrimp Land Co., LLC on July 28, 2021, as recorded in a Special Warranty Deed dated July 30, 2021 (Document Number 2021-33190, Cameron County, Official Records).

1.5 Recorded Liens, Encumbrances, Easements, Servitudes, or Restrictions

Three (3) known easements are recorded for utility and/or power lines within the currently proposed LMPRM footprint. All known easements are associated with the previous aquaculture facility's infrastructure. These easements are not within the mudflats establishment habitat areas but do cross the proposed tidal creek connections. Because the easements were placed specifically for the commercial aquaculture facility and terminate within the current EIP property boundary and the current owner (EIP) wishes to remove the power lines and terminate the easements, EIP is currently working with the utility providers to terminate the easements. A map of the exact location of the easements is under construction and will be inserted as **Appendix G** of this PRMP once onsite surveys are completed. If the easements are terminated prior to authorization of this LMPRM this section will be modified to state that no easements exist within the proposed footprint.

2.0 MITIGATION OBJECTIVES

2.1 Objectives Overview

The primary objective of the LMPRM is to provide a net gain in ecological functionality in lieu of permanent, unavoidable loss of 41.8 acres of tidal mudflats and 1.1 acres of PEM. Using the watershed approach[4], the LMPRM aims to establish, and preserve approximately 117 acres of coastal wetland resources by establishing a hydrologically self-sustaining coastal tidal flat. In doing so, an additional 5.03 acres of estuarine and marine wetland preservation; 1.16 acres of riverine habitat preservation; 2.49 acres of estuarine and deepwater habitat establishment, enhancement, and preservation; 2.65 acre of channel establishment and rehabilitation, and 26.41 acres of non-hydric buffer preservation will be included in the overall LMPRM footprint. Water quality and habitat conditions surrounding the Terminal are considered to be degraded as a result of anthropogenic stressors associated with industrial developments and activities along the Brownsville Ship Channel (BSC) and at the Port of Brownsville; therefore, the LMPRM would result in a net increase in ecological functionality above that of the Terminal for the benefit of threatened or endangered (T&E) species, migratory birds, and other native species occurring in the coastal areas of Cameron County, Texas. Specifically, the LMPRM objectives include:

- excavation and grading of the LMPRM's landscape to specified construction elevations based on tidal exchange modeling and observed tidal datums to create flats habitat;
- establish unrestricted tidal connection between tidal waters of the LLM Bay and the restoration areas of the LMPRM;
- demonstrate restored hydrology within the restoration areas of the LMPRM;
- demonstrate the presence of hydric soil conditions within the restored areas of the LMPRM;
- demonstrate that any natural recruitment of vegetation will be monitored for exotic species and that invasive species will be kept below a 5% threshold;
- providing long-term viability of the LMPRM by ensuring the appropriate financial assurance mechanisms and long term stewardship are in place; and,
- protecting the newly established wetland resources under a permanent conservation easement.

The Terminal is located in the BSC sub-watershed, a component of the primary South Laguna Madre watershed (HUC No. 12110208). Developments in the BSC are comprised primarily of industrial facilities

4. As defined in 33 CFR § 332.2, *watershed approach* "means an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs, and how locations and types of compensatory mitigation projects address those needs. A landscape perspective is used to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services caused by activities authorized by DA permits. The watershed approach may involve consideration of landscape scale, historic and potential aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements for DA permits."

associated with the Port of Brownsville (e.g., ship dismantling facilities, bulk petroleum storage terminals, marine vessel refurbishing and manufacturing facilities); therefore, loss of habitat and degradation of water quality present a continuous challenge to coastal resources located along the BSC, including areas surrounding the Terminal. While surface water resources are not anticipated to be significantly impacted by the proposed construction or operation of the Terminal (Texas LNG, 2019), the Terminal would result in the permanent loss of 41.8 acres of tidal mudflats and 1.1 acres of palustrine emergent wetland habitat suitable to T&E species, shorebirds, and migratory bird species.

A review of T&E species lists for Cameron County revealed seventeen (17) federally protected species and thirty-two (32) state protected species which may potentially occur within the vicinity of the Terminal and LMPRM. In addition, the USFWS has also designated portions of the primary watershed as critical habitat for wintering Piping Plovers. According to 33 CFR 332.3(c)(2), mitigatory considerations "should not be focused solely on achieving a specific function (e.g., water quality or habitat for a certain species)", but rather on "providing a suite of functions typically provided by the affected resource"; therefore, EIP intends to establish and preserve wetland habitats that will not only offset the permanent loss of habitat at the Terminal, but also establish resources that would provide increased ecological productivity sufficient to support a variety of functions.

2.2 Established Regional Goals and LMPRM Conformance

2.2.1 Watershed Plans and Initiatives

The LMPRM and Terminal are both located in the South Laguna Madre Watershed (Hydrologic Unit Code No. 12110208), which encompasses the entirety of the LLM bay. As part of the preparation of this report, a review of literature related to the management of the South Laguna Madre Watershed was performed. In general, the following reports have goals aimed at improving water quality, restoration and preservation of habitat, and protection of local marine and coastal resources within the watershed. A brief summary of the reviewed plans and initiatives is provided below.

<u>Lower Laguna Madre/Brownsville Ship Channel Watershed Protection Plan Development</u>

In 2016, a watershed characterization study was initiated as part of a broader goal of developing a Watershed Protection Plan (WPP) through the LLM – Brownsville Ship Channel Watershed Partnership (TCEQ, 2021). At present, water quality and flow measurement data are being collected from the main tributaries draining into the LLM. The goal of the watershed protection development plan and associated watershed characterization study is to identify pollutant sources and quantify reduction milestones necessary to meet state water quality standards. The watershed characterization study is currently in progress and anticipated to be completed in 2022.

Since the created restoration areas would be permanently protected through a conservation easement, establishment of the LMPRM would prevent future development that may contribute to degradation in water quality of the LLM bay and have adverse impacts to existing native coastal habitats at the LMPRM and adjacent LANWR. Consequently, the LMPRM will be in conformance with the LLM/Brownsville Ship Channel Watershed Protection Plan Development initiative.

Arroyo Colorado Watershed Protection Plan (WPP)

The Arroyo Colorado WPP is a compilation of watershed-based strategies intended to address degradation of water quality and habitats (riparian and aquatic) in the Arroyo Colorado Watershed (a sub-watershed of the South Laguna Madre Watershed). Specifically, the collaborative efforts described in the plan were developed to set 10-year pollution reduction targets and implement habitat improvement actions needed to meet state-designated land use criteria and provide compliance with state-mandated water quality standards (Flores et al., 2018).

Since the LMPRM will supplement habitat improvement efforts and wetland preservation efforts within the South Laguna Madre Watershed, which is presently characterized by highly degraded coastal habitats and diminished water quality, the LMPRM would be in conformance with the goals of the Arroyo Colorado WPP.

Lower Laguna Madre Estuary Program Environmental Strategic Plan

The Lower Laguna Madre Estuary Program has developed an Environmental Strategic Plan modeled after the National Estuary Program (NEP), whose purpose is to protect nationally significant estuaries threatened by development, pollution, and overuse (Jones et al., 2018). The strategic plan aims to establish precedent for the development of a formal Comprehensive Conservation Management Plan (CCMP) for the LLM estuary. The document focuses on the national significance of the estuary, estuary-specific needs and goals, and plans for long-term viability of a CCMP, should it be accepted into the NEP program.

The LMPRM would establish and protect vital coastal resources against future development and provide beneficial impacts to water quality, T&E species, and migratory bird species. Cumulatively, these effects would contribute to the overall health and significance of the LLM estuary; therefore, the LMPRM will be in conformance with the Lower Laguna Madre Estuary Program Environmental Strategic Plan.

2.2.2 Existing Regional Habitat and Species Projects

Establishing the LMPRM would benefit a number of regional projects associated with habitat preservation and species-specific recovery efforts. A brief discussion of the projects and relevancy of the LMPRM to the respective efforts is provided below.

Texas South Bay Coastal Preserve

The South Bay Coastal Preserve is located approximately 10 miles to the southeast of the LMPRM and consists of approximately 3,500 acres of emergent and submergent vegetation and varying types of coastal flats (TPWD, 1989). The Texas Parks and Wildlife Department (TPWD) has leased the property from the Texas General Land Office (GLO) since 1988 and currently manages the preserve in coordination with the GLO and USFWS with the intended goal of preserving the unique marine ecosystem. Organic productivity provided by the extensive algal flats and stands of black mangrove-gulf cordgrass communities are of particular importance to South Bay's ecological functionality, supporting the numerous finfish, shellfish, federally listed sea turtles, coastal birds, and migratory bird species. The

LMPRM would provide unique tidal mudflat habitat that would serve as an important resource for dependent shorebird and migratory bird species. In addition, areas where inundation remains persistent are anticipated to aid in the establishment of algal mats and native coastal vegetation. Consequently, the goals of the LMPRM are aligned with those of the South Bay Coastal Preserve.

Bahia Grande Coastal Corridor Project (BGCC)

The BGCC project involves the acquisition and addition of approximately 6,000 acres of land to the existing 105,000-acre corridor of conservation lands including the LANWR, Boca Chica State Park, and the Lower Rio Grande National Wildlife Refuge. In addition, the BGCC project would provide connection to more than 2 million acres of private ranchland located to the north of the LANWR and 1.3 million acres of protected areas in northeastern Mexico. The BGCC includes the acquisition and protection of the KAAPA Tract, which consists of former aquaculture stock ponds located immediately adjacent and to the west of the LMPRM. As the KAPPA Tract was acquired to create habitat for "dependent migratory bird species" (USFWS, 2017), establishment of the LMPRM would serve the overall goal of the BGCG by providing increased connectivity between the existing protected coastal habitats in the KAPPA Tract and LANWR system while simultaneously enhancing ecological productivity of the LMPRM due to the establishment of a tidally influenced benthic invertebrate community.

U.S. Fish and Wildlife Service (USFWS) Designated Critical Habitat for Piping Plover (*Charadrius melodus*)

In 2008, the USFWS proposed 18 critical habitat units along the Texas Gulf Coast for the federally and state threatened Piping Plover (U.S. Department of Interior, 2008). A final ruling was issued in May 2009, thereby incorporating extensive areas comprised of mudflats, salt flats, and algal flats within Cameron County for protection of the species. Establishment of coastal tidal flats at the LMPRM would provide additional foraging, loafing, and roosting habitat for overwintering Piping Plovers within the South Laguna Madre Watershed; therefore, the LMPRM would contribute towards the overarching goal of preserving critical habitat for the species.

U.S. Fish and Wildlife Service Recovery Plan for the Ocelot (*Leopardus pardalis*)

The long-term goal of the recovery plan is to improve scientific understanding and management of the federally and state endangered Ocelot, to secure its survival so the species can be federally delisted. The plan proposes a review of known information about the Ocelot's life history and habitat needs in order to identify data gaps necessary to implement effective restoration of Ocelot habitat and conservation of the species (USFWS, 2016). The designated Texas-Tamaulipas Management Unit (TTMU), which supports a highly imperiled population of the species, overlaps with habitat adjacent to and including the LMPRM. Consequently, establishing the LMPRM would aid the USFWS's recovery plan by providing increased connectivity between habitats utilized by a known population of the species while also precluding future development of the sensitive coastal areas located within the LMPRM boundaries.

3.0 SITE SELECTION

3.1 Overview

In accordance with 33 CFR § 332(b)(1), a hierarchical evaluation of compensatory alternatives was performed to determine the most practicable and environmentally preferable mitigatory option for the Terminal. In order, compensatory alternatives discussed and considered included:

- purchasing of mitigation credits from an operational mitigation bank;
- purchasing of credits from an approved in-lieu fee program;
- permittee responsible mitigation using a watershed approach;
- permittee responsible mitigation using an on-site and in-kind mitigation; and
- permittee responsible mitigation using an off-site and/or out-of-kind mitigation.

Per 33 CFR § 332.3(c), the watershed approach should be utilized to establish compensatory mitigation requirements to the extent practicable. Additionally, the rule recommends considerations such as watershed plans, habitat requirements for important species, and location factors (e.g., hydrology, surrounding land use).

The Terminal is located within the 8-digit Hydrologic Unit Code (HUC-8) known as the South Laguna Madre Watershed (HUC No. 12110208), a component of the Nueces-Rio Grande River Basin. No approved mitigation sites providing in-kind compensatory credits or in-lieu fee programs are present in within the HUC-8 of the Terminal. Additionally, onsite mitigation was considered unattainable due to the absence of sufficient acreage within the Terminal site boundaries. Consequently, the most practicable and environmentally beneficial alternative was determined to be an off-site, in-kind permittee responsible mitigation.

The LMPRM location was subsequently identified as the most practicable alternative based on general criterion outlined in 33 CFR § 332(b)(1). The LMPRM location's selection was based on:

1. a common river basin (Nueces-Rio Grande River Basin) and common major watershed (*South Laguna Madre Watershed*);
2. shared soil series (*Barrada*, *Sejita*, *Lomalta*, and *Point Isabel*);
3. similarities in range of elevation and irregular topographies consistent with native coastal areas of the LLM;
4. similar geological and climatological (e.g., wind and tidal) influences;
5. similar ecological makeup (i.e., floral and faunal community composition);
6. suitability of LMPRM site to meet the objectives defined in **Section 2**; and;
7. availability of LMPRM as a mitigation area.

3.2 LMPRM Site Suitability

A review of historical aerial imagery indicates that native vegetative community at the LMPRM demonstrates a high degree of resiliency. Despite substantial physical modifications to the LMPRM during the 1940's and 1980's-1990's, previously disturbed areas appeared to have been rapidly recolonized by native vegetation. Eastern portions of the site were also found exhibit ecological functionality akin to

other unmodified coastal habitats in the immediate vicinity of the site and the LMPRM is located in close proximity to unmodified and highly productive ecosystems of the adjacent LANWR.

3.3 LMPRM Alternatives

As part of the planning process, several conceptual designs were considered for the LMPRM. Specifically, the aims of the conceptual plan were to 1) minimize the potential for adverse effects to existing wetland features at the LMPRM and 2) ensure the maximum likelihood of success in meeting the objectives outlined in **Section 2.1**. As described in **Section 5.0** of this PRMP, field assessments were conducted at the LMPRM between 2020 and 2021 to obtain baseline data regarding onsite wetland functionality and general ecological characteristics represented at the LMPRM. This information was subsequently used to make informed decisions regarding the most practicable alternative for the LMPRM. A discussion of the alternatives considered during the planning process, including maps of the respective designs is presented below.

Alternative 1

An initial Conceptual Mitigation Plan (Alternative 1) was developed in January 2020, and consisted of three (3) proposed tidal creeks to be constructed at the eastern and northeastern areas of the LMPRM. Under this alternative, the northern stock pond would be connected via an existing drainage ditch at the northern boundary of the property and a coastal tidal flat area immediately to the east of the pond's berm. The southern stock pond would be connected to LLM via an existing intake pond previously constructed for aquaculture operations at the property. The restoration areas would subsequently be graded to match elevations of existing tidal mudflats located at the eastern portions of the LMPRM (approximately +0.6 feet NAVD88) prior to breeching of the existing berm system. A conceptual layout of Alternative 1 is presented in **Figure 2**.

Alternative 2

Upon further review, a second alternative was proposed to provide tidal connectivity to the northern aquaculture pond utilizing the former aquaculture facility's main drainage canal. Under this alternative, the proposed tidal creek would span approximately 770 feet along the existing drainage ditch before commencing northwest across a vegetated flat, and entering the southeastern corner of the northern stock pond. In effect, this would preclude the need for significant excavation activities initially proposed at the northeastern portions of the LMPRM, thereby minimizing potential impacts to the sensitive wetland features located in construction zones under Alternative 1. Modifications to the conceptual design for the southern restoration area included the westward extension of the southern tidal creek, thereby increasing the overall size of the restoration area. A copy of the conceptual layout for Alternative 2 is presented in **Figure 3**.

Alternative 3 (Selected)

A third conceptual alternative (Alternative 3) proposed in October 2021 entailed modification of tidal creek locations at both the northern and southern stock ponds (see **Figure 4**). Under this alternative, the northern tidal creek proposed under alternative 2 was extended to the west, beyond an existing weir

located in the main drainage canal. Breaching of the existing berm wall would occur on the south side of the pond to allow for increased aeolian influences from the prevailing southeasterly winds while also avoiding impacts to a the vegetated flat, which would have occurred under alternative 2. Design modifications associated with the southern pond involved construction of the tidally connected creek approximately 180 feet to the north of the existing estuarine pond and the westward extension of the tidal creek to incorporate two additional stock ponds into the restoration area. Orientation of the tidal creek was modified to provide optimal tidal flow into the established tidal mudflat, while simultaneously reducing potential impacts to established offsite seagrass beds.

Since the area immediately to the south of the proposed tidal creek was historically used as a disposal area for dredge spoil generated by pond maintenance activities, topography of this area would be restored to a lower elevation by degrading of the topography. In effect, this would allow for increased influence from southeasterly winds, thereby aiding in tidal exchange into the restoration areas. Lastly, the pond would be utilized to create habitat conducive to seagrass establishment. To achieve this, dredge spoil would be used to backfill the existing pond to a depth of approximately -0.5 NAVD88. As connection of the pond is currently provided by underground piping, tidal exchange into the pond is considered muted. Consequently, an inlet would be excavated at its eastern edge to restore full, natural tidal exchange into the pond and increase the potential for seagrass propagules to become established.

Consequently, wetland impacts associated with Alternative 3 include an approximately 0.06-acre estuarine wetland area (E2USN) at the outfall of the southern tidal creek, an approximately 0.9-acre impact to WOTUS associated with the selective filling of the estuarine pond (E1ABLx), and an approximately 1.1-acre impact to the existing main drainage canal (R2UBFx).

Hydrologic modeling of Alternative 3 was conducted using the USACE's Advanced Circulation (ADCIRC) model for oceanic, coastal and estuarine waters. Input data for the model included topographic and bathymetric data, tidal gauge data within close proximity to the LMPRM, and design survey data (Coastal Engineering Consultants, 2021). The study found that predicted water level elevations at the proposed restoration areas exhibited similar inundation characteristics to those of an existing tidal mudflat located in the eastern portion of the LMPRM; therefore, the LMPRM construction design is anticipated to meet the desired goal of promoting tidal flushing and healthy habitat sustainability.

Based on these findings, Alternative 3 was selected as the most practicable alternative for meeting the Project's goals to establish, enhance, and preserve both existing and created coastal resources at the LMPRM. Since the LMPRM would be subject to unrestricted tidal exchange, it is anticipated that saturation and inundation by waters of the LLM will result in the rapid establishment of a productive benthic community within the tidal creeks and restoration areas. Colonization by native coastal vegetation at edge habitats along the tidal creeks and restoration areas are also expected to be expedited as a result of regular tidal exchanges. When considered in concert with the natural resiliency and dynamic nature of the native coastal ecosystem, the conceptual design proposed under Alternative 3 is anticipated to have a high likelihood of success; however, to further ensure that the desired tidal exchange and ecological functionality of the LMPRM are achieved, maintenance and monitoring activities would also be performed as described in **Section 8.0** and **Section 10.0** of this PRMP, respectively. Management and monitoring efforts outlined within these sections will serve to further minimize risk associated with the proposed Project and increase the likelihood of successfully establishing the desired resources and functions.

4.0 SITE PROTECTION INSTRUMENT

EIP IV Shrimp Land Co., LLC has purchased the property and will lease the property to EIP IV Credit Company, LLC[5]. In accordance with Chapter 183, Subchapter A of the Texas Natural Resources Code and 33 CFR § 332.7(a)(5), EIP will encumber the LMPRM with a conservation easement held by a qualified non-profit conservation easement holder following approval of the PRMP.

EIP has initiated correspondence with the future easement[6] holder[7], a group which holds numerous easements for mitigation with the USACE Galveston District, to coordinate the conservation easement's language and approval. A letter of intent to accept the conservation easement is provided in **Attachment B** and a formal acceptance letter will be provided under a separate cover. Upon execution of the recorded conservation easement in the real property records of Cameron County, a copy of the record will be provided to USACE Galveston District Office. No liens, mortgages, or security interest are currently imposed on the property.

Except where expressly allowed in the PRMP, the conservation easement for the LMPRM will prohibit further subdivision of the LMPRM; commercial (retail or industrial) development; use of biocides; disturbance of natural habitat at the LMPRM; dumping; unauthorized vehicle traffic; signage; planting of any non-native species; pollution and/or disturbance to hydrology of the LMPRM; unauthorized hunting, fishing or trapping, use of the LMPRM for livestock grazing; or excavation or mineral extraction outside of the specific provisions as stated in **Section 1.6**.

Details relating to the above activities and LMPRM use will be outlined in the Conservation Easement.

5. Ecosystems Investment Partners IV, LP (EIP) owns and manages both Ecosystem Investments Partners IV Shrimp Land Co., LLC (the entity used to contract for the purchase of real estate) and EIP IV Credit Co., LLC (the entity which operates EIP's mitigation projects).
6. Per Texas Natural Resources Code 183, a *conservation easement* is defined as "a nonpossessory interest of a holder in real property that imposes limitations or affirmative obligations designed to (A retain or protect natural, scenic, or open-space values of real property or assure its availability for agricultural, forest, recreational, or open-space use; (B) protect natural resources; (C) maintain or enhance air or water quality; or (D) preserve the historical, architectural, archeological, or cultural aspects of real property".
7. Per Texas Natural Resources Code 183, a *holder* is defined as "(A) a governmental body empowered to hold an interest in real property under the laws of this state or the United States; or (B) a charitable corporation, charitable association, or charitable trust created or empowered to (i) retain or protect the natural, scenic, or open-space values of real property; (ii) assure the availability of real property for agricultural, forest, recreational, or open-space use; (iii) protect natural resources; (iv) maintain or enhance air or water quality; or (v) preserve the historical, architectural, archeological, or cultural aspects of real property".

5.0 BASELINE INFORMATION

5.1 LMPRM Overview

The LMPRM is located within the Level III (Western Gulf Coast Plain) Ecoregion, and is situated in the South Laguna Madre primary watershed, which extends from the northern county line of Willacy County, Texas south to the Rio Grande River levee system. Information regarding the general ecology, soil types, and hydrology at the LMPRM is presented below.

5.1.1 LMRPM Historical Ecological Characteristics

A review of historical aerial images and United States Geological Survey (USGS) topographic maps were reviewed to ascertain historical ecological conditions of the LMPRM. No historical aerial images of the LMPRM site were available prior to 1950; however, the available resources indicate that the property was located in an area characterized by native coastal habitat since at least the early 1920's. By 1950, the central and western portions of the LMPRM had been heavily modified to construct earthen berms, roadways, three (3) artillery ranges, and row-crop farmlands. Eastern portions of the site appear to have consisted of unmodified coastal habitats and areas that were maintained or used for agricultural purposes. In addition, natural drainageways of the eastern portion of the site appear to have been modified as a result of the construction of a drainage canal in the mid-1930's. By 1970, the artillery ranges appear to have been vacated and native coastal vegetation dominated the LMPRM.

Native vegetation across the LMPRM was again cleared by at least 1985 for development of the former aquaculture farm. The easternmost portions of the LMPRM appears to have remained intact and characterized by native coastal flats (e.g., salt flats, mudflats, algal flats and vegetated flats), and coastal ridge habitats. No significant alterations to the LMPRM were evident between 1990 and the present day.

Based on a review of the archived historical imagery, significant disturbance to the LMPRM's natural ecological functionality has occurred as a consequence of the repeated cycles of removal of the native coastal vegetation, alterations of natural topography and modification of natural drainageways. The diminished ecological functionality of the LMPRM makes it an opportune candidate for the purposes of restoration.

5.1.2 LMPRM Wetland Delineation

A wetland delineation study was performed between June and August 2021 to document the status, extent, and jurisdiction of wetlands within the larger, 506-acre tract which encompasses the LMPRM. Findings of the investigation identified forty-six (46) distinct wetland features comprising approximately 374.57 acres across the 506-acre tract. A summary of the findings, including acreages, descriptions, and classifications based on the Cowardin System (1979) is provided in **Table 2** below. Delineation maps derived from the investigation's findings are provided in **Appendix D**.

Table 2. Summary of Identified Wetlands

Map Id	Classification	Wetland Type	Acres	Regulatory Authority
1	R2UBFx	Riverine	4.60	None
2	R2UBFx	Riverine	7.41	None
3	PUBFx	Freshwater Pond	1.21	Section 404
4	PUBFx	Freshwater Pond	1.57	Section 404
5	PEM1Fx	Freshwater Emergent Wetland	10.72	Section 10/404
6	E2USP	Estuarine and Marine Wetland	7.09	Section 10/404
7	E2AB1N	Estuarine and Marine Wetland	3.93	Section 10/404
8	E2USN	Estuarine and Marine Wetland	3.75	Section 10/404
9	E2SS3N	Estuarine and Marine Wetland	19.98	Section 10/404
10	E1AB3L	Estuarine and Marine Deepwater	19.88	Section 10/404
11	E2EM1P	Estuarine and Marine Wetland	12.23	Section 10/404
12	E2USM	Estuarine and Marine Wetland	5.87	Section 10/404
13	R2UBFx	Riverine	3.71	Section 10/404
14	R1UBNx	Riverine	2.18	Section 10/404
15	R5UBFx	Riverine	0.27	Section 10/404
16	PUSKx	Freshwater Pond	10.66	None
17	L2USKx	Lake	45.21	None
18	PUSKx	Freshwater Pond	2.54	None
19	PUSKx	Freshwater Pond	1.24	None
20	PUBKx	Freshwater Pond	0.99	None
21	PUBKx	Freshwater Pond	0.85	None
22	PUSKx	Freshwater Pond	1.01	None
23	PUSKx	Freshwater Pond	0.29	None
24	PUSKx	Freshwater Pond	0.35	None
25	PUSKx	Freshwater Pond	0.33	None
26	PUSKx	Freshwater Pond	0.35	None
27	PUSKx	Freshwater Pond	0.30	None
28	PUSKx	Freshwater Pond	0.32	None
29	PUSKx	Freshwater Pond	0.26	None
30	PUSKx	Freshwater Pond	0.27	None
31	PUBKx	Freshwater Pond	0.27	None
32	PUBKx	Freshwater Pond	2.22	None
33	PUBKx	Freshwater Pond	1.72	None
34	PUBKx	Freshwater Pond	2.90	None
35	PUBKx	Freshwater Pond	10.17	None
36	L2USKx	Lake	43.60	None
37	L2UBKx	Lake	29.82	None

Map Id	Classification	Wetland Type	Acres	Regulatory Authority
38	L2UBKx	Lake	32.11	None
39	PUBKx	Freshwater Pond	9.84	None
40	PUSKx	Freshwater Pond	17.17	None
41	L2USKx	Lake	38.28	None
42	PUSKx	Freshwater Pond	8.88	None
43	PUBKx	Freshwater Pond	1.81	None
44	E1ABLx	Estuarine and Marine Deepwater	1.06	Section 10/404
45	PEM1A(x)*	Freshwater Emergent Wetland/Problematic	4.94	Section 404
46	E2EM1P	Estuarine and Marine Wetland	0.41	Section 10/404
(x)*	Portion of wetland has been excavated			

Findings from the delineation activity were subsequently evaluated against National Wetland Inventory (NWI) and National Hydrography Dataset (NHD) data to verify recognized wetland areas and identify additional wetland areas across the larger, 506-acre tract. Results of the investigation verified approximately 93.86 acres of features potentially subject to jurisdiction under Section 404 of the Clean Water Act (CWA) and/or Section 10 of the Rivers and Harbors Act (RHA), including one (1) PEM1Fx, one (1) E2USP, one (1) E2AB1N, one (1) E2USN, one (1) E2SS3N, one (1) E1AB3L, one (1) E2EM1P, one (1) E2USM, one (1) R2UBFx, one (1) R1UBNx, one (1) R5UBFx, one (1) E1ABLx, and one (1) E2EM1P wetland.

In addition, four (4) of the potentially jurisdictional wetland areas identified were not recognized on current NWI maps. These include an approximately 12.23-acre estuarine and marine wetland (Map ID No. 11), an approximately 5.87-acre estuarine and marine wetland (Map ID No. 12), an approximately 1.81-acre aquaculture stock pond (Map ID No. 43), and an approximately 0.41-acre estuarine and marine wetland (Map ID No. 46). Additional information, including NWI and NHD maps used for comparative purposes during the delineation can be found in the *Wetland Delineation Report* (AEC, 2021) .

5.1.3 LMPRM Vegetation

NRCS Ecological Site data associated with Major Land Resources Area (MLRA) 150B and observations made during the field investigation identified four (4) distinct vegetative communities at the LMPRM (NRCS, 2021); however, as a result of previous modifications to the LMPRM site, soil survey data and the corresponding ecological site data was considered to be problematic. In particular, ground disturbing activities associated with the construction of aquaculture stock ponds were found to exhibit characteristics of coastal flat and salt marsh habitats. Since no historical aerial imagery was available prior to 1950, native features of the former landscape are unknown but presumed to be akin to contiguous coastal tracts located immediately to the north and south of the LMPRM. A discussion of the vegetative communities currently present at the LMPRM is presented below. Species-specific information pertaining to wetland indicator status is based on categorical definitions provided in the Corp of Engineers *Wetland Delineation Manual* (1987) and the National Wetland Plant List (2018) for the Atlantic and Gulf Coast Plain. Estimated acreages of the respective communities at the LMPRM are provided in **Table 3**.

Wind Tidal Flats

Wind tidal flats are present to the east of the northern stock pond, extending eastwards towards the LLM. Live blue-green algal (*Lyngbya* spp.) crust communities are evident in the wind tidal flat areas where saturated soils are present. This community is generally characterized by hydrophytic halophytes such as Dwarf Saltwort (*Salicornia bigelovii*, OBL), Shoreline Sea-Purslane (*Sesuvium portulacastrum*, FACW), Turtleweed (*Batis maritima*, OBL), and scattered patches of Black Mangrove (*Avicennia germinans*, OBL). In general, these species are sparsely distributed across the flat and subject to high turnover as a result of precipitation and extreme climatological events (e.g., extended drought, tropical cyclones, etc.).

Salt Flats

Salt flats at the LMPRM are characterized by nearly flat or concave topographies and consist of washover sediments (e.g., dredge, loamy aeolian deposits, and marine sediments). Less disturbed areas of the LMPRM characterized by salt flats communities are present at the eastern portions of the site. Lower elevations within the salt flats are generally comprised of hydrophytic halophytes such as Dwarf Saltwort, Turtleweed, and Sea Blite (*Suaeda linearis*, OBL).

The vegetative community structure grades into a community comprised of Sea-Ox-Eye Daisy (*Borrichia frutescens*, OBL), Shoregrass (*Monanthochloe littoralis*, OBL), and Seashore Saltgrass (*Distichlis spicata*, OBL) at mid-level elevations. Species such as Carolina Sea Lavender (*Limonium carolinianum*, OBL) and Herbaceous Seepweed (*Suaeda maritima*, OBL) are also present in lower abundance.

At the upper extent of salt flats, the community transitions into a midgrass prairie-like community, as evidenced by an increased present in occurrence of species such as Camphor Daisy (*Rayjacksonia phyllocephala*, FACU), Sea Blite, Australian Saltbush (*Atriplex semibaccata*, FAC), Guineagrass (*Urochloa maxima*, UPL), and Screwbean Mesquite (*Prosopis pubescens*, UPL).

Southern Salt Marsh

Southern salt marsh areas occur on the landward side of the LLM bay in nearly level areas containing scattered depressions, drainages, and open water bays. The ecosystem state of southern salt marshes is particularly influenced by precipitation and tropical weather events. Consequently, these marsh areas remain in a constant state of transition between mudflats and wet grassland communities.

Species present in low lying areas or in close proximity to surface waters included Dwarf Saltwort, Turtleweed, Sea Blite, and Sea Purslane. At higher elevations, species such as Gulf Cordgrass (*Spartina spartinae*, OBL), Sea-Ox-Eye Daisy, Seashore Saltgrass, Carolina Sea Lavender, Shoregrass, Bitter Panicgrass (*Panicum amarum*, FAC), Camphor Daisy, Australian Saltbush and Screwbean Mesquite (*Prosopis pubescens*, not listed) can routinely be observed.

Coastal Ridge

Coastal Ridge areas are associated with convex, elevated clay dunes (“lomas”) found in coastal areas of Cameron County. Elevations can range from mean sea level (MSL) to approximately 50 feet; however,

topography is continuously subjected to accretion and erosion as a result of geographic and climatologic influences. In general, coastal ridge habitat is highly dynamic and characterized by midgrass prairie with scattered patches of thrornscrub and prickly-pear associations.

Species present in coastal ridge communities at the eastern portions of the LMPRM include Texas Sage (*Leucophyllum frutescens*, not listed), Sea-Ox-Eye Daisy, Screwbean Mesquite, Honey Mesquite, Prickly-Pear Cactus (*Opuntia engelmannii*, not listed), Spanish Dagger (*Yucca aloifolia*, UPL), Coyotillo (*Karwinskia humboldtiana*, not listed), and Western Ragweed (*Ambrosia psilostachya*, FAC).

5.1.4 LMPRM Hydrology

Hydrologic features within the existing stock ponds differ significantly from external areas of the LMPRM. While the ponds were intentionally flooded via a network of feeder ditches during past aquaculture operations, the ponds have remained out-of-use for at least 3 years. Consequently, hydrology of the ponds is dependent on runoff and ponding associated with precipitation events. Since these areas are also subject to intense evaporation and desiccation throughout the majority of the year, evidence of hydrology within the ponds is markedly fleeting, persisting only for a matter of days or weeks following a substantial precipitation event.

Outside of the berms, LMPRM's hydrology is driven by tidal influences and precipitation events. De facto wetland areas at the eastern portions of the LMPRM display clear evidence of tidal exchange such as inundation or saturation in natural and man-made depressions, visual evidence of the high tide lines, presence of active fiddler crabs (*Uca* sp.), drift deposits, algal mats and salt crust, hydrogen sulfide odors, and oxidized rhizospheres along living roots. Included in the wetland areas at the eastern portions of the LMPRM were areas characterized by natural tidal mudflats. Tidal mudflat habitat was associated with an approximate elevation of +0.6 ft NAVD88 and characterized by the primary hydrology indicators listed above as well as various secondary hydrology indicators (e.g., surface soil cracks, geomorphic position, fiddler crab burrows, and apparent drainage patterns).

The influence of precipitation on hydrology at areas located outside of the stock ponds is also considerable. Due to the irregular topography of the landscape, runoff from berms and other elevated areas at the LMPRM feeds directly into coastal waters or terminates within isolated depressional features or drainage ditches located in the inland portions of the LMPRM. Ponding at these inland features displays a similar trend to those of the stock ponds, persisting for a matter of days or weeks until high evaporative rates render these areas dry.

5.1.5 LMPRM Soils

A preliminary review of USDA NRCS Soil Survey Geographic Database (SSURGO) data identified four (4) soil units within the LMPRM, including *Sejita silty clay loam* (SE)*, Lomalta clay* (LM), *Barrada clay* (BA), and *Point Isabel clay loam* (PO). While these soil types are derived from deltaic parental material which generally characterizes the western bayshores of the LLM, extensive modifications to the LMPRM have resulted in substantial disturbance to onsite soils. Since the degree of offsite soil placement and mixing with native soils is not known, soil classifications derived from the preliminary review are considered to be problematic. A map illustrating the distribution of the soils as provided by the SSURGO review is

presented in **Figure 5**.

A breakdown of acreage and key characteristics associated with the identified soil units is presented in **Table 3** and a summary of the respective soil types as described by USDA official soil series descriptions is provided below.

Table 3. Key Characteristics of LMPRM Soils

Key	Soil Series	Shrink/Swell Potential	Hydric Rating	Ecological ID	Acreage (est.)
SE	Sejita Silty Clay Loam	LOW	YES	Salt Flat	230.24
LM	Lomalta Clay	VERY HIGH	YES	Salt Marsh	210.48
BA	Barrada Clay	HIGH	YES	Tidal Flat	24.43
W	Water	N/A	YES	LLM Bay (Open Water)	23.01
PO	Point Isabel Clay Loam	HIGH	NO	Coastal Ridge	14.97

Sejita silty clay loam (SE)

Sejita soils are found in flat or nearly flat areas along the Gulf Coast of south Texas where stratified and marine sediments have been modified by aeolian deposition of silts and clays from nearby tidal flats. This soil series is characterized by moderate to slow permeability, poor drainage, with very slow to ponded runoff. The soil is highly saline; consequently, native vegetation supported by the series is primarily characterized by coastal communities that are often composed of halophytic species such as the sea ox-eye daisy, dwarf saltwort, and screwbean mesquite. Soil usage is primarily associated with rangelands and wildlife habitat. USDA-NRCS resource reports indicate that this soil unit is rated as hydric.

Lomalta clay (LM)

The Lomalta soil series is characterized by calcareous, saline clays in semi-marsh environments located adjacent to the Gulf of Mexico. Lomalta clay is found in level and slightly depressional areas located in broad terraces adjacent to slopes. Very slow permeability and very low available water capacity results in very slow to ponded runoff, with ponding surviving for days to several weeks after significant rainfall events. Lomalta clay is high in exchangeable sodium, thus, soil usage is primarily associated with rangelands and wildlife habitat. Due to the highly saline character of the soils, vegetation is primarily characterized by coastal, often halophytic species such as cordgrasses, shoregrass, seashore saltgrass, sea lavender, sea ox-eye daisy, glasswort, dwarf saltwort, and wolfberry. USDA-NRCS resource reports indicate that this soil unit is rated as hydric.

Barrada clay (BA)

The Barrada series consists of deep, poorly drained, saline soils located on barren wind tidal flats. The Barrada clay soil unit is associated with broad areas that are a few inches to several feet below the

surrounding topography and characterized by nearly flat surfaces, very slow permeability, and very slow to ponded runoff. The soil unit is subject to flooding during topical weather events, high tides, or extended periods of high-intensity rainstorms. Areas of this soil type are generally devoid of vegetation; however, prolonged periods of inundation can result in the short-lived presence of halophytic vegetation (e.g., glasswort, dwarf saltwort, sea purslane) and the presence of a thin blue-green algal mat. As ponded areas dry and surface salinities rise, vegetation and algae die off, creating barren flats. During prolonged dry periods, algal crusts on the soil surface can break down, allowing soil particles to be carried by the wind. Due to high salinities and general lack of vegetation, Barrada soils are primarily used for range and wildlife refuges. USDA-NRCS resource reports indicate that this soil unit is rated as hydric.

Point Isabel clay loam (PO)

The Point Isabel series is associated with gently sloping to sloping clay dunes ("lomas") along the Gulf Coast. The Point Isabel clay loam soil unit is often located on the northwestern edge of areas of Barrada soils. The soil unit is typically characterized by a convex surface, slopes ranging from 1-8%, slow permeability, rapid runoff, and salinities ranging from low to high. Loma elevations can range from 5-30 feet above mean sea level (MSL); therefore, vegetation is characterized primarily by a variety of grasses (e.g., giant sacaton, buffalo grass, plains bristlegrass, etc.) with scattered associations of prickly-pear cactus, spiny hackberry, coyotillo, acacia species, and other species generally associated with chapparal-type landscapes. USDA-NRCS resource reports indicate that this soil unit is *not* rated as hydric.

5.2 Reference Site (Laguna Atascosa Wildlife Refuge)

An assessment was conducted at a reference site located at the LAWNR, approximately 0.5 mile to the north-northeast of the LMPRM. The reference site was recognized as exhibiting a high degree of physical and ecological similarities to the desired LMPRM site, including hydrogeomorphic influences, salt flat, algal flat, and mudflat habitats, and corresponding vegetation communities. As part of the assessment, two transects were selected for evaluation of hydrology, vegetation, and soil characteristics. The transects were specifically selected to encompass the full range of coastal habitats, from upland coastal ridge to subtidal waters of the LLM. A total of nineteen (19) points were sampled across the two transects using methods outlined in the USACE's 1987 *Wetland Delineation Manual*. A map showing the location of the reference site relative to the LMPRM is presented in **Figure 6** and a summary of conditions observed at the reference site as they relate to the goals of the LMPRM is provided below.

5.2.1 Reference Site Vegetation

A combination of Ecological Site data provided by the Natural Resources Conservation Service (NRCS) and observations during field investigations identified three distinct vegetative communities at the reference site, including coastal ridge habitat associated with lomas, black mangrove stands located in tidal and subtidal areas at the bayward portions of each transect, and mudflat and algal crust communities. At the reference site, coastal ridge habitat was identified from the loma edge (approximately 2.95 feet above MSL) upwards to the loma crest. Moving baywards from the loma edge, the area was characterized by salt crust communities grading into mudflats and apparently older algal crust communities. Live algal mats were identified at approximately 1.14 feet above MSL. Vegetation was observed across both transects at elevations ranging from approximately 0.49 feet above MSL to approximately 1.8 feet above MSL. In

general, lower lying elevations consisted of sparse patches of saltwort and turtleweed communities while a black mangrove and turtleweed community were associated with the higher elevations. It was noted that both transects encompassed areas where freshwater runoff and ponding appeared to occur, thereby allowing for the establishment of black mangroves. Accretion and mounding of sediments appeared to occur as a result of the physical structure provided by the black mangroves, in turn providing suitable conditions for the establishment of turtleweed.

As the LMPRM site is intended to provide self-sustaining tidal mudflat habitat, vegetation in areas characterized by mudflat and algal crust communities was of particular concern. In general, areas at the reference site characterized by these habitats consisted of sparsely distributed obligate wetland species such as dwarf saltwort and turtleweed, although broad expanses devoid of vegetation were not uncommon. Based on the data obtained at the reference site, it is anticipated that a target elevation of +0.6 feet NAVD88 within the LMPRM's proposed restoration areas would exhibit similar patterns of occupancy and distribution by native halophytic species, particularly in areas where saturation is persistent; however, due to the high degree of spatial and temporal variation within tidal mudflat habitat, the use of success criteria derived from vegetation data is considered to be impractical for the goals and objectives of the LMPRM.

5.2.2 Reference Site Hydrology

With exception to the landward-most sample points within each transect, evidence of hydrology was observed routinely across the sampled areas within the reference site. Hydrology indicators observed at apparent wetland areas of the reference site were associated with tidal waters of the LLM and included saturated soils, drainage patterns, drift deposits, shell hash, salt crust, and live algal mats. Areas of inundation ranged 2" to 12.5" in depth and included faunal observations of fiddler crabs (*Uca* sp.), hermit crabs (*Clibanarius* sp.), and unidentified fishes.

Tidal mudflats are a subset of a larger dynamic category of coastal tidal flats, often occurring within a larger mosaic of salt flats, algal flats, and cordgrass dominated flats. Shifting from one community structure into another can be associated with tropical weather events or other direct impacts that result in the burial or removal of established vegetation. Of particular importance to the productivity of a tidal mudflat community is the frequency and duration of flooding (USDA, 2019). Given the proximity of the reference site to the LMPRM, connection of the proposed restoration areas to waters of the LLM is anticipated to result in a similar frequency and degree of flooding and/or ponding, and therefore, presence of similar hydrology indicators. Consequently, wetland hydrology is considered to be a critical variable by which success of the LMPRM can be assessed.

5.2.3 Reference Site Soils

A preliminary review of NRCS data for the reference site indicated that both transects were located in areas characterized by *Point Isabel clay loam*, *Barrada clay*, and *Sejita silty clay loam*. With the exception of *Point Isabel clay loam*, all soils identified within the reference site are rated as hydric. Hydric soil indicators consistently identified at the reference site included soil saturation, glistening, presence of gypsum deposits, anoxic conditions, and mixed sandy silty clay loam derived from deltaic parent material. Elevation data collected during the investigation indicated that, *Point Isabel clay loam* occurred from the

upper crests of lomas and decreased to approximately 2.95 feet above mean sea level (MSL) at the loma edge. From here, soils transitioned into *Sejita silty clay loam*, which appeared to be associated with the intertidal zone and extended baywards to a lower elevation of approximately 1.14 feet above MSL. From here, soils appeared to grade into *Barrada clay*, which extended baywards into the subtidal waters of the LLM bay. Considerable overlap appeared to be present between areas characterized by *Sejita silty clay loam* and *Barrada clay*. This indistinct transition was contributed to the dynamic nature of nearshore areas of the LLM, which are subject to continually varying influences of wind, tidal action, rainfall, and high evaporation rates. Given the irregular topographies which characterize the LLM coastline, no absolute elevation ranges associated with the above soil types could be inferred from the limited field study; however, soils along the eastern shores of the LLM bay are anticipated to generally follow similar geographic distributions at nearby areas.

Soil characteristics identified at the reference site were found to exhibit a high degree of similarity to those identified at the LMPRM. Since the LMPRM is largely comprised of the same deltaic parental material as that of the reference site, it is anticipated that establishing tidal connectivity to the proposed restoration areas would result in a similar array of hydric soil indicators in spite of the substantial disturbances caused by past modifications to the landscape. In particular, highly saturated or inundated areas would be anticipated to show signs of glistening, anoxic soil conditions, and a similar mixed sandy silty clay loam profile. Based on the high degree of similarity between the LMPRM and reference site soils, the likelihood of successfully achieving hydric soil conditions at the LMPRM's proposed restorations areas is considered to be very high. Consequently, the use of success criteria derived from hydric soil data is considered to be impractical for the goals and objectives of the LMPRM.

6.0 DETERMINATION OF CREDITS

The LMPRM will mitigate for permanent, unavoidable loss of 41.8 acres of tidal mudflats and 1.1 acres of PEM, providing a minimum offsite in-kind compensatory ratio of 2.5:1 and an offsite out-of-kind mitigation ratio of 5:1. A breakdown of the Terminal impacts, corresponding mitigation acreages and ratios is presented in **Table 4** below.

Table 4. Determination of Necessary Credits

Terminal Impacts		**LMPR Mitigation**		
Permanent		**Type**	**Amount**	**Mitigation Impact Ratio**
41.8 acres	Tidal Flats	In-Kind	104.5 acres	2.5 : 1
1.1 acres	PEM	Out of Kind	5.5 acres	5: 1
Total: 42.9 acres			**Total: 117 acres**	

In accordance with 33 CFR § 332.3(f)(2), the district engineer must require a mitigation ratio greater than 1:1 where necessary to account for the following, which were considered as described in sections below:

1. the method of compensatory mitigation (see **Section 6.1**),
2. likelihood of success (see **Section 6.2**),
3. the differences between functions lost at the impact site and those anticipated to be established at the mitigation site, temporal losses of aquatic resource functions (see **Sections 6.3** and **6.4**),
4. the difficulty of restoring or establishing the desired aquatic resource type and functions, (see **Section 6.2**) and/or
5. the distance between the affected aquatic resource and the LMPRM.

In cases where applicable functional or conditional assessments methods are available, these methods should be used as a means of determining the extent of compensatory mitigation required. If these methods are not used, a minimum 1:1 acreage or linear foot compensation ratio must be used.

Since no functional assessment was performed as part of this PRMP, the amount of compensatory mitigation necessary to meet the project objectives was determined based on acreage, considerations of the compensatory mitigation method, functional differences between the Terminal and LMPRM, and temporal loss[8] associated with establishment of the LMPRM. A detailed breakdown of the of the proposed mitigation measures is presented in **Section 6.1**. Further examination of the respective mitigation considerations is provided below in **Sections 6.2 – 6.4**, and discussions regarding the risks and likelihood of success of the LMPRM are discussed in **Section 3.0**.

8. As defined in 33 CFR § 332.2, *temporal loss means* the time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site. Higher compensation ratios may be required to compensate for temporal loss. When the compensatory mitigation project is initiated prior to, or concurrent with, the permitted impacts, the district engineer may determine that compensation for temporal loss is not necessary, unless the resource has a long development time.

6.1 Compensation Method

The proposed creation of tidal mudflats at the mitigation site will potentially result in the establishment of coastal habitats comprised of tidal mudflats, salt flats, and algal flats or a combination of these habitats. Overtime, native coastal vegetation is also anticipated to increase in peripheral areas located adjacent to saturated and inundated soils in the restoration areas and along the tidal creeks. Since impacted habitat at the Terminal is considered to be degraded and subject to extended periods devoid of sufficient tidal exchange, it is anticipated that the established resources of the LMPRM would provide significantly higher ecological functionality above that of the Terminal site as a result of having full and direct tidal connection to the waters of the LLM. Consequently, in addition to the proposed 2.5:1 mitigation ratio, losses at the Terminal would be further offset by the higher quality habitat that is preferable to T&E species and dependent wading and migratory birds.

Cumulatively, establishment of the LMPRM would result in the placement of a conservation easement over a total of 154.74 acres of habitat. Specifically, mitigation efforts would include the establishment of 117 acres of tidal mudflat; 2.65 acres of channel establishment and rehabilitation; 2.49 acres of estuarine-deepwater habitat establishment, enhancement and preservation; 1.6 acres of riverine preservation, 5.03 acres of estuarine & marine wetlands habitat preservation, and 26.41 acres of non-hydric buffer preservation.

A summary of the proposed mitigation measures and corresponding acreages is provided in **Table 5** below.

Table 5. LMRPM Summary of Proposed Compensation

Easement	Cowardin Classification		Acreage	Subtotals
Mudflats Establishment	E2USP-E2AB1N-E2USN-E2553N		117	117
Channel Establishment	R2UBF		0.7	2.65
Channel Rehabilitation	R2UBF		1.95	
Estuarine - Deepwater Establishment	E1ABL		0.09	
Estuarine - Deepwater Enhancement	E1AB3L		1.07	2.49
Estuarine & Deepwater Preservation	E1AB3L		1.33	
Riverine Preservation	R1UBNx		1.16	1.16
Estuarine & Marine Wetlands Preservation	E2AB1N		0.19	
Estuarine & Marine Wetlands Preservation	E1SS3N		4.6	5.03
Estuarine & Marine Wetlands Preservation	E2USN		0.24	
Non-Hydric	Buffer		26.41	26.41
Total LMPRM Habitat Acres			**154.74**	

A depiction of the LMPRM mitigation areas and their corresponding mitigation methods is presented in **Figure 7**.

6.2 Likelihood of Success and Restoration Challenges

In accordance with 33 CFR § 332.3(f)(2), successful restoration of the LMPRM is considered to have a high likelihood. As discussed in **Section 3.2**, the LMPRM site occurs in a coastal area with historic disturbance, where unmaintained areas have naturally recolonized with native coastal habitats. Given the inherent resiliency of the native coastal vegetative community and abundance of surrounding native seed sources, it is anticipated that restoring and establishing the desired resource types and functions will have a high likelihood of success. In addition, establishment of the desired resources at the LMPRM is anticipated to have a significantly reduced risk as a result of the unrestricted tidal connection to waters of the LLM that will be provided to the LMPRM restoration areas.

Since successful establishment of unrestricted tidal exchange into the created mudflat habitat will be dependent on the presence of suitable on-site elevation ranges and channel prisms, tidal hydrology of the selected LMPRM alternative was evaluated by correlating the observed tidal datum from local tidal stations to the on-site design elevations. As discussed in **Section 3.3**, adequate tidal exchange of the LMPRM's restoration areas was validated against the tidal station datum. Consequently, the LMPRM is anticipated to have a high likelihood of successfully achieving performance objectives defined in **Sections 9.2** and **9.3**.

6.3 Ecologically Functional Differences – Terminal and the LMPRM

Of the 42.9 acres of permanent impacts at the Terminal, the majority of wetland acreage (41.8 acres) to be impacted consists of tidal mudflats. These tidal mudflats are characterized as often exposed, dry, and sparsely vegetated due to the initial construction of the BSC and routine maintenance dredging activities associated with its upkeep. As dredged spoils generated by BSC maintenance activities have historically been deposited along the BSC, natural tidal exchange into the tidal mudflat areas of the Terminal has been permanently altered. Consequently, tidal mudflats within the Terminal site boundaries are considered highly disturbed and tend to exhibit wetland functionality only in lower lying areas as a result of significant precipitation events, periods of extreme high tides, or during storm surges. In addition, due to the Terminal's proximity to industrial facilities located along the BSC, water quality in the vicinity of the Terminal is considered to be degraded as a result of discharges from nearby industrial facilities.

Since the LMPRM is located approximately 9.1 miles to the northwest of the BSC, ambient water quality is not likely to be affected by industrial activities associated with the Port of Brownsville. Additionally, unrestricted tidal connectivity to the restoration areas at the LMPRM would result in a substantially higher ecological functionality over that afforded by the limited tidal exchanges at the Terminal. Therefore, the offsite, in-kind mitigation ratio is anticipated to be higher than the 2.5:1 recognized in this PRMP.

6.4 Temporal Losses of Aquatic Resource Functions

Temporal losses of functionality at the LMPRM, which may occur during and following the construction period as restored resources develop and mature, are anticipated to be fully offset by the inclusion of an additional 37.74 acres of coastal habitat that will be established, enhanced, rehabilitated, and preserved under the 154.74-acre conservation easement. In addition, recovery of the aquatic resources is anticipated to be fully achieved within the five-year lifespan of the Project.

6.5 Additional Mitigation Considerations

Additional mitigation factors considered during the LMPRM design included watershed scale (33 CFR § 332.3(c)(4)), watershed conditions and needs (33 CFR § 332.3(c)(3)(i)), sources of watershed impairment (33 CFR § 332.3(c)(2)(i)), locational factors (33 CFR § 332.3(c)(2)(ii)), and habitat requirements of important species (33 CFR § 332.3(c)(2)(i)).

Since the Terminal and LMPRM share a common watershed and unmodified coastal resources (i.e., coastal habitats, floral and faunal communities) represented throughout the watershed exhibit a high degree of homogeneity, establishment of the desired resources at the LMPRM would provide effective compensation for the permanent impacts at the Terminal. Consequently, watershed scale was dismissed from further review. Similarly, since ecological characteristics at the LMPRM would be consistent with those expected in the coastal habitats along the LLM bay, the effective distance between the Terminal and LMPRM (approximately 10 miles) would only serve as an added benefit to the LMPRM due to the industrially-driven degradation of water quality and coastal habitat in areas around the Terminal. As a result, distance between the Terminal and LMPRM was also dismissed from further review.

Establishment of the LMPRM will be in conformance with a number of watershed plans and initiatives, as well as supplement habitat and species-specific regional projects (see **Section 2.2**). Collectively, these efforts are primarily aimed at improving water quality within the South Laguna Madre Watershed and meeting conservational needs of the diverse and unique ecosystems that characterize the region. By restoring significantly disturbed coastal habitat and providing perpetual protection for the resources and functions created, the LMPRM would not only achieve the primary objective of offsetting permanent losses at the Terminal, but result in the uplift of ecological functionality in a significantly disturbed coastal area, prevent future development in sensitive coastal habitat located adjacent to a federally protected wildlife refuge, produce increased contiguity amongst existing native coastal habitats, and concomitantly provide suitable habitat capable of supporting a variety of T&E species, shorebirds, and migratory bird species that may occur in the area. Cumulatively, the additional mitigation considerations examined for the LMPRM would positively contribute to the overall health and functionality of the South Laguna Madre Watershed.

7.0 MITIGATION WORKPLAN FOR THE SITE

In general, construction at the LMPRM will occur from east to west to avoid potential ground or surface water issues such as ponding, which may inhibit operation of heavy machinery. In addition to the measures outlined below, construction of the LMPRM would incorporate TPWD best management practices (BMPs), construction BMPs, and recommendations provided by the USFWS for erosion control, dust control, and protection of T&E and migratory bird species. Daily briefings concerning site safety and protection of native wildlife will be conducted prior to the initiation of any construction activities.

7.1 Construction Sequencing Plan

In general, construction activities would proceed from the eastern portions of the LMPRM towards the west to minimize downtime which may occur as a result of flooding or ponding from groundwater intrusion or precipitation and to minimize potential impacts to existing habitats at the LMPRM. Breeching of the berms and establishment of tidal connectivity will occur once the tidal creeks have been constructed and final site grading activities have been completed. The following is a general construction sequencing plan of the proposed construction activities for the LMPRM.

Clearing of conveyance channels, restoration areas, and berms

- Existing conveyance channels, restoration areas, and berms will be cleared of debris or other obstructions (e.g., PVC drainage pipes, wooden piers, box culverts, weirs) using an excavator. A 100-foot buffer will also be cleared around all proposed restoration areas. Conveyance channels will be scraped, cleaned, and any removed debris will be stacked in piles not to exceed 10 feet in height. Debris piles will be subsequently conveyed offsite to an appropriate disposal facility.

- Where necessary, construction machinery (e.g., excavators, scrapers, dozers, motor graders, and off road trucks) will be used to remove debris from dredge disposal areas and berms. In addition, debris clearing will occur within a 100-foot buffer around the proposed restoration areas.

- Dredge spoil materials generated during the clearing process will be placed adjacent to the excavated areas prior to being conveyed to a designated, onsite dredge disposal area.

- Where feasible, clearing and grubbing will be confined to the immediate construction zone to minimize unnecessary impacts to established vegetation.

- To minimize the construction footprint, where feasible, all construction machinery and construction materials will be stored within or immediately adjacent to the construction zone or on caliche roadways at the LMPRM.

- To ensure fluidity of construction operations construction machinery will be used to maintain and grade roadways.

Construction of tidal creeks

- The northern and southern tidal creeks will be constructed to a suitable target elevation of approximately -2.5 ft NAVD88, with a construction tolerance of +0.3 feet NAVD88. Over-dredge tolerances are anticipated to be 0.5 feet (vertical) and 10 feet (horizontal).

- Construction targets for the dredge spoil/berm degrading area will be a target depth of -1ft NAVD88 and target width of 40 feet. No deviations from the above construction and over-dredge tolerances are anticipated at the dredge spoil/berm degrading area.

Excavation and LMPRM Grading

- Restoration areas will be graded using scraper haulers, excavators, or other heavy machinery.

- Following preparation of restoration areas, conveyance channels, and constructed tidal creeks, excavation will be performed using scraper equipment outfitted with lasers or machine controls. Spoils generated during the grading process will be piled and conveyed to onsite designated disposal areas, as described above.

- No irregular topographies will be intentionally created during the LMPRM's construction; however, minor fluctuations in elevations at the established LMPRM are anticipated as a result of construction and survey tolerances. Variance in elevation is anticipated to provide increased biological diversity and therefore, would contribute to overall uplift of the LMPRM.

- Excavators will be used to load earthmoving equipment (i.e., scrapers) in the event the ground is too saturated to conduct scraping activities.

Berm breaching

- Upon completion of the internal tidal creek construction process, the LMPRM's existing berm system will be strategically breached at tidal connection points to provide connection to waters of the LLM.

- Where feasible, clearing and grubbing will be confined to the immediate construction zone to minimize unnecessary impacts to established vegetation.

- One breach would occur at the northern restoration area's southern berm wall, adjacent and immediately to the north of the existing main drainage canal.

- A total of six breaches will be made at the southern restoration area, providing tidal connectivity to four former aquaculture stock ponds. The breaches will occur at the western berm of each respective pond.

- All spoils generated during the breaching process will be placed adjacent to the excavated areas prior to being conveyed to a designated dredge disposal area.

- Silt curtains will be utilized at the tidal connection points to prevent discharge of sediment plumes into water of the LLM. Following completion of construction activities, the silk curtains will be removed.

Erosion Control Measures

- Since existing berms at the LMPRM are characterized by established vegetation, erosive influences are anticipated to be minimal and entirely contained within the boundaries of the site.

- Where necessary, selective seeding may be utilized to provide enhanced protection against erosive actions. Any seeding activities would involve the use of commercially available seed or seed mix that match native coastal vegetation observed at the LANWR reference site.

- Where deemed necessary, additional erosion control measures (e.g., silt fencing, erosion control blankets, selective placement of rip-rap) may be implemented to protect against heavy runoff or severe erosion and prevent delays to the construction process. Materials for silt fencing or erosion control blankets will be constructed of biodegradable materials.

- Any erosion control measures remaining at the LMPRM will be removed following completion of construction activities.

7.2 LMPRM Jurisdictional Impacts

Establishment of tidal mudflats at the LMPRM site would require augmentation of the existing landscape in order to provide tidal connectivity to the proposed restoration areas. To achieve the proposed restoration, 0.06-acre of existing wetlands would be impacted at the outfall associated with the southern constructed tidal creek in order to connect the proposed Project to the Laguna Madre. An additional 0.9-acre of impacts to WOTUS would occur at an existing, excavated estuarine pond formerly utilized by the aquaculture farm and 1.1 acres of riverine impacts would be incurred as a result of the widening and grading of an existing drainage canal.

Presently, the existing 0.9 acre pond is characterized by a muddy, unconsolidated bottom and is connected to waters of the LLM bay via a buried pipeline. Under the proposed LMRPM activities, the pond would be selectively filled to a depth of -0.5 ft NAVD88 and directly connected to waters of the LLM via a constructed channel at its eastern side. Selective filling of the pond to an elevation that better matches existing seagrass beds in adjacent waters of the LLM would allow for the potential establishment of seagrasses within the pond; thereby providing a net increase in the pond's ecological value. As a result, impacts to the estuarine pond are anticipated to be entirely offset by the inherent increase in ecological functionality provided by unrestricted connection to the LLM bay. Similarly, while impacts to the 0.06-acre and 1.1-acre wetland areas are necessary to establish tidal connection to the LMPRM's restoration areas, the impacts are expected to be entirely offset by the inclusion of an additional 37.74 acres of established, enhanced, rehabilitated, and preserved areas, and the net uplift in ecological value of the LMPRM as the site matures.

8.0 MAINTENANCE PLAN

The LMPRM will be monitored and maintained by EIP as part of EIP's commitment to establish and maintain wetland functionality and meet performance standards outlined in this PRMP. EIP will submit project plans, annual monitoring reports, and any necessary contingencies pertaining to adaptive management of the LMPRM to the USACE.

During the construction period (Year 0), daily inspections will include monitoring of any natural vegetation colonization or invasive species control activities. In addition, inspections will note any signs of trespass or vandalism, trash or debris removal, and document the integrity of the LMPRM's berms, breaches, and tidal creeks. To aid future maintenance and management efforts of the LMPRM, a maintenance task list will also be compiled based on the maintenance needs documented in the monthly reports.

Post-construction monitoring of the LMPRM will also be performed annually for the first five years (Year 1 – Year 5) following completion of construction activities. Maintenance actions and recommendations and where necessary, any modifications to the Adaptive Management Plan will be reported by EIP annually. By Year 5, the LMPRM is anticipated to be fully established; consequently, maintenance activities are anticipated to be minimal and performed solely on an "as needed" basis. Invasive species control measures will continue to be implemented as necessary during the post-construction period. Upon achieving long-term performance standards, yearly inspections of the LMPRM will be endowed with a designated long-term land steward to ensure long-term management.

9.0 PERFORMANCE STANDARDS

In accordance with 33 CFR § 332.4(c)(9) and 33 CFR § 332.5, ecological performance standards were developed for the purpose of assessing the expected development of the LMPRM. The following section outlines short-term, interim, and long-term performance standards consistent with the objectives listed in **Section 2.0**. Success criteria as described below were developed based on normal climatological and meteorological conditions (e.g., non-drought, no natural disasters). Should extreme climatological or meteorological conditions occur, adaptive management strategies, as outlined in **Section 12.0**, may need to be implemented to ensure success of the LMPRM. In addition to the performance standards outlined below, restoration areas at the LMPRM will be maintained clear of any trash and debris throughout the 5-year lifespan of the project.

A summary of the LMPRM performance standards as they relate to the 117-acre establishment of tidal mudflats is provided in **Table 6** and discussed below.

Table 6. Summary of LMPRM Performance Standards

Performance Standard	Year 0 (Construction Period)	Years 1-4 (Interim Period)	Year 5 (Final Success Criteria)
Hydrology	Submission of an *As-Built Report* to the USACE.	Inundation and/or saturation will be maintained for at least 4% of the growing season (i.e., 14 days) by the end of Year 4.	Inundation and/or saturation will be maintained for at least 5% of the growing season (i.e., 18 days).
Elevation	Submission of an *As-Built Report* to the USACE.	Elevation surveys and tidal datum evaluations will demonstrate inundation and/or saturation in restoration areas commensurate with naturally occurring tidal mudflats in the immediate area.	Elevation surveys and tidal datum evaluations will demonstrate inundation and/or saturation in restoration areas commensurate with naturally occurring tidal mudflats in the immediate area.
Soils	Submission of an *As-Built Report* to the USACE; collection of soil data within the restoration areas to determine baseline soil conditions.	Collection and evaluation of soil data from within the restoration areas for comparisons against baseline soil data; documentation of existing hydric soil conditions.	Presence of hydric soil indicators (as defined by the *1987 USACE Wetland Delineation Manual* and the *Regional Supplement - Gulf Coastal Plain Region, ver. 2.0*) within the restoration areas.
Invasive Species Control		Less than 10% invasive plant species. Report annually on natural recruitment.	Less than 5% invasive plant species. Report annually on natural recruitment.

In addition to performance criteria discussed above, ecological performance standards were developed for the purpose of assessing the additional establishment, enhancement, rehabilitation, and preservation areas included as part of the LMPRM. Specifically, these areas include an additional 2.65 acres of channel

establishment and rehabilitation; 5.03 acres of estuarine and marine wetland preservation; 1.16 acres of riverine habitat preservation; 2.49 acres of estuarine and deepwater habitat establishment, enhancement, and preservation; and 26.41 acres of non-hydric buffer preservation that will be included in the 154.74-acre LMPRM footprint's conservation easement. Success criteria associated with these additional mitigation areas is presented in **Tables 7-10** below.

Table 7. Performance Standards - Establishment Areas

Performance Standards – Establishment Areas	Cowardin Classification	Acreage	Year 0 (Construction Period)	Years 1-4 (Interim Period)	Year 5 (Final Success Criteria)
Channel Establishment	R2UBF	0.70	Submission of an *As-Built Report* to the USACE.	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument
Estuarine - Deepwater Establishment	E1ABL	0.09	Submission of an *As-Built Report* to the USACE.	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument

Table 8. Performance Standards - Rehabilitation Area

Performance Standards - Rehabilitation	Cowardin Classification	Acreage	Year 0 (Construction Period)	Years 1-4 (Interim Period)	Year 5 (Final Success Criteria)
Channel Rehabilitation	R2UBF	1.95	Weirs, piers, piping, and other structural impoundments removed from the existing channel; submission of an *As-Built Report* to the USACE.	Passive Tidal flow Monitoring Report & Site Protection Instrument	Passive Tidal flow Monitoring Report & Site Protection Instrument

Table 9. Performance Standards - Enhancement Areas

Performance Standards - Enhancement	Cowardin Classification	Acreage	Year 0 (Construction Period)	Years 1-4 (Interim Period)	Year 5 (Final Success Criteria)
Estuarine - Deepwater Enhancement	E1AB3L	1.07	Submission of an *As-Built Report* to the USACE; weirs and other obstructions removed from channel, channel widened to design specifications	Passive flow of waters within the enhanced estuarine pond to and from LLM bay; removal of any additional obstructions (i.e., discarded, windblown, tidally or storm-deposited structures).	Passive flow of waters within the enhanced estuarine pond to and from LLM bay; removal of any additional obstructions (i.e., discarded, windblown, tidally or storm-deposited structures).

Table 10. Performance Standards - Preservation Areas

Performance Standards - Preservation	Cowardin Classification	Acreage	Year 0 (Construction Period)	Years 1-4 (Interim Period)	Year 5 (Final Success Criteria)
Riverine Preservation	R1UBNx	1.16	Submission of an *As-Built Report* to the USACE; Site Protection Instrument	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument
Estuarine & Marine Wetlands Preservation	E2AB1N	0.19	Submission of an *As-Built Report* to the USACE; Site Protection Instrument	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument
Estuarine & Marine Wetlands Preservation	E1SS3N	4.60	Submission of an *As-Built Report* to the USACE; Site Protection Instrument	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument
Estuarine & Marine Wetlands Preservation	E2USN	0.24	Submission of an *As-Built Report* to the USACE; Site Protection Instrument	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument
Estuarine & Deepwater Preservation	E1AB3L	1.33	Submission of an *As-Built Report* to the USACE; Site Protection Instrument	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument
Non-Hydric	Buffer	26.41	Submission of an *As-Built Report* to the USACE; Site Protection Instrument	Monitoring Report & Site Protection Instrument	Monitoring Report & Site Protection Instrument

9.1 Construction and Initial Success Criteria (Year 0)

Quality assurance monitoring efforts will be performed continuously throughout the construction phase of the LMPRM as described in **Section 10.0** of this PRMP. Documentation compiled by the technician will include work summaries, photographs, and a discussion regarding on-site performance in comparison to performance standards outlined in this PRMP. Upon completion of LMPRM construction activities, EIP will complete and submit an *As-Built Report* including a map of the final LMPRM site grades to the USACE.

Hydrology

At the conclusion of the construction period, EIP will submit an As-Built Report to the USACE. The report will demonstrate conformance to the approved construction plans and will include a map of the final LMPRM site grades and summarize the restoration activities performed during the construction of the LMPRM.

Elevation

At the conclusion of the construction period, EIP will submit an As-Built Report to the USACE. The report will demonstrate conformance to the approved construction plans, including a map of the final LMPRM

site grades, and summary of the restoration activities performed during the LMPRM's construction.

Soils

A review of NRCS soil data indicates that with exception to *Point Isabel clay loam* and the associated coastal ridge vegetative community located outside of the proposed restoration areas, soils within the LMPRM are considered to be characterized as hydric or relict-hydric. Given that the scope of construction activities would involve the removal of the upper levels of existing soils within the restoration areas, baseline data would be collected prior to construction activities to establish baseline data regarding the presence or absence of existing hydric soil conditions.

Invasive Species Control

Since the established LMPRM will be comprised of coastal tidal flats, vegetation is anticipated to be a sparsely distributed natural component and therefore, considered an impractical metric for gauging overall performance of the LMPRM tidal flats habitat. However, species composition and assembly will be documented post construction to monitor for the presence of invasive species. If invasive species are identified post construction, a plan to intercede shall be implemented to ensure a final success criteria of less than 5% will be achieved in Year 5.

9.2 Interim Success Criteria (Year 1-4)

Monitoring reports documenting observed on-site performance relative to performance standards outlined in this PRMP, will be submitted to the USACE on an annual basis during the interim period. Specifically, annual monitoring reports will address:

Hydrology

Restoration areas will demonstrate wetland hydrology, as defined in the *1987 USACE Wetland Delineation Manual*. Specifically, conditions of inundation and/or saturation within designated restoration areas will be maintained for at least 4% of the growing season (i.e., 14 days). A combination of aerial photography, elevation profiles derived from field observations, and tidal gauge data will be used to demonstrate hydrology within the restoration areas sufficient to meet the goals of the Project. If during the course of Years 1-4, tidal exchanges into restoration areas are found to be insufficient, corrective measures will be implemented to ensure adequate tidal exchange occurs within the restoration areas.

Elevation

Data collected from elevation transects will confirm that the LMPRM's restoration areas continue to fall within an appropriate range sufficient for inundation by tides with the same general frequency as similar, naturally occurring habitat in the immediate vicinity. A combination of aerial photography, elevation profiles derived from field observations, and tidal gauge data will be used to demonstrate elevations within the restoration areas are sufficient to meet the goals of the Project. If during the course of Years 1-4, elevations are found to be insufficient for proper tidal inundation, corrective measures will be implemented to ensure adequate tidal exchange occurs within the restoration areas.

Soils

Soil data collected from within the restoration areas will be used to evaluate hydric soil conditions against baseline soil data collected during the construction period (Year 0).

Invasive Species Control

Throughout Years 1-4, if necessary, invasive vegetation will be maintained to an overall abundance of less than 10% within the restoration areas, with the desired effect of reducing the overall percentage annually.

9.3 Final Success Criteria (Year 5)

In addition to success criteria outlined in this section, a formal wetland delineation of the LMPRM will be completed at the end of Year 5 to demonstrate that the restored areas meet the definition of a wetland, as defined in the *1987 USACE Wetland Delineation Manual*.

Hydrology

At the conclusion of Year 5, restoration areas within the LMPRM will demonstrate wetland hydrology. Specifically, conditions of inundation and/or saturation within designated restoration areas will be maintained for at least 5% of the growing season (i.e., 18 days). A combination of aerial photography, elevation profiles derived from field observations, and tidal gauge data will be used to demonstrate hydrology within the restoration areas sufficient to meet the goals of the Project.

Elevation

Data collected from elevation transects will confirm that the LMPRM's restoration areas continue to fall within an appropriate range sufficient for inundation by tides with the same general frequency as similar, naturally occurring habitat in the immediate vicinity. A combination of aerial photography, elevation profiles derived from field observations, and tidal gauge data will be used to demonstrate elevations within the restoration areas are sufficient to meet the goals of the Project.

Soils

Soils within the restoration areas will demonstrate the presence of hydric soil conditions, as defined by the *1987 USAE Wetland Delineation Manual* and the *Regional Supplement - Gulf Coastal Plain Region, Ver. 2.0* by the end of Year 5.

Invasive Species Control

Invasive vegetation will meet an abundance criteria of less than 5% within the restoration areas.

10.0 MONITORING AND REPORTING REQUIREMENTS

In accordance with 33 CFR § 332.6(c), monitoring reports documenting the progression of the LMPRM will be provided by EIP to the USACE on an annual basis. Monitoring reports will be compiled in accordance with requirements promulgated in the USACE Regulatory Guidance Letter (RGL) No. 08-03, "*Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources*".

EIP will perform all work necessary to monitor the LMPRM and demonstrate compliance with the LMPRM objectives as stated in **Section 2.0**. Monitoring is anticipated to occur daily (internally) at the site during the construction phase (Year 0), and annually during the interim (Years 1-4) and final (Year 5) monitoring periods, or until all performance standards are met. At a minimum, monitoring reports will include documentation related to the following:

- an overview of LMPRM conditions and functionality during the monitoring event;
- a review of site hydrology within the restoration areas, based on elevation surveys, tidal station datums, and/or tidal data loggers;
- a brief summation of any corrective actions or maintenance activities performed during the monitoring period;
- descriptions of vegetation recruitment, survival, wetland indicator status, and any potential causes of mortality within the restoration areas;
- a general description of non-native/invasive vegetation observed during the monitoring efforts;
- a general description of wildlife usage at the LMPRM, with particular emphasis on coastal, wading, and migratory birds;
- a discussion of any applicable hydrology-altering features;
- supporting documentation including but not limited to maps, plans, results of qualitative assessments of ecological functionality, and ground-level digital images of restoration areas, established photo point areas, and other locations throughout the LMPRM;
- a review of the Project's progression towards achievement of set performance standards; and
- any specific recommendations pertaining to adaptive management needs for the LMPRM.

To demonstrate compliance with performance standards outlined in **Section 9.0**, monitoring will be performed at the LMPRM in accordance with the following protocols.

Year 0 – Construction Period

Routine monitoring activities will be performed throughout the duration of the construction phase of the LMPRM (Year 0). Data collected during Year 0 will be used to demonstrate conformance to the approved construction plans and document additional information pertinent to the success criteria outlined in **Section 9.0**. Findings from the monitoring efforts for Year 0 will be evaluated and compiled in an *As-Built Report*, to be submitted to the USACE. In addition, a series of at least five (5) photo points will be established prior to the commencement of any construction activities at the LMRPM. The photo points will be utilized to track spatiotemporal changes and monitor functionality of the established resources during interim and final monitoring periods (Years 1-5).

Years 1 – 4 – Post-Construction Establishment (Interim) Period

Monitoring will be performed on an annual basis during the post-construction period of the project (Years 1-4). A report documenting findings from the yearly monitoring activities will be prepared and submitted to the USACE on an annual basis. Maintenance needs and/or any necessary modifications to the LMPRM's Adaptive Management Plan will also be documented and conveyed in the annual report.

Year 5 – Final Monitoring Period

A final annual monitoring report will be prepared and submitted in accordance with the post-construction monitoring protocols outlined above. If performance standards are not achieved by the end of Year 5, reports presenting documentation related to monitoring efforts will continue to be submitted to the USACE on an annual basis until all performance criteria have been met.

11.0 LONG-TERM MANAGEMENT PLAN

In accordance with 33 CFR § 332.7(d), following the successful performance of the LMPRM in Year 5, EIP IV Credit Co. LLC will assume management responsibilities as the Long-Term Steward for the LMPRM until the responsibility is otherwise transferred. Should transfer of long-term management responsibilities occur, a qualified steward would be selected to ensure the continued viability of the LMPRM and notification of the transfer will be provided to the USACE. Upon final approval of the LMPRM by the USACE, EIP will endow a fund to cover long-term management activities. As the LMPRM would result in self-sustaining tidal mudflats, maintenance and management activities are anticipated to be minimal by the end of Year 5 and primarily limited to routine inspections and removal of any trash or debris.

Annual inspections will be conducted by the Long-Term Steward to identify and execute any maintenance needs. Where practicable, the Long-Term Steward will conduct inspections during the growing season to determine maintenance needs regarding invasive species control, boundary issues, or implementation of adaptive management techniques, as specified in **Table 11**. Once an adaptive management plan has been developed, the Long-Term Steward will address the identified concerns through general repairs, seeding/reseeding, herbicide application, or other necessary measures.

11.1 Mineral Rights and Mineral Management Plan

Surface resources at the LMPRM are currently owned by EIP IV Shrimp Land Co., LLC, mineral rights of the LMPRM are currently retained by Dr. Jack C. Parker (16.889%), William D. Kennedy (12.75%); H.L. Brown, Jr. (12.75%); Gary B. Laughlin (12.75%); Suzanne R. Benson, R.H. Kinner, H.L. Brown, J.T. Trotter, Co-Trustees for the Vivian L. Smith Trust f/b/o Sandra Smith Dompier and the Vivian Smith Trust for Bobby Smith Cohn (9.6805%); Shrimp, Inc. (9.6805%); Cyril Wagner, Jr. (12.75%); and Jack E. Brown (12.75%). Rights to LMPRM ingress/egress are currently retained by EIP.

According to online records provided by the Texas Railroad Commission, no active or inactive natural gas lines, meters, or other miscellaneous easements exist on the LMPRM and no active oil, gas or mineral leases are known to affect the LMPRM.

Since surface landowners in the State of Texas cannot wholly control a subsurface mineral holder's access to those minerals, the exploration, production, and transportation of any subsurface mineral resources under the LMPRM are considered acceptable provided that any drilling activities be conducted in a manner that minimizes adverse environmental impacts to the greatest extent practicable. The EIP shall notify the USACE as soon as practicable prior to any exploratory activities related to subsurface minerals under the LMPRM. To minimize the potential for adverse impacts associated with subsurface mineral exploration, EIP, the future easement holder, long-term LMPRM manager, and the mineral holders, will establish an agreement to manage potential subsurface mineral exploration activities at the LMPRM. Specifically, protective elements of the agreement include:

- All drilling activities must be conducted in a manner that minimizes adverse environmental impacts to the LMPRM. The mineral rights holder will be required to develop a written Best Management Practices (BMP) plan for the drilling operations.

- All drilling activities shall comply with applicable regulatory requirements, including those under Section 404 of the Clean Water Act (CWA).

- Any drilling equipment will be limited to existing access roads.

The driller and/or operator must restore all impacted areas to pre-existing conditions as soon as is practicable following the initiation or conclusion of drilling activities.

12.0 ADAPTIVE MANAGEMENT PLAN

In accordance with 33 § 332.7(c), contingency plans are included in this section to address unforeseeable conditions, unanticipated issues, or changes in condition of the LMPRM. This Adaptive Management Plan consists of potential activities performed outside of normal management and maintenance of the LMPRM based on the determination during field observations for adaptive management needs during the interim and long-term monitoring periods for the LMPRM. This Adaptive Management Plan will serve to facilitate existing management plans in light of changing conditions of the LMPRM that may inhibit or prolong successful achievement of the LMPRM goals.

EIP will assume responsibility for implementation of the PRMP to ensure achievement of performance criteria during the interim monitoring period. Should EIP, the Long-Term Steward, or the USACE determine that the LMPRM is not achieving performance criteria as outlined in **Section 9.0**, a Notice of Deficiency (NOD) stating the deficiency will be developed by the entity making the determination. Upon identification of a deficiency, EIP, the Long-Term Steward, and/or USACE will evaluate the issue to determine the cause of the failure, reach consensus on appropriate adaptive management solutions, and implement actions to correct the deficiency.

This Adaptive Management Plan will serve as a living document to be evaluated for effectiveness and updated if needed on an annual basis. Should additional contingencies need to be incorporated into the Adaptive Management Plan, an updated plan will be submitted to the USACE for approval.

An outline of potential issues and corresponding adaptive management strategies is presented in **Table 11** below.

Table 11. Adaptive Management Strategies

Potential Issue(s)	Adaptive Management Solutions
Elevation changes within wetlands or tidal creeks as a result of accretion/sedimentation	• If sedimentation results in adverse effects to hydrophytic vegetation or hydrologic performance, sediments will be excavated to restore specified flow
Control of invasive plant species	• Where identified, invasive vegetation will be controlled by application of herbicide on a spot treatment basis

13.0 FINANCIAL ASSURANCES

Construction and Establishment

In accordance with 33 CFR § 332.7(n)(1), financial assurances will be established in the form of a performance bond to ensure high level of confidence that the LMPRM will be successfully constructed and completed within the applicable performance standards. The surety bond (to be sent under a separate cover) will provide operative language that the surety company will pay necessary funds to a third-party cover construction, maintenance, and monitoring costs associated with the LMPRM's mitigation obligations. Total financial exposure for construction and establishment of the LMPRM and starting financial obligation is **$5,791,141.42**. Estimated costs and timeline for construction, establishment, and monitoring of the mitigation LMPRM is provided in **Table 12** below.

Table 12. Construction and Management Costs

Year 0 (Construction)	Unit	Unit Cost	Number	Total Cost
Mobilization	LS	$112,333.60	1	$112,333.60
Earthwork	C/Y	$7.71	645,650	$4,980,580.49
Dust & Erosion Control	LS	$127,627.42	1	$127,627.42
Utilities Removal	LS	$10,927.27	1	$10,927.27
Biological Monitoring	T/M	$15,385.00	14	$218,545.40
Survey (Layout and As Built)	LS	$131,127.24	1	$131,127.24
			Subtotal	**$5,581,141.42**
Year 1-5 Monitoring and Reporting	**Unit**	**Unit Cost**	**Number**	**Total Cost**
Annual Monitoring	T/M	$35,000.00	5	$175,000.00
Maintenance and Support	MONTH	$250.00	60	$15,000.00
Wetland Delineation	LS	$20,000.00	1	$20,000.00
			Subtotal	**$210,000.00**
			Total	***$5,791,141.42***

Interim Monitoring and Management Activities

Upon completion of construction activities and deliverance of the "As-Built" plans, the LMPRM is anticipated to have a significantly increased likelihood of success. As a result, the financial assurances should be reduced and focus only on the risk that the remaining activities will not lead to successfully meet final performance standards. Following acceptance of the As-Built construction survey, financial assurances would be reduced to **$210,000.00**. Each subsequent year of successful monitoring would then prompt a reduction of financial assurance to follow the schedule in **Table 13** below.

Table 13. Financial Assurances

Event	Financial Assurances to be placed	Value Based on
Initial Approval	$5,791,141.42	Construction plus 5 years of Monitoring and Management
Approval of As-Built	$210,000.00	5 years of Monitoring and Management
Approval of 1st year Monitoring	$172,000.00	4 years of Monitoring and Management
Approval of 2nd year Monitoring	$134,000.00	3 years of Monitoring and Management
Approval of 3rd year Monitoring	$96,000.00	2 years of Monitoring and Management
Approval of 4th year Monitoring	$58,000.00	1 year of Monitoring and Management
Final Approval of Mitigation	$0.00	Elimination of need for financial assurance

Long-Term Monitoring and Management Activities

Upon receipt of Final Approval from USACE that all performance standards will have been met, bonded construction and establishment financial assurance requirements would be removed and the Non-Wasting Stewardship Endowment would become available for use for the Long-Term Steward.

As part of the LMPRM's long-term financing mechanism, a Long-Term Management and Maintenance (LTMM) endowment would be established in the amount of approximately $360,000.00 with the National Fish and Wildlife Foundation (NFWF). The LTMM endowment would be 100% funded by EIP by the end of Year 5. All accrued interest will be used for the administrative, operational, maintenance, and/or other activities that directly benefit the LMPRM. The principal will be maintained at the original, fully-funded amount and will remain as part of the LMPRM's assets to ensure that funds are available should long-term maintenance responsibilities be assumed by a third party.

Should results of the LTMM endowment model significantly deviate from the model assumptions, EIP agrees to coordinate with the USACE and NFWF for the purposes of establishing a mutually agreeable model or to make performance-based adjustments to the current model. Long-term annualized cost estimations are summarized in **Table 14** below.

Table 14. Long-Term Annualized Cost Estimations Summary

Long Term Maintenance	Unit	Unit Cost	Number	Total
Invasive Species Control	YR	$2,500.00	1	$2,500.00
Erosion Control	YR	$1,600.00	1	$1,600.00
LTM Review	YR	$1,500.00	1	$1,500.00
Monitoring	YR	$2,700.00	1	$2,700.00
Admin	YR	$2,500.00	1	$2,500.00
			Subtotal	$10,800.00
			Interest-Inflation	3%
Endowment Value				$360,000.00

14.0 REFERENCES

Ambiotec Environmental Consultants (AEC), Inc. (2021). *Wetland Delineation Report*.

Belaire Environmental, Inc. (2021). *Seagrass Survey*.

Belaire Environmental, Inc. (2021). Technical Memorandum. *Jurisdiction Limits, High Tide Line and Mean High Water Line Elevations*.

Coastal Engineering Consultants, Inc. (2021). Technical Memorandum. *Hydrologic Modeling of Laguna Madre Wetland Mitigation Bank.*

Cowardin, L. M. (1979). *Classification of wetlands and deepwater habitats of the United States*. Fish and Wildlife Service, US Department of the Interior.

Environmental Laboratory. (1987). "Corps of Engineers Wetland Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Flores, Jaime, J. A. Benavides, and T. Cawthon. "Update to the Arroyo Colorado watershed protection plan." *Texas Water Resources Institute Technical Report—504* (2017): 3-152.

GeoSearch. Historical Aerial Photograph Report (1950-2018). 2021.

GeoSearch. Historical Topographic Map Report (1922-2013). 2021.

Jones, K. D., Camacho, L., Sinha, T., Al-Qudah, O., DeYoe, H., Gonzalez, A. S., ... & Guerrero, J. (2018). Laguna Madre Estuary Program Environmental Strategic Plan.

Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov/. Accessed [August 6, 2021].

Peacock, D., & Smith, F. (2020). *A Photographic Guide to the Vegetation of the South Texas Sand Sheet*. Texas A&M University Press.

Richardson, A. (1995). *Plants of the Rio Grande Delta*. University of Texas Press.

Texas Commission on Environmental Quality. Nonpoint Source Program. (2021). *Lower Laguna Madre/Brownsville Ship Channel Watershed Protection Plan Development*.

Texas LNG. (2019). *Texas LNG Project Final Environmental Impact Statement Volume I*.

Texas Parks and Wildlife Department (1989). Management Plan – Coastal Preserve System, South Bay, Cameron County, Texas.

U.S. Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation

Manual, Atlantic and Gulf Coastal Plain Region, Version 2.0.

U.S. Department of Agriculture. 2019. *Ecological Site Description – R150BY552TX Tidal Flat.* Natural Resources Conservation Service.

U.S. Department of Agriculture. 1977. *Hydric Soils of Texas.* Natural Resources Conservation Service. http://media.swf.usace.army.mil/pubdata/environ/regulatory/other/links/soillinks/hydricsoilslistfortexas.htm.

U.S. Department of Agriculture. Soil Conservation Service. 1977. *Soil Survey of Cameron County, Texas.*

U.S. Department of the Interior. 2008. *Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Wintering Population of the Piping Plover (Charadrius melodus) in Texas.* 50 CFR Part 17, pgs. 29,293-29,321.

U.S. Federal Emergency Management Agency. 2018. *National Flood Hazard Layer Firmette (48061C0350F, February 16, 2018)*. https://msc.fema.gov/portal/home

U.S. Fish and Wildlife Service. 2021. *National Wetlands Inventory Map*. USFWS Wetlands Mapper. https://www.fws.gov/wetlands/data/mapper.html.

U.S. Fish and Wildlife Service. 2016. *Recovery Plan for the Ocelot (Leopardus pardalis). First Revision*.

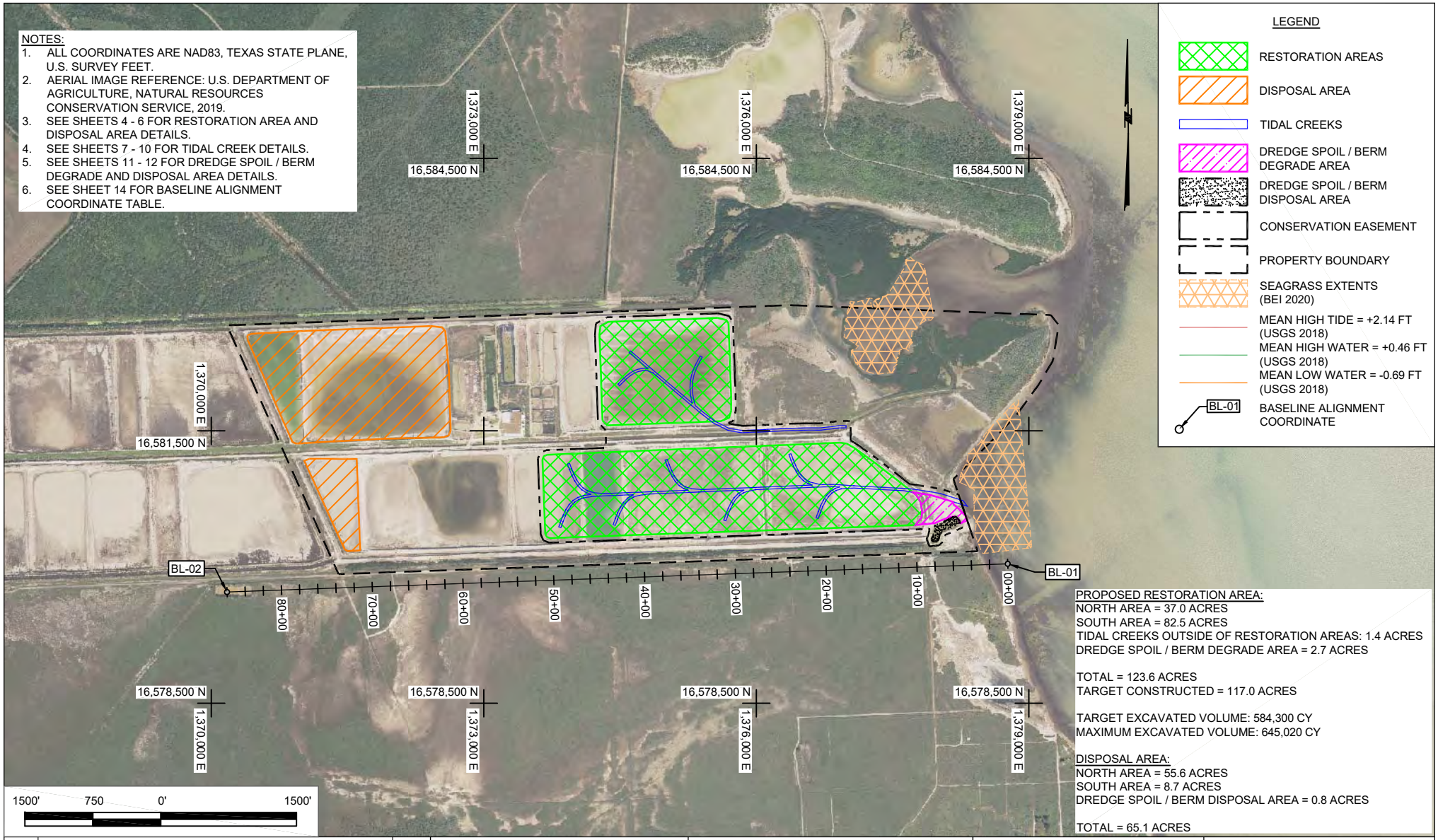
U.S. Fish and Wildlife Service. 2017. *The KAPPA, Thomas and Zarate Tracts Within the Bahia Grande Coastal Corridor, Adaptive Management and Monitoring Plan*.

United States Geological Survey (USGS). South Texas Lidar, 2018-02-23. Web. 2021-05-20.

FIGURES

FIGURE 1

Laguna Madre Permittee Responsible Mitigation Site Map



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

PROJECT OVERVIEW MAP

DATE: OCTOBER 2021

SHEET 3 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

FIGURE 2

LMPRM Alternative 1 Site Map

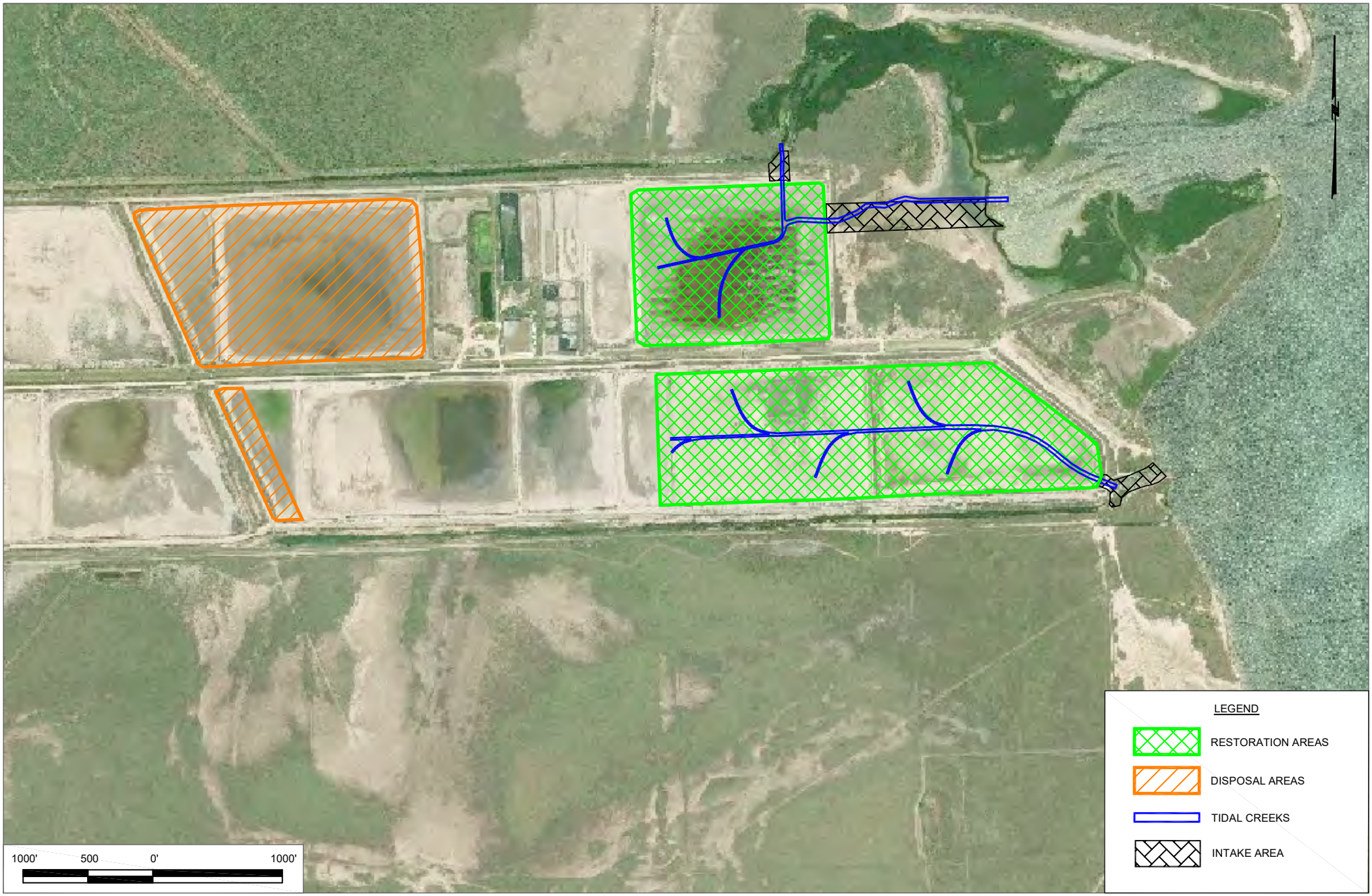

LEGEND
RESTORATION AREAS
DISPOSAL AREAS
TIDAL CREEKS
INTAKE AREA
1000'
500
0'
1000'

FIGURE 3

LMRPM Alternative 2 Site Map

LEGEND

MEAN HIGH TIDE

RESTORATION AREAS

DISPOSAL AREAS

TIDAL CREEKS

40+00

30+00

20+00

10+00

00+00

80+00

70+00

60+00

50+00

40+00

30+00

20+00

10+00

00+00

800' 400 0' 800'

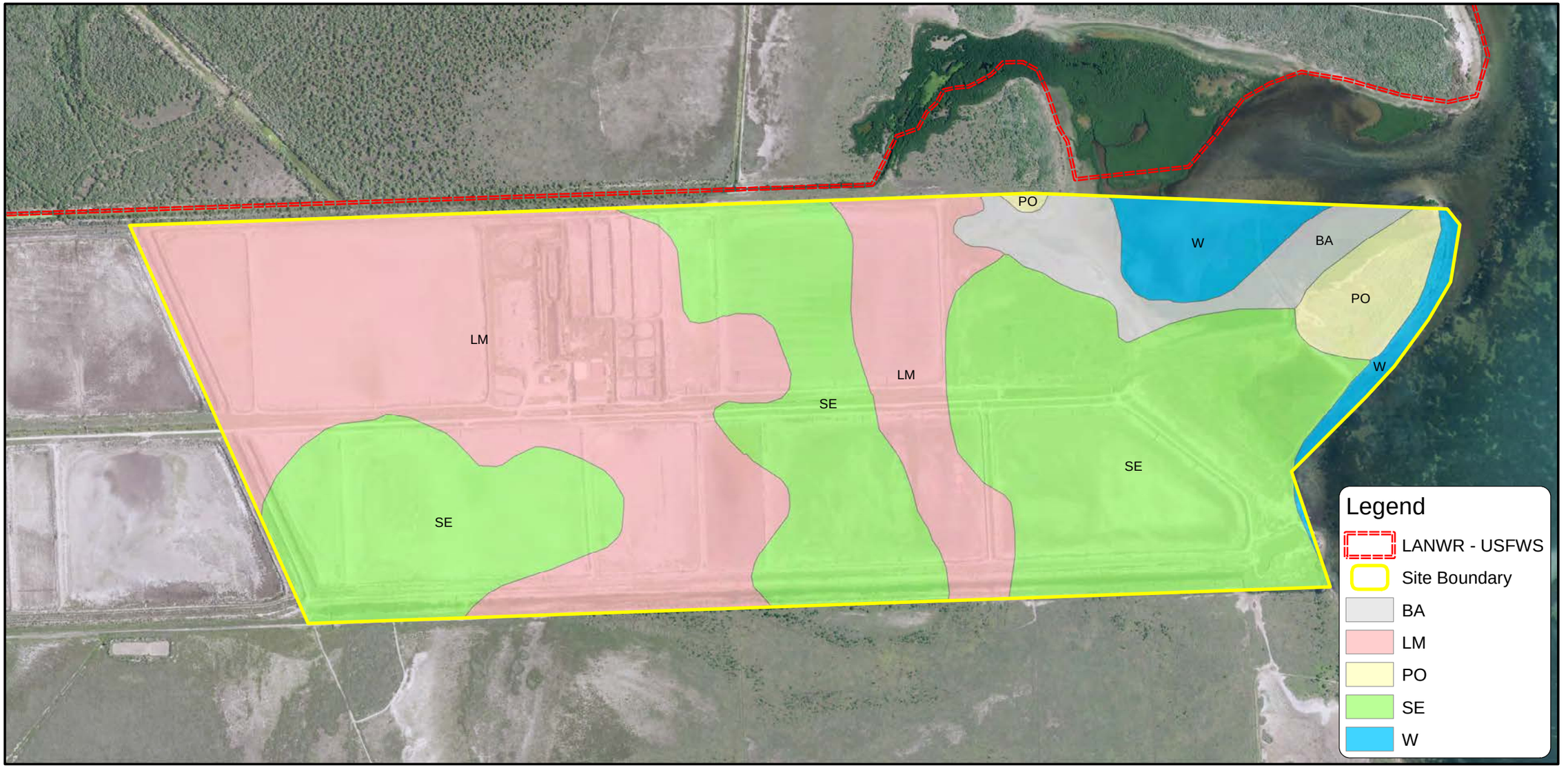
FIGURE 4

LMRPM Alternative 3 (Selected) Site Map


LEGEND
RESTORATION AREAS
DISPOSAL AREAS
TIDAL CREEKS
DREDGE SPOIL / BERM DEGRADE AREA "A"
DREDGE SPOIL / BERM DEGRADE AREA "B"
DREDGE SPOIL / BERM DISPOSAL AREA
CONSERVATION EASEMENT
PROPERTY BOUNDARY
BL-01
BASELINE ALIGNMENT COORDINATE
SURVEY BASELINE
60+00
N
16,584,700 N
1,370,000 E
16,584,700 N
1,373,200 E
16,584,700 N
1,376,400 E
16,581,500 N
1,370,000 E
16,581,500 N
1,379,600 E
BL-02
BL-01
80+00
70+00
60+00
50+00
40+00
30+00
20+00
10+00
00+00
16,578,300 N
1,370,000 E
16,578,300 N
1,373,200 E
16,578,300 N
1,376,400 E
16,578,300 N
1,379,600 E
800'
400
0'
800'

FIGURE 5

LMPRM Soil Survey Geographic Database (SSURGO) Map



AMBIOTEC GROUP

Ecosystem Investment Partners

Laguna Madre Permittee Responsible Mitigation

PRMP SSURGO Map

Figure 7

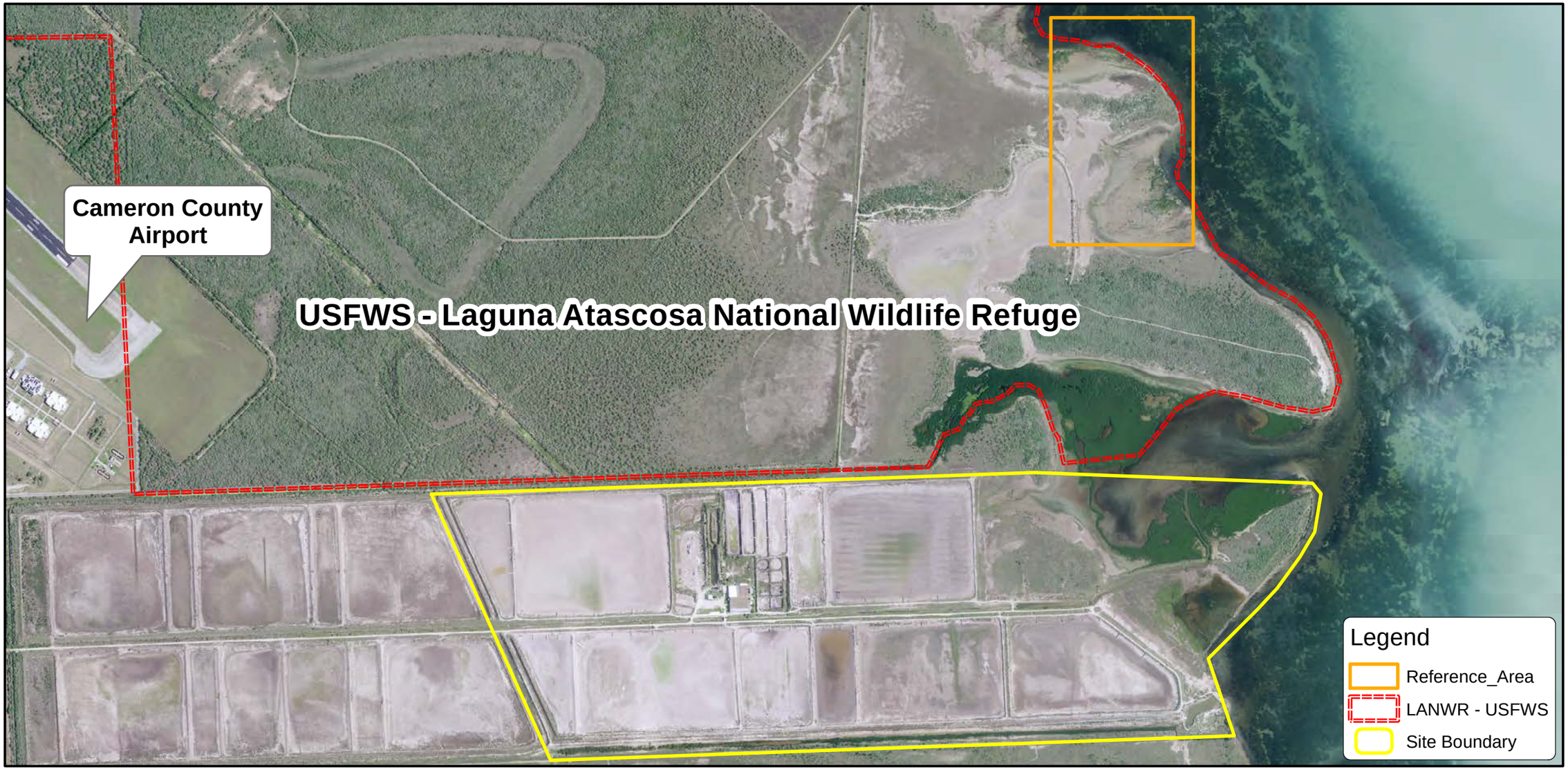
Image: National Arieal Imagery Program 2020

0 315 630 1,260 1,890 2,520 Feet

N

FIGURE 6

Laguna Atascosa National Wildlife Refuge (LANWR)
Reference Site Map



AMBIOTEC GROUP

Ecosystem Investment Partners

Laguna Madre Permittee Responsible Mitigation

LANWR Reference Site Map

Figure 8

Image: National Arieal Imagery Program 2020

0 475 950 1,900 2,850 3,800 Feet

N

FIGURE 7

LMPRM Compensation Summary Map

LEGEND

EASEMENT FOOTPRINT (154.74 AC)

CHANNEL ESTABLISHMENT

R2UBF (0.70 AC)

CHANNEL REHABILITATION

R2UBF (1.95 AC)

ESTUARINE & MARINE ESTABLISHMENT

E1ABL (0.09 AC)

ESTUARINE & DEEPWATER ENHANCEMENT

E1AB3L (1.07 AC)

MUDFLATS ESTABLISHMENT

E2USP-E2AB1N-E2USN-E2553N (117.0 AC)

NON-HYDRIC INCLUSION

NON-HYDRIC INCLUSION (BUFFER) (26.4 AC)

RIVERINE PRESERVATION

R1UBNx (1.16 AC)

ESTUARINE AND MARINE WETLANDS PRESERVATION

E2AB1N (0.19 AC)

E2SS3N (4.60 AC)

E2USN (0.24 AC)

ESTUARINE AND DEEPWATER PRESERVATION

E1AB3L (1.33 AC)

TOTAL HABITAT ACRES = 154.74

APPENDICES

APPENDIX A

Mitigation LMPRM and Reference LMPRM Photographs

LMPRM Restoration Areas and Northern Tidal Creek Map (Orientation North)

View looking west at the proposed southern restoration areas

View looking northwest at the proposed northern restoration area

View looking west along the center ditch proposed to be converted into the northern tidal creek

View looking west-northwest showing the proposed northern restoration area and intended berm breaching area (foreground at the left)

LMPRM Restoration Areas and Northern Tidal Creek Map (Orientation North)

View looking northwest at the center ditch on the east side of the road crossing

View looking to the northeast at the center ditch before the weir dam and cross netting.

View looking west at the drainage control devices located within the center ditch that would be removed as part of the restoration

View to the northeast across the proposed southern restoration area

LMPRM Inlet Pond and Southern Tidal Creek Map

View across the inlet pond located in the southeast corner of the LMPRM

View towards the west across the inlet pond

View of a concrete retaining wall located at the eastern side of the inlet pond with waters of the LLM bay on the left

View of waters edge at the eastern end of the inlet pond

LMPRM Inlet Pond and Southern Tidal Creek Map

View of intake equipment to be removed as part of the restoration

View across the inlet pond from the pump station

Bermed dredge material disposed of adjacent to the inlet pond

View of the mixed soil and dredge materials generated by the past construction and maintenance of the inlet pond

LMPRM Inlet Pond and Southern Tidal Creek Map

View of the concrete retaining wall, disposed dredge spoil, and the inlet pond (at right in the background)

View of disturbed vegetated areas located to the north of the inlet pond

View of proposed outfall for the southern tidal creek with the LLM bay on the right

View along the proposed southern tidal creek showing berm wall to be breached (background left)

LANWR Reference Site Map (orientation North)

Dense coastal ridge habitat of loma (upland) areas at transect 1

View from the edge of the loma at transect 1

Edge of salt crust and coastal ridge habitats

Mudflat and salt crust community (looking bayward)

Ecosystem Investment Partners

AMBIOTEC GROUP

SEG ENVIRONMENTAL

LANWR Reference Site

Appendix A
Site Photos

LANWR Reference Site Map (orientation North)

Edge of salt crust and algal flat community at transect 1

View of algal mat and a sparse patch of *Salicornia*

View (landwards) across the algal and mudflats with loma in the distance

Patches of *Batis* and *Avicennia* in northern ponded areas of transect 1

Ecosystem Investment Partners

AMBIOTEC GROUP

SMG ENVIRONMENTAL

LANWR Reference Site

Appendix A
Site Photos

LANWR Reference Site Map (orientation North)

Stand of black mangrove at point 9 of transect 1

View of a healthy black mangrove stand with the LLM bay in the background

Vegetated edge of tidal flats at transect 2

View of wading birds foraging and loafing at inundated flats located at transect 2

Ecosystem Investment Partners

AMBIOTEC GROUP

SEG ENVIRONMENTAL

LANWR Reference Site

Appendix A
Site Photos

LANWR Reference Site Map (orientation North)

Patchy vegetation inundated by tidal waters at transect 2

View of algal mats and drift deposits at the waters edge of transect 2

View of turtleweed and black mangroves in the eastern areas of transect 2

View of a natural drainage way supporting healthy stands of black mangrove at the eastern area of transect 2

Ecosystem Investment Partners

AMBIOTEC GROUP

SEG ENVIRONMENTAL

LANWR Reference Site

Appendix A
Site Photos

APPENDIX B

Future Easement Holder Letter of Intent

(Document is pending selection of a permanent easement holder)

APPENDIX C

Permit Plan Plats

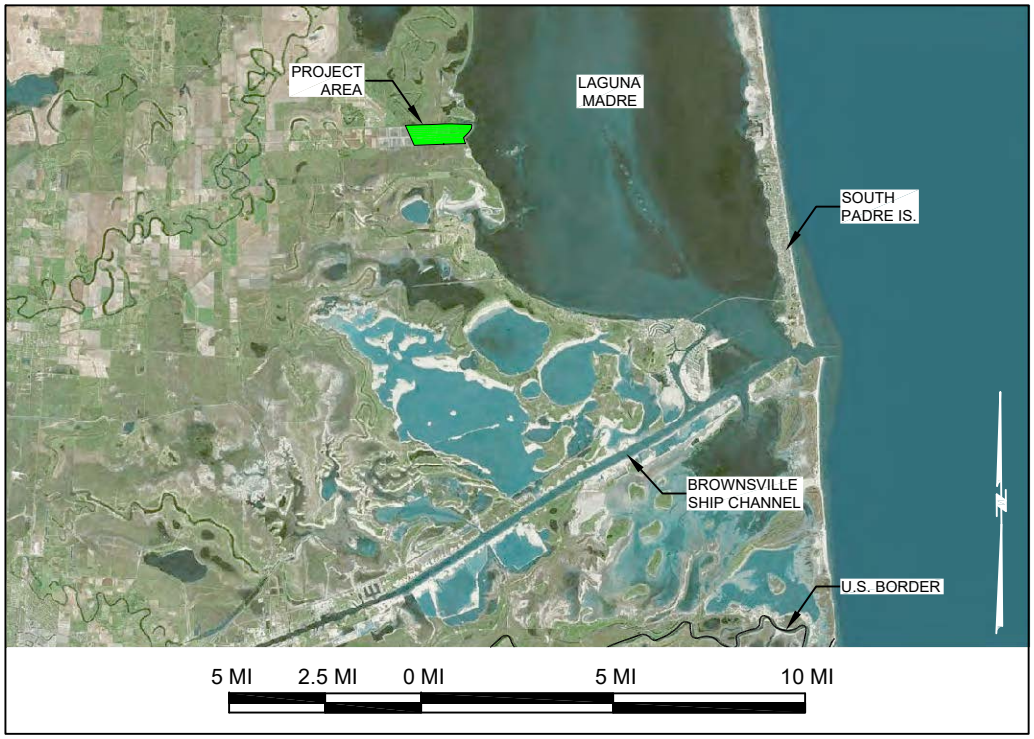
TEXAS LNG BROWNSVILLE, LLC

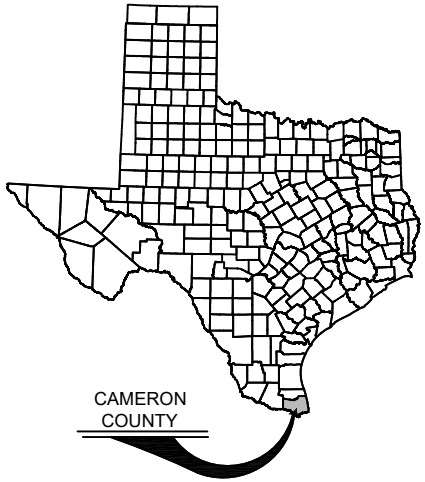
LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

CAMERON COUNTY, TEXAS

PRELIMINARY

INDEX TO SHEETS





NOTES:

1. FOR PERMITTING PURPOSES ONLY. NOT TO BE USED FOR CONSTRUCTION.
2. RETAIN ENTIRE SET AS ONE, INDIVIDUAL SHEETS SHOULD NOT BE REMOVED.

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: TX 125452

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

TITLE SHEET

DATE: OCTOBER 2021

SHEET 1 OF 23

GENERAL NOTES:

1. CONTRACTOR SHALL BECOME FAMILIAR WITH THE SITE, CONSTRUCTION PLANS, AND CONTRACT DOCUMENTS AND SHALL CONDUCT WORK IN STRICT ACCORDANCE WITH ALL PERMITS AND APPROVALS OBTAINED FOR THIS PROJECT.
2. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO COMMENCEMENT OF CONSTRUCTION, ANY DEVIATION IN PLAN INFORMATION SHALL BE REPORTED TO THE ENGINEER AND OWNER'S REPRESENTATIVE IMMEDIATELY.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING TEXAS ONE CALL SYSTEM (811) A MINIMUM OF 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY EXCAVATION OR DEMOLITION ACTIVITY.
4. CONTRACTOR SHALL BE REQUIRED TO CONFINE HIS/HER EQUIPMENT, AND OPERATIONS OF PERSONNEL WITHIN THE LIMITS OF THE WORK AREA, AREAS PERMITTED BY LAW, ORDINANCES, PERMITS, AND THE REQUIREMENTS OF THE CONTRACT DOCUMENTS. CONTRACTOR SHALL NOT UNREASONABLY ENCUMBER THE PREMISES WITH PLANT OR EQUIPMENT.
5. CONTRACTOR SHALL FOLLOW ACCESS CORRIDORS AND SHALL NOT, AT ANY TIME, TRAVEL ON EXISTING MARSH OR VEGETATED WETLANDS OUTSIDE OF THE PROJECT AREA UNLESS SPECIFIED IN THE PERMIT OR THROUGH WRITTEN DIRECTION FROM ENGINEER.
6. CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES AND DRAINAGE STRUCTURES PRIOR TO CLEARING, DEMOLITION AND EXCAVATION AND WILL BE RESPONSIBLE FOR THE DAMAGE OF ANY ON-SITE OR OFF-SITE FACILITIES THAT ARE NOT A PART OF THIS PROJECT AND NOT IDENTIFIED TO BE REMOVED.
7. CONTRACTOR SHALL WORK COOPERATIVELY WITH THE OWNER TO ADDRESS THE NOTIFICATION AND COORDINATION REQUIREMENTS WITH THE LANDOWNERS AND UTILITY OPERATORS. CONTRACTOR SHALL COORDINATE THE REMOVAL OF ANY EXISTING UTILITIES WITH THE OWNER OF SAID UTILITY PRIOR TO COMMENCEMENT OF WORK.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING TRAFFIC AND USAGE OF THE EXISTING STREETS ADJACENT TO THE PROJECT. ALL TRAFFIC MAINTENANCE CONTROL SHALL BE IN ACCORDANCE WITH LOCAL AND STATE REGULATORY STANDARDS. TRAFFIC CONTROL OPERATION PROCEDURES SHALL BE SUBMITTED TO OWNER FOR APPROVAL PRIOR TO BEGINNING CONSTRUCTION.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR STABILIZATION OF EXISTING BERMS DURING CONSTRUCTION.
10. CONTRACTOR SHALL ESTABLISH AND PROPERLY FLAG PROPERTY LINES / CLEARING LIMITS PRIOR TO CLEARING.
11. CONTRACTOR SHALL UTILIZE SUITABLE EROSION CONTROL DURING CONSTRUCTION. PROTECTIVE BARRIERS WILL REMAIN IN PLACE FOR DURATION OF CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PREVENTION AND CONTROL OF ANY EROSION, SEDIMENTATION OR SURFACE WATER TURBIDITY CAUSED BY THEIR ACTIVITY.
12. CONTRACTOR TO DEMOLISH AND REMOVE STRUCTURES WITHIN LIMITS AS SHOWN ON CONTRACT PLANS UNLESS OTHERWISE NOTED.
13. CONTRACTOR SHALL REMOVE VEGETATION WITHIN LIMITS AS SHOWN ON CONTRACT PLANS UNLESS OTHERWISE NOTED.
14. IF PREHISTORIC OR HISTORIC ARTIFACTS, SUCH AS POTTERY OR CERAMICS, STONE TOOLS OR METAL IMPLEMENTS, OR ANY OTHER PHYSICAL REMAINS THAT COULD BE ASSOCIATED WITH NATIVE AMERICAN CULTURES, OR EARLY COLONIAL OR AMERICAN SETTLEMENT ARE ENCOUNTERED AT ANY TIME WITHIN THE PROJECT SITE AREA, THE PERMITTED PROJECT SHOULD CEASE ALL ACTIVITIES INVOLVING SUBSURFACE DISTURBANCE IN THE IMMEDIATE VICINITY OF SUCH DISCOVERIES AND NOTIFY THE OWNER IMMEDIATELY. PROJECT ACTIVITIES SHOULD NOT RESUME WITHOUT VERBAL AND/OR WRITTEN AUTHORIZATION FROM THE OWNER FOLLOWING COORDINATION WITH THE APPROPRIATE AGENCIES. IN THE EVENT THAT UNMARKED HUMAN REMAINS ARE ENCOUNTERED DURING PERMITTED ACTIVITIES, ALL WORK SHALL STOP IMMEDIATELY AND THE PROPER AUTHORITIES AND OWNER NOTIFIED.
15. CONTRACTOR SHALL LEGALLY DISPOSE OF ALL DEBRIS AS DESIGNATED ON CONTRACT PLANS OR SPECIFICATIONS.
16. THIS DRAWING SET IS FOR PERMITTING PURPOSES ONLY AND IS NOT TO BE USED FOR CONSTRUCTION.
17. AERIAL IMAGE REFERENCE: U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE, 2019.

SURVEY NOTES:

1. ALL COORDINATES ARE NORTH AMERICAN DATUM OF 1983 (NAD 83 - GEOID 18), TEXAS STATE PLANE, SOUTHERN ZONE, U.S. SURVEY FEET. ALL RESTORATION AREA ELEVATIONS ARE BASED ON NATIONAL GEODETIC SURVEY (NGS) MONUMENT AB4188.

MONUMENT	ELEVATION	NORTHING	EASTING
AB4188 (BAYVIEW)	18.6'	16,582,700.65	1,364,977.37

2. ADDITIONAL PROJECT CONTROL ESTABLISHED BY EMC WITHIN THE PROJECT SITE INCLUDE THE FOLLOWING POINTS,

CONTROL POINT	ELEVATION	NORTHING	EASTING
EMC-1	12.618'	16,581,309.006	1,373,300.462
EMC-2	12.558'	16,581,376.624	1,372,454.450

3. ALL ELEVATIONS ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88 - 2004.65), U.S. SURVEY FEET UNLESS OTHERWISE SPECIFIED.
4. PROJECT AREA SURVEY PERFORMED BY EMC INC., MAY 18 THROUGH JUNE 5, 2021.
5. MEAN HIGH TIDE, MEAN HIGH WATER, MEAN LOW WATER CONTOURS DERIVED FROM UNITED STATES GEOLOGICAL SURVEY (USGS), SOUTH TEXAS LIDAR COLLECTED FEBRUARY 23, 2018, ADJUSTED TO NGS MONUMENT AB4188.
6. SEAGRASS SURVEY PERFORMED BY BELAIRE ENVIRONMENTAL, INC. (BEI), OCTOBER 5 - 6, 2020.
7. INFORMATION SHOWN HEREIN REFLECTS CONDITIONS AS THEY EXISTED ON THE SURVEY DATE SHOWN AND CAN ONLY BE CONSIDERED INDICATIVE OF CONDITIONS AT THAT TIME.

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

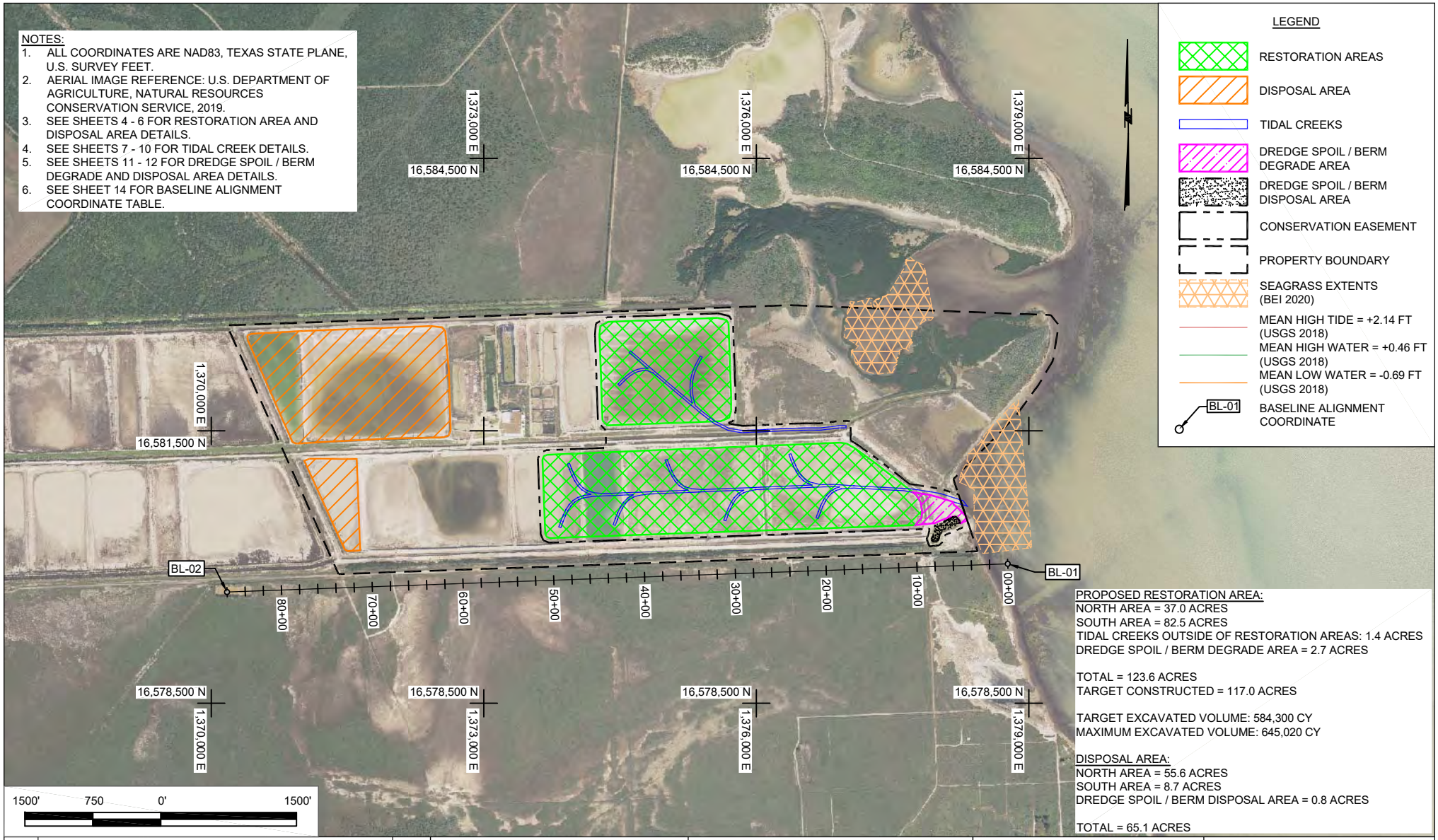
GENERAL NOTES

DATE: OCTOBER 2021

SHEET 2 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

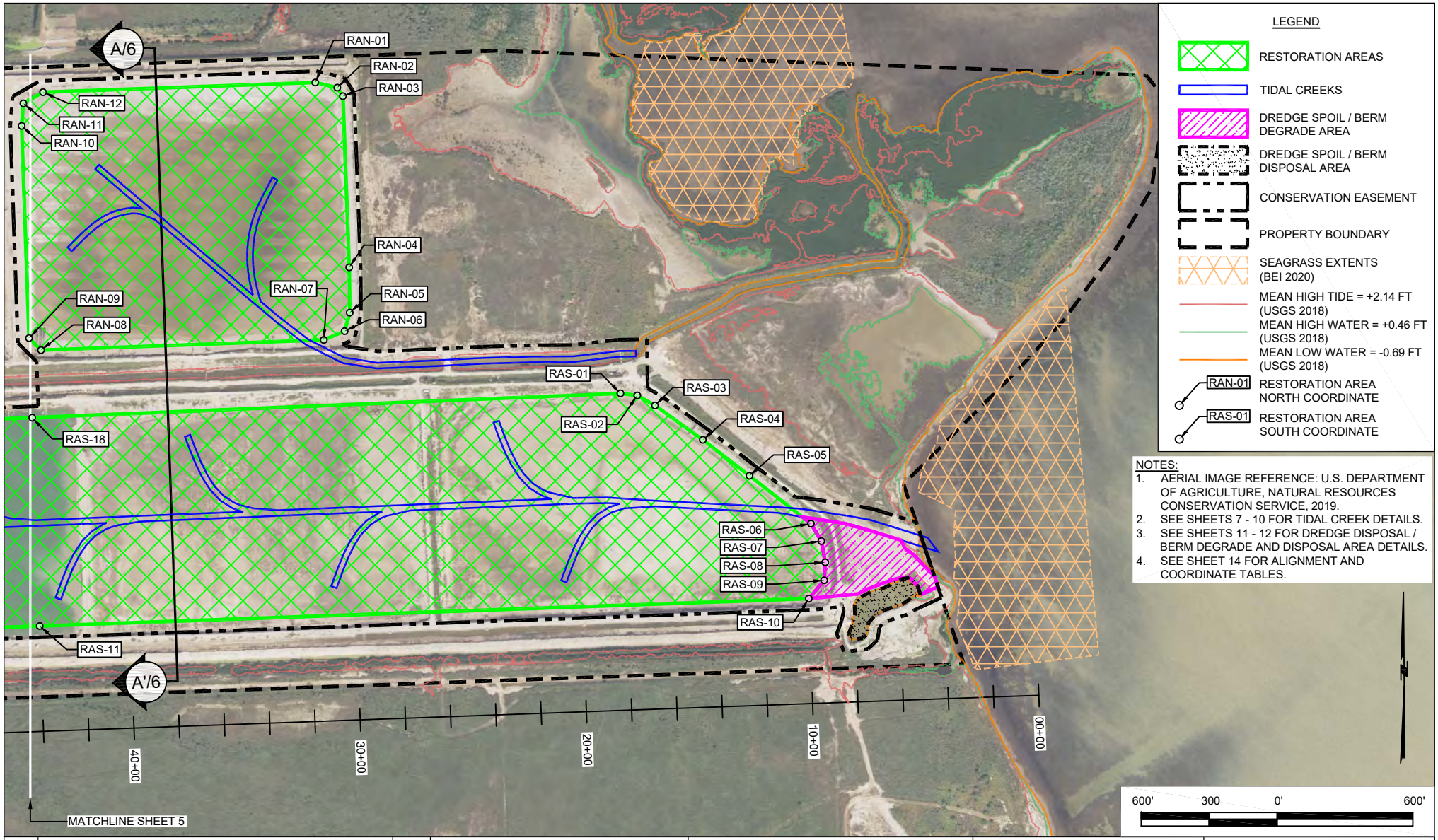
PROJECT OVERVIEW MAP

DATE: OCTOBER 2021

SHEET 3 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

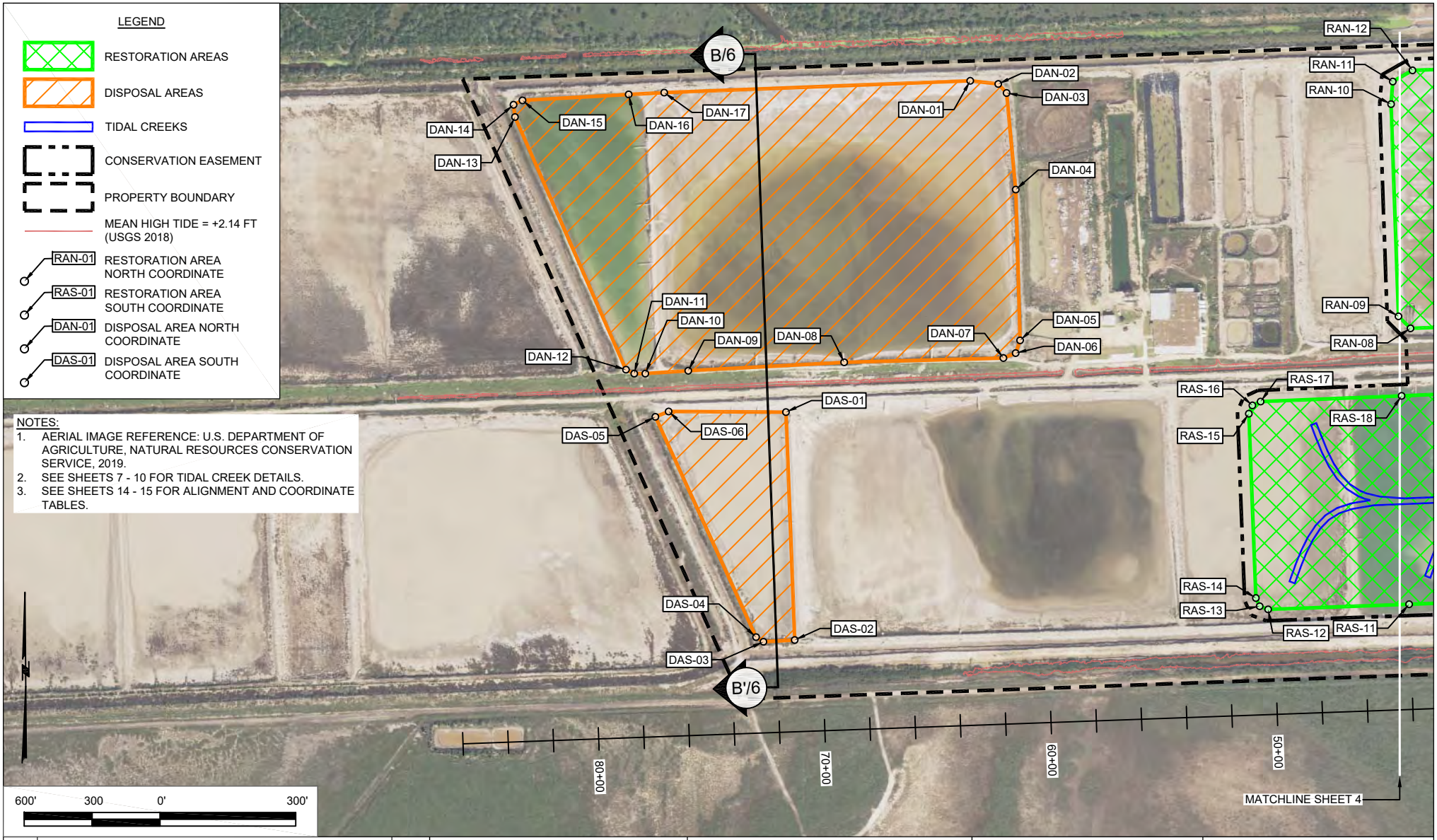
RESTORATION AND DISPOSAL AREA PLAN VIEW

DATE: OCTOBER 2021

SHEET 4 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

RESTORATION AND DISPOSAL AREA PLAN VIEW

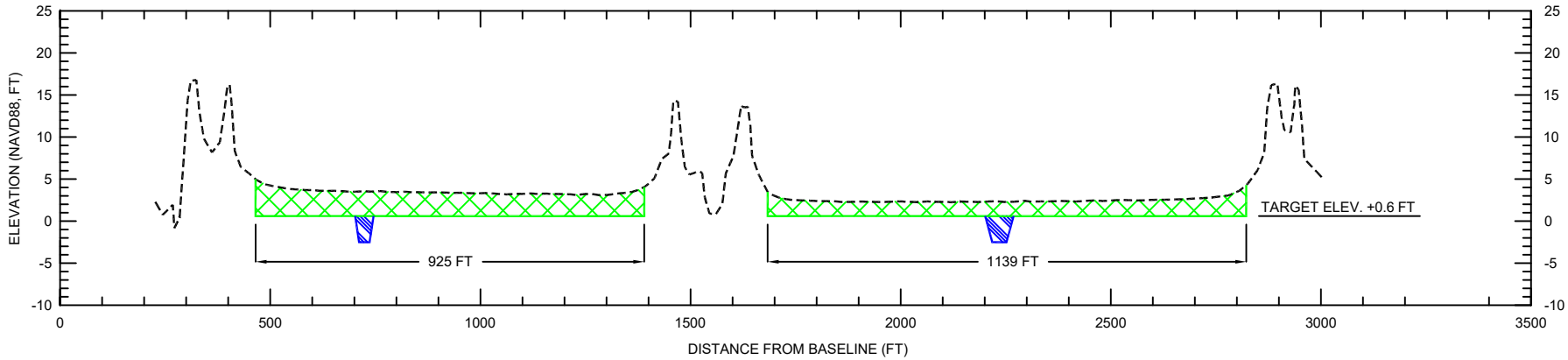
DATE: OCTOBER 2021

SHEET 5 OF 23

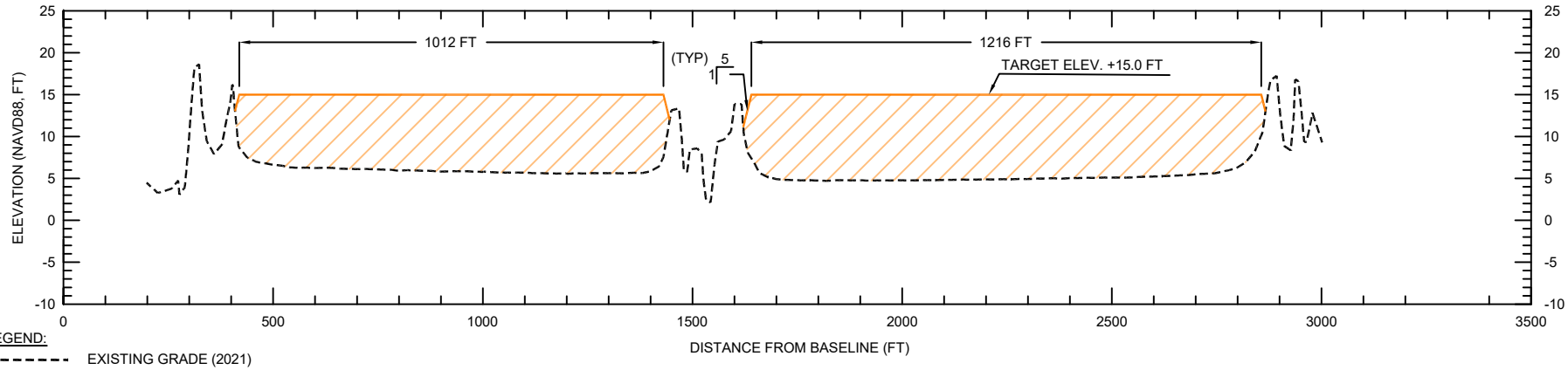
DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

A - A'



B - B'



LEGEND:

- EXISTING GRADE (2021)
- RESTORATION AREA TEMPLATE
- DISPOSAL AREA TEMPLATE
- TIDAL CREEK

NOTES:

1. EXISTING GRADE SURVEY PERFORMED BY EMC, 2021.
2. CONSTRUCTION TOLERANCE + 0.3 FT.
3. SEE SHEETS 7 - 10 FOR TIDAL CREEK DETAILS.

SCALE:
H: 1" = 400'
V: 1" = 20'

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

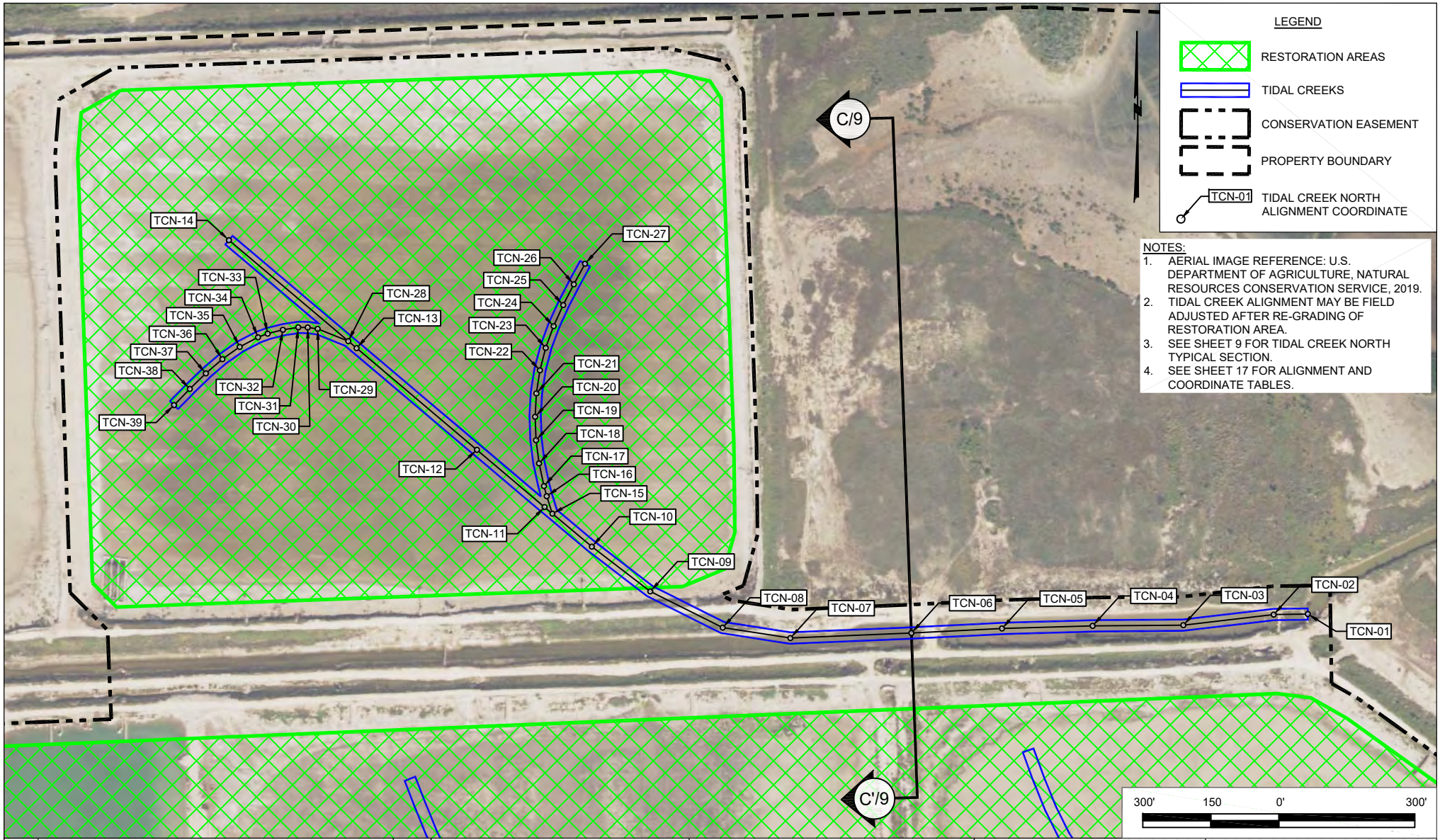
Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

RESTORATION AND DISPOSAL AREA TYPICAL SECTIONS

DATE: OCTOBER 2021



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

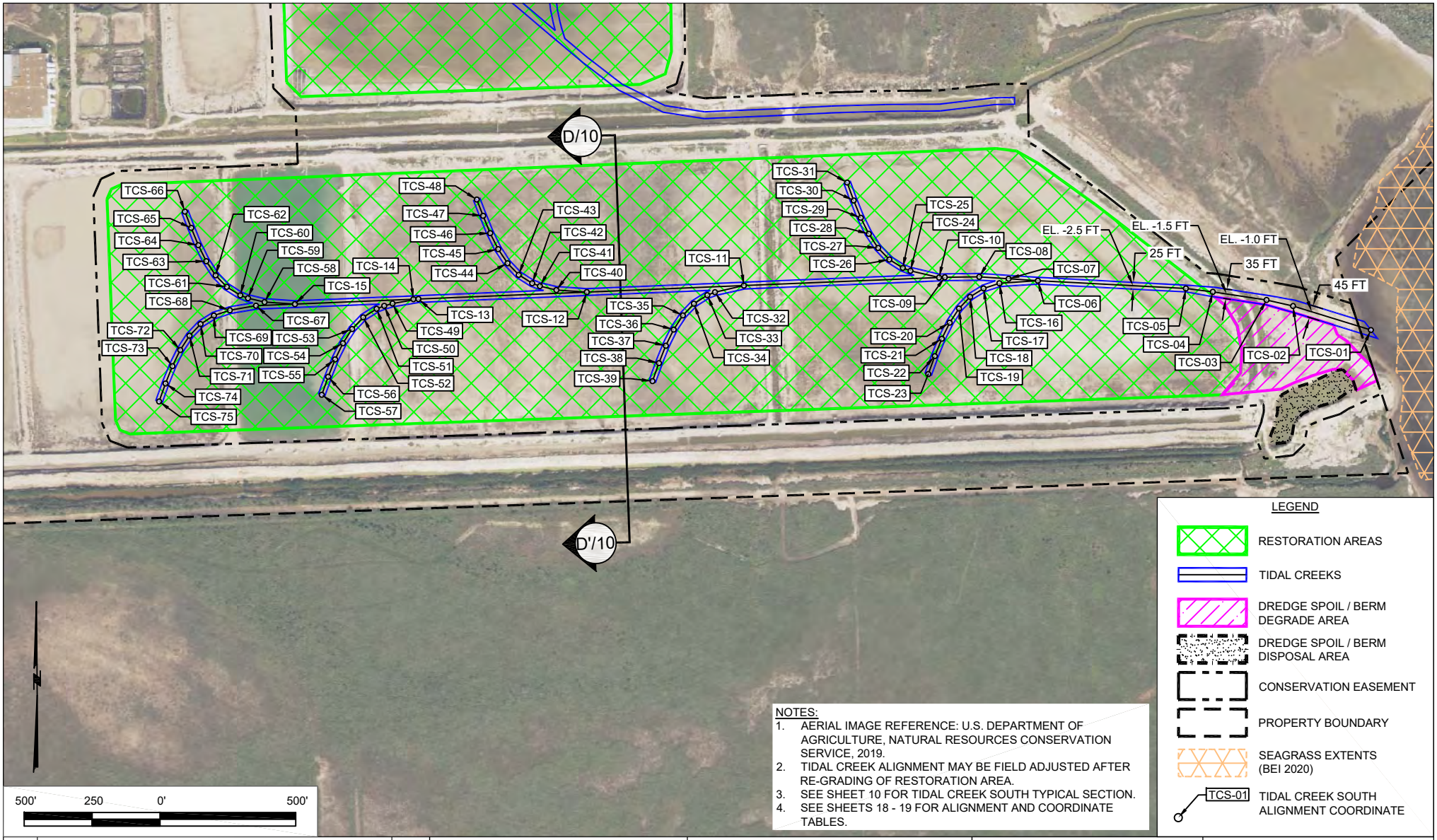
TIDAL CREEK NORTH PLAN VIEW

DATE: OCTOBER 2021

SHEET 7 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452



NOTES:
1. AERIAL IMAGE REFERENCE: U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE, 2019.
2. TIDAL CREEK ALIGNMENT MAY BE FIELD ADJUSTED AFTER RE-GRADING OF RESTORATION AREA.
3. SEE SHEET 10 FOR TIDAL CREEK SOUTH TYPICAL SECTION.
4. SEE SHEETS 18 - 19 FOR ALIGNMENT AND COORDINATE TABLES.

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

TIDAL CREEK SOUTH PLAN VIEW

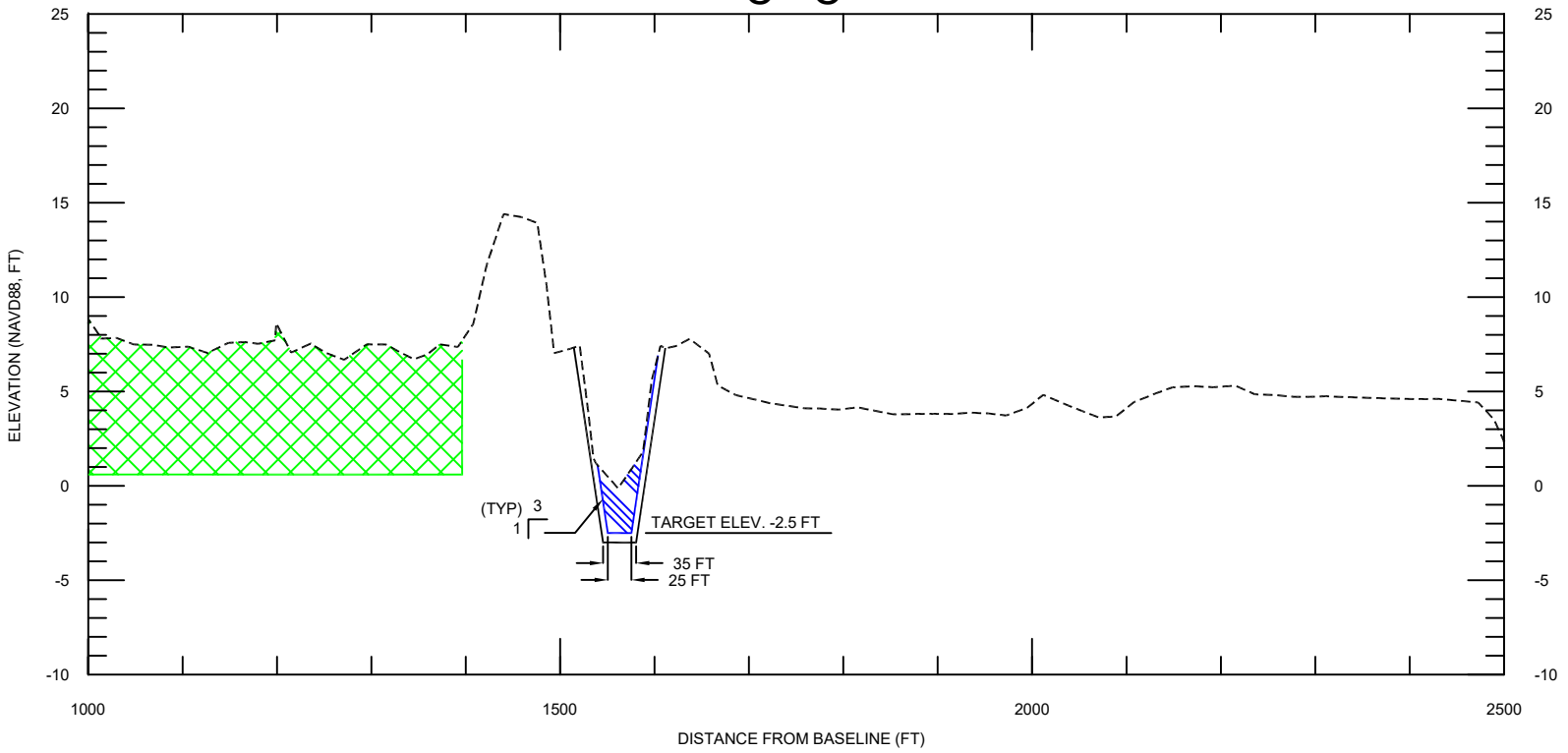
DATE: OCTOBER 2021

SHEET 8 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

C - C'



LEGEND:

- EXISTING GRADE (2021)
- RESTORATION AREA TEMPLATE (SEE NOTE 2)
- TIDAL CREEK TEMPLATE
- OVERDREDGE (SEE NOTES 3 & 4)

NOTES:

1. EXISTING GRADE SURVEY PERFORMED BY EMC, 2021.
2. RESTORATION AREA CONSTRUCTION TOLERANCE +0.3 FT.
3. TIDAL CREEK VERTICAL OVERDREDGE TOLERANCE 0.5 FT.
4. TIDAL CREEK HORIZONTAL OVERDREDGE TOLERANCE 10 FT.

SCALE:
H: 1" = 200'
V: 1" = 10'

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

TIDAL CREEK NORTH TYPICAL SECTION

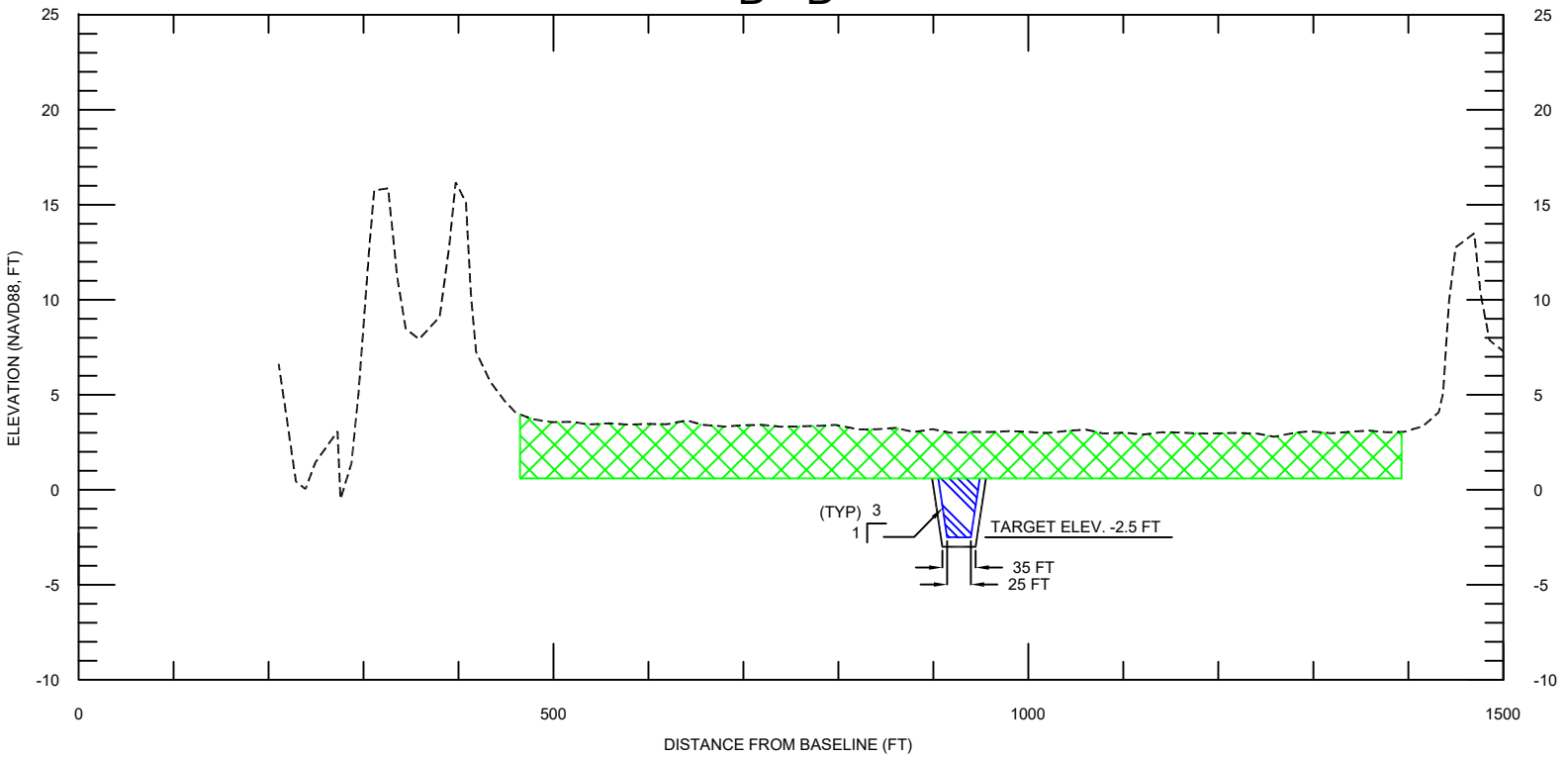
DATE: OCTOBER 2021

SHEET 9 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

D - D'



LEGEND:

- EXISTING GRADE (2021)
- RESTORATION AREA TEMPLATE (SEE NOTE 2)
- TIDAL CREEK TEMPLATE
- OVERDREDGE (SEE NOTES 3 & 4)

NOTES:

1. EXISTING GRADE SURVEY PERFORMED BY EMC, 2021.
2. RESTORATION AREA CONSTRUCTION TOLERANCE +0.3 FT.
3. TIDAL CREEK VERTICAL OVERDREDGE TOLERANCE 0.5 FT.
4. TIDAL CREEK HORIZONTAL OVERDREDGE TOLERANCE 10 FT.

SCALE:
H: 1" = 200'
V: 1" = 10'

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

Ecosystem Investment Partners

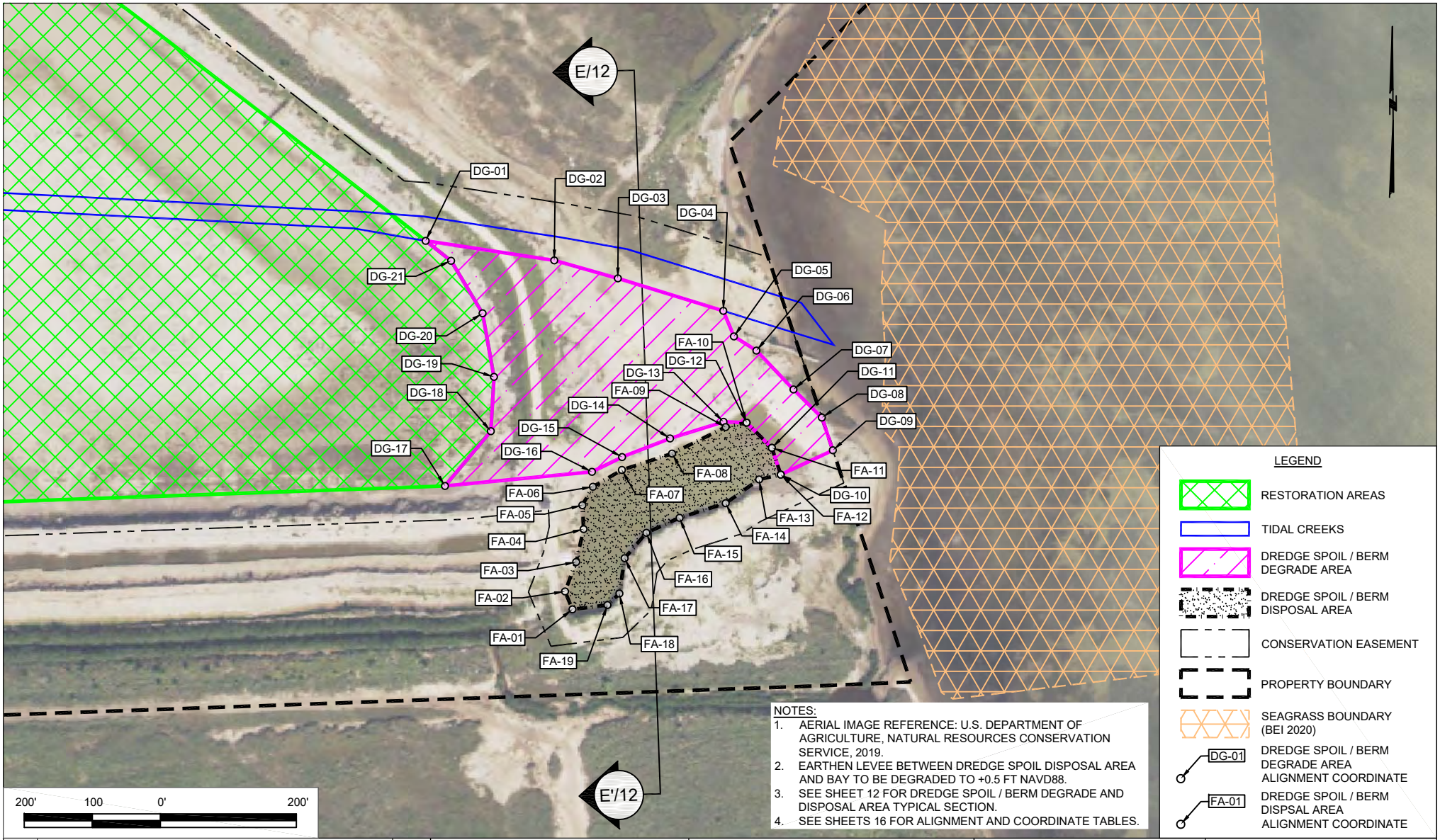
LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

TIDAL CREEK SOUTH TYPICAL SECTION

DATE: OCTOBER 2021

SHEET 10 OF 23



NOTES:
1. AERIAL IMAGE REFERENCE: U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE, 2019.
2. EARTHEN LEVEE BETWEEN DREDGE SPOIL DISPOSAL AREA AND BAY TO BE DEGRADED TO +0.5 FT NAVD88.
3. SEE SHEET 12 FOR DREDGE SPOIL / BERM DEGRADE AND DISPOSAL AREA TYPICAL SECTION.
4. SEE SHEETS 16 FOR ALIGNMENT AND COORDINATE TABLES.

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

DREDGE SPOIL / BERM DEGRADE AND DISPOSAL AREA PLAN VIEW

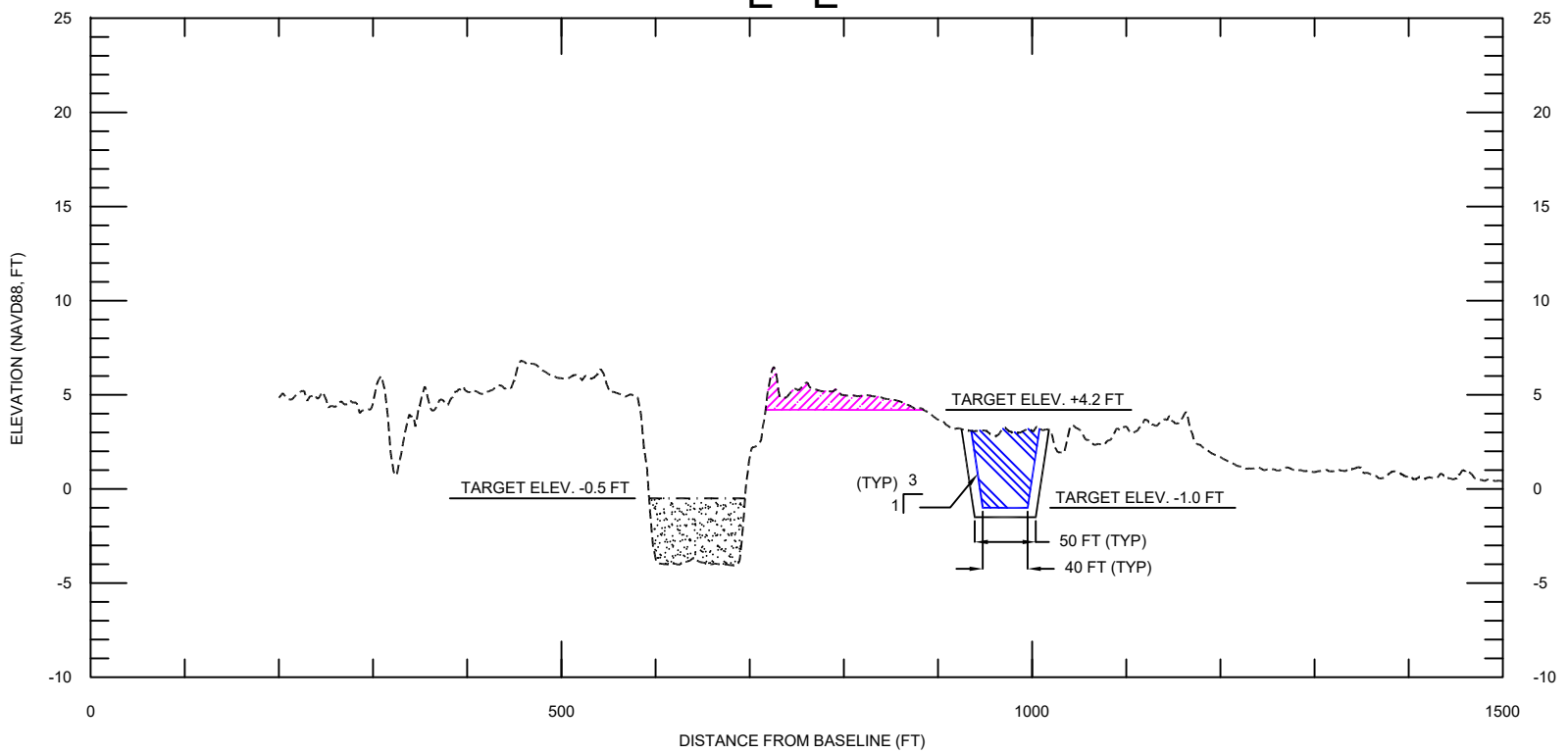
DATE: OCTOBER 2021

SHEET 11 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

E - E'



LEGEND:

- EXISTING GRADE (2021)
- DREDGE SPOIL / BERM DEGRADE AREA TEMPLATE (SEE NOTE 2)
- DREDGE SPOIL / BERM DISPOSAL AREA TEMPLATE (SEE NOTE 2)
- TIDAL CREEK TEMPLATE
- OVERDREDGE (SEE NOTES 3 & 4)

NOTES:

1. EXISTING GRADE SURVEY PERFORMED BY EMC, 2021.
2. DREDGE SPOIL / BERM DEGRADE AND DISPOSAL AREA CONSTRUCTION TOLERANCE +0.3 FT.
3. TIDAL CREEK VERTICAL OVERDREDGE TOLERANCE 0.5 FT.
4. TIDAL CREEK HORIZONTAL OVERDREDGE TOLERANCE 10 FT.

SCALE:
H: 1" = 200'
V: 1" = 10'

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

Ecosystem Investment Partners

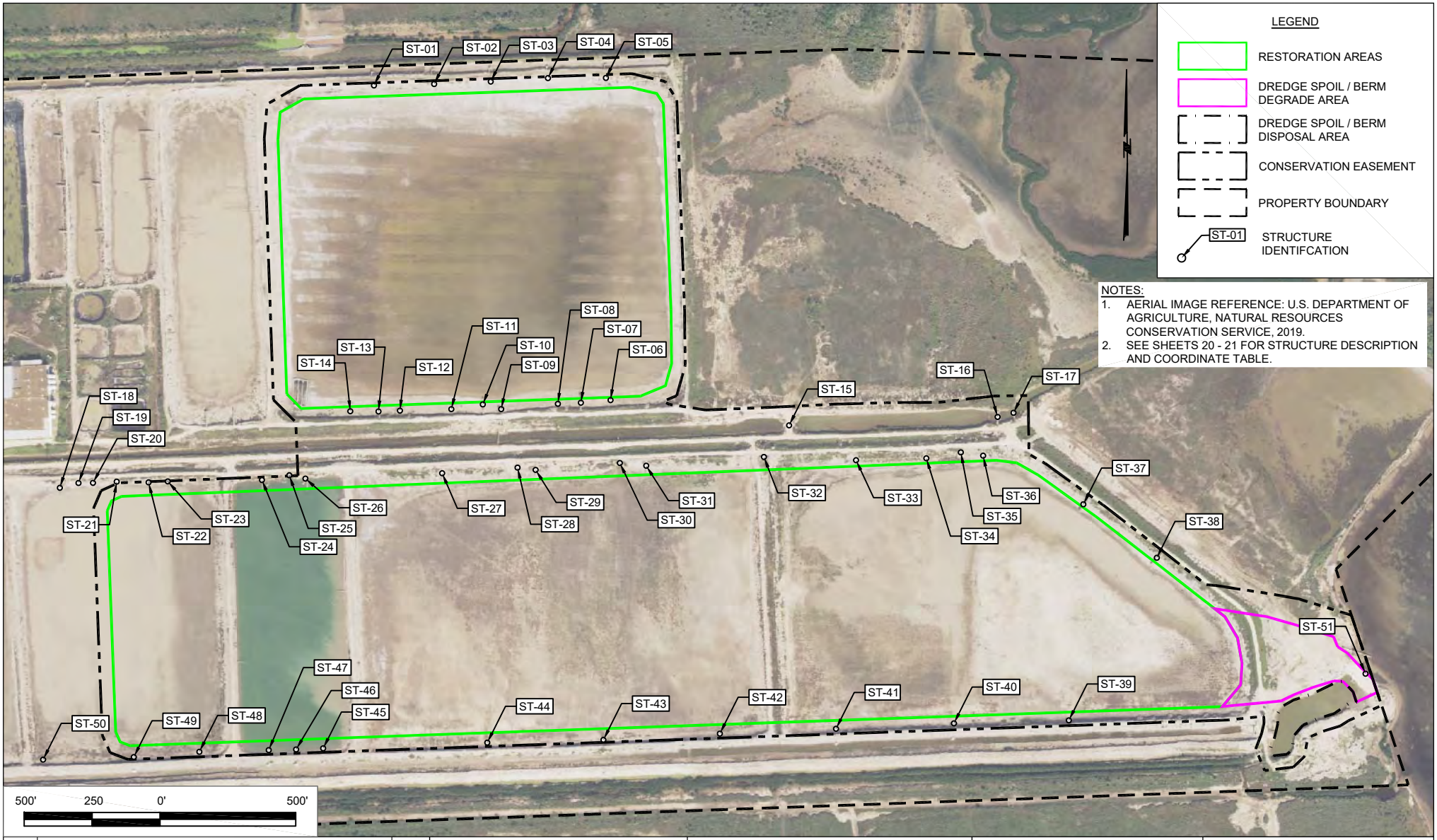
LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

DREDGE SPOIL / BERM DEGRADE AND DISPOSAL AREA TYPICAL SECTION

DATE: OCTOBER 2021

SHEET 12 OF 23



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

STRUCTURE REMOVAL OVERVIEW MAP

DATE: OCTOBER 2021

SHEET 13 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

PROJECT AREA BASELINE ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
BL-01	16,580,035.07	1,378,767.86	26º 08' 43.1301"N	97º 17' 50.7336"W
BL-02	16,579,724.36	1,370,173.48	26º 08' 40.8553"N	97º 19' 25.0709"W

RESTORATION AREA NORTH ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
RAN-01	16,582,743.14	1,375,571.20	26º 09' 10.2504"N	97º 18' 25.5294"W
RAN-02	16,582,720.49	1,375,668.60	26º 09' 10.0170"N	97º 18' 24.4630"W
RAN-03	16,582,682.81	1,375,693.20	26º 09' 09.6415"N	97º 18' 24.1968"W
RAN-04	16,581,926.23	1,375,721.18	26º 09' 02.1460"N	97º 18' 23.9683"W
RAN-05	16,581,726.19	1,375,723.67	26º 09' 00.1646"N	97º 18' 23.9618"W
RAN-06	16,581,644.25	1,375,701.05	26º 08' 59.3552"N	97º 18' 24.2185"W
RAN-07	16,581,605.59	1,375,608.82	26º 08' 58.9810"N	97º 18' 25.2345"W
RAN-08	16,581,560.32	1,374,359.88	26º 08' 58.6494"N	97º 18' 38.9442"W
RAN-09	16,581,613.35	1,374,306.85	26º 08' 59.1795"N	97º 18' 39.5207"W
RAN-10	16,582,551.04	1,374,274.08	26º 09' 08.4692"N	97º 18' 39.7833"W
RAN-11	16,582,650.74	1,374,281.82	26º 09' 09.4558"N	97º 18' 39.6881"W
RAN-12	16,582,700.24	1,374,368.70	26º 09' 09.9380"N	97º 18' 38.7296"W

RESTORATION AREA SOUTH ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
RAS-01	16,581,369.44	1,376,919.29	26º 08' 56.5193"N	97º 18' 10.8789"W
RAS-02	16,581,360.26	1,376,993.73	26º 08' 56.4214"N	97º 18' 10.0630"W
RAS-03	16,581,315.92	1,377,072.04	26º 08' 55.9750"N	97º 18' 09.2082"W
RAS-04	16,581,164.15	1,377,283.45	26º 08' 54.4520"N	97º 18' 06.9042"W
RAS-05	16,581,005.26	1,377,489.36	26º 08' 52.8591"N	97º 18' 04.6613"W
RAS-06	16,580,793.67	1,377,760.71	26º 08' 50.7380"N	97º 18' 01.7058"W
RAS-07	16,580,716.44	1,377,806.93	26º 08' 49.9688"N	97º 18' 01.2067"W
RAS-08	16,580,622.94	1,377,823.74	26º 08' 49.0412"N	97º 18' 01.0320"W
RAS-09	16,580,543.07	1,377,819.13	26º 08' 48.2507"N	97º 18' 01.0909"W
RAS-10	16,580,462.54	1,377,751.75	26º 08' 47.4595"N	97º 18' 01.8386"W
RAS-11	16,580,341.10	1,374,353.92	26º 08' 46.5752"N	97º 18' 39.1357"W
RAS-12	16,580,318.26	1,373,730.93	26º 08' 46.4071"N	97º 18' 45.9742"W
RAS-13	16,580,332.24	1,373,693.45	26º 08' 46.5491"N	97º 18' 46.3840"W
RAS-14	16,580,368.62	1,373,676.82	26º 08' 46.9109"N	97º 18' 46.5627"W
RAS-15	16,581,183.07	1,373,645.57	26º 08' 54.9798"N	97º 18' 46.8216"W
RAS-16	16,581,219.86	1,373,661.27	26º 08' 55.3427"N	97º 18' 46.6454"W
RAS-17	16,581,236.64	1,373,697.58	26º 08' 55.5055"N	97º 18' 46.2453"W
RAS-18	16,581,261.84	1,374,320.64	26º 08' 55.6970"N	97º 18' 39.4057"W

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

SHEET 14 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

DISPOSAL AREA NORTH ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
DAN-01	16,582,654.16	1,372,414.60	26° 09' 09.6635"N	97° 19' 00.1779"W
DAN-02	16,582,640.21	1,372,538.36	26° 09' 09.5139"N	97° 18' 58.8212"W
DAN-03	16,582,600.25	1,372,575.18	26° 09' 09.1147"N	97° 18' 58.4213"W
DAN-04	16,582,173.58	1,372,615.66	26° 09' 04.8853"N	97° 18' 58.0210"W
DAN-05	16,581,507.24	1,372,634.98	26° 08' 58.2843"N	97° 18' 57.8776"W
DAN-06	16,581,450.88	1,372,615.25	26° 08' 57.7280"N	97° 18' 58.0999"W
DAN-07	16,581,429.00	1,372,561.07	26° 08' 57.5163"N	97° 18' 58.6967"W
DAN-08	16,581,410.18	1,371,857.68	26° 08' 57.3952"N	97° 19' 06.4171"W
DAN-09	16,581,372.92	1,371,168.79	26° 08' 57.0900"N	97° 19' 13.9804"W
DAN-10	16,581,360.38	1,370,978.97	26° 08' 56.9834"N	97° 19' 16.0646"W
DAN-11	16,581,360.16	1,370,930.15	26° 08' 56.9858"N	97° 19' 16.6003"W
DAN-12	16,581,377.64	1,370,893.64	26° 08' 57.1622"N	97° 19' 16.9992"W
DAN-13	16,582,494.01	1,370,403.13	26° 09' 08.2637"N	97° 19' 22.2674"W
DAN-14	16,582,548.29	1,370,396.81	26° 09' 08.8019"N	97° 19' 22.3312"W
DAN-15	16,582,567.56	1,370,436.28	26° 09' 08.9891"N	97° 19' 21.8961"W
DAN-16	16,582,594.01	1,370,905.33	26° 09' 09.2077"N	97° 19' 16.7462"W
DAN-17	16,582,602.02	1,371,062.43	26° 09' 09.2725"N	97° 19' 15.0214"W

DISPOSAL AREA SOUTH ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
DAS-01	16,581,190.09	1,371,600.43	26° 08' 55.2394"N	97° 19' 09.2627"W
DAS-02	16,580,183.03	1,371,639.11	26° 08' 45.2622"N	97° 19' 08.9416"W
DAS-03	16,580,175.27	1,371,500.96	26° 08' 45.1982"N	97° 19' 10.4582"W
DAS-04	16,580,195.88	1,371,468.30	26° 08' 45.4053"N	97° 19' 10.8145"W
DAS-05	16,581,169.18	1,371,023.35	26° 08' 55.0857"N	97° 19' 15.5972"W
DAS-06	16,581,192.88	1,371,082.08	26° 08' 55.3150"N	97° 19' 14.9502"W

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

DREDGE SPOIL / BERM DEGRADE AREA ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
DA-01	16,580,822.98	1,377,723.34	26° 08' 51.0318"N	97° 18' 02.1128"W
DA-02	16,580,794.25	1,377,912.30	26° 08' 50.7295"N	97° 18' 00.0423"W
DA-03	16,580,767.86	1,378,005.81	26° 08' 50.4593"N	97° 17' 59.0190"W
DA-04	16,580,720.05	1,378,160.76	26° 08' 49.9712"N	97° 17' 57.3237"W
DA-05	16,580,682.46	1,378,176.46	26° 08' 49.5975"N	97° 17' 57.1554"W
DA-06	16,580,661.58	1,378,209.42	26° 08' 49.3876"N	97° 17' 56.7959"W
DA-07	16,580,604.44	1,378,263.92	26° 08' 48.8165"N	97° 17' 56.2038"W
DA-08	16,580,563.14	1,378,305.66	26° 08' 48.4036"N	97° 17' 55.7501"W
DA-09	16,580,515.07	1,378,321.79	26° 08' 47.9260"N	97° 17' 55.5781"W
DA-10	16,580,479.18	1,378,245.24	26° 08' 47.5778"N	97° 17' 56.4218"W
DA-11	16,580,518.59	1,378,232.15	26° 08' 47.9693"N	97° 17' 56.5614"W
DA-12	16,580,555.65	1,378,195.01	26° 08' 48.3398"N	97° 17' 56.9650"W
DA-13	16,580,556.86	1,378,161.13	26° 08' 48.3550"N	97° 17' 57.3367"W
DA-14	16,580,532.40	1,378,082.50	26° 08' 48.1202"N	97° 17' 58.2021"W
DA-15	16,580,505.02	1,378,012.01	26° 08' 47.8557"N	97° 17' 58.9784"W
DA-16	16,580,483.32	1,377,967.77	26° 08' 47.6449"N	97° 17' 59.4661"W
DA-17	16,580,462.54	1,377,751.75	26° 08' 47.4595"N	97° 18' 01.8386"W
DA-18	16,580,543.07	1,377,819.13	26° 08' 48.2507"N	97° 18 01.0909"W
DA-19	16,580,622.94	1,377,823.74	26° 08' 49.0412"N	97° 18' 01.0320"W
DA-20	16,580,716.44	1,377,806.93	26° 08' 49.9688"N	97° 18' 01.2067"W
DA-21	16,580,793.67	1,377,760.71	26° 08' 50.7380"N	97° 18' 01.7058"W

DREDGE SPOIL / BERM DISPOSAL AREA ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
FA-01	16,580,281.10	1,377,939.09	26° 08' 45.6449"N	97° 17' 59.8020"W
FA-02	16,580,307.42	1,377,928.19	26° 08' 45.9066"N	97° 17' 59.9188"W
FA-03	16,580,350.67	1,377,944.53	26° 08' 46.3334"N	97° 17' 59.7349"W
FA-04	16,580,399.07	1,377,955.43	26° 08' 46.8117"N	97° 17' 59.6103"W
FA-05	16,580,434.26	1,377,953.62	26° 08' 47.1604"N	97° 17' 59.6265"W
FA-06	16,580,461.35	1,377,969.15	26° 08' 47.4272"N	97° 17' 59.4533"W
FA-07	16,580,486.09	1,378,011.75	26° 08' 47.6682"N	97° 17' 58.9833"W
FA-08	16,580,510.14	1,378,085.49	26° 08' 47.8994"N	97° 17' 58.1716"W
FA-09	16,580,549.12	1,378,164.23	26° 08' 48.2781"N	97° 17' 57.3035"W
FA-10	16,580,555.65	1,378,195.01	26° 08' 48.3398"N	97° 17' 56.9650"W
FA-11	16,580,518.59	1,378,232.15	26° 08' 47.9693"N	97° 17' 56.5614"W
FA-12	16,580,479.18	1,378,245.24	26° 08' 47.5778"N	97° 17' 56.4218"W
FA-13	16,580,472.13	1,378,213.44	26° 08' 47.5109"N	97° 17' 56.7715"W
FA-14	16,580,437.19	1,378,164.30	26° 08' 47.1695"N	97° 17' 57.3144"W
FA-15	16,580,415.71	1,378,096.49	26° 08' 46.9632"N	97° 17' 58.0607"W
FA-16	16,580,393.63	1,378,047.76	26° 08' 46.7491"N	97° 17' 58.5978"W
FA-17	16,580,356.33	1,378,015.79	26° 08' 46.3827"N	97° 17' 58.9525"W
FA-18	16,580,304.39	1,378,008.10	26° 08' 45.8691"N	97° 17' 59.0422"W
FA-19	16,580,287.45	1,377,990.55	26° 08' 45.7029"N	97° 17' 59.2366"W

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

SHEET 16 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

TIDAL CREEK NORTH ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
TCN-01	16,581,544.88	1,376,987.37	26° 08' 58.2505"N	97° 18' 10.1136"W
TCN-02	16,581,543.71	1,376,912.14	26° 08' 58.2459"N	97° 18' 10.9391"W
TCN-03	16,581,520.42	1,376,712.86	26° 08' 58.0340"N	97° 18' 13.1284"W
TCN-04	16,581,518.87	1,376,512.78	26° 08' 58.0374"N	97° 18' 15.3241"W
TCN-05	16,581,513.14	1,376,312.86	26° 08' 57.9994"N	97° 18' 17.5185"W
TCN-06	16,581,503.07	1,376,113.09	26° 08' 57.9185"N	97° 18' 19.7116"W
TCN-07	16,581,491.93	1,375,846.04	26° 08' 57.8331"N	97° 18' 22.6433"W
TCN-08	16,581,514.99	1,375,696.90	26° 08' 58.0755"N	97° 18' 24.2774"W
TCN-09	16,581,594.83	1,375,537.11	26° 08' 58.8811"N	97° 18' 26.0225"W
TCN-10	16,581,693.60	1,375,408.21	26° 08' 59.8714"N	97° 18' 27.4268"W
TCN-11	16,581,780.89	1,375,303.87	26° 09' 00.7456"N	97° 18' 28.5627"W
TCN-12	16,581,907.08	1,375,154.64	26° 09' 02.0094"N	97° 18' 30.1871"W
TCN-13	16,582,131.45	1,374,889.31	26° 09' 04.2562"N	97° 18' 33.0755"W
TCN-14	16,582,369.58	1,374,607.68	26° 09' 06.6409"N	97° 18' 36.1413"W
TCN-15	16,581,766.39	1,375,321.20	26° 09' 00.6004"N	97° 18' 28.3740"W
TCN-16	16,581,804.94	1,375,308.66	26° 09' 00.9833"N	97° 18' 28.5076"W
TCN-17	16,581,827.24	1,375,302.64	26° 09' 01.2048"N	97° 18' 28.5714"W
TCN-18	16,581,877.28	1,375,291.72	26° 09' 01.7014"N	97° 18' 28.6860"W
TCN-19	16,581,928.37	1,375,285.07	26° 09' 02.2080"N	97° 18' 28.7537"W
TCN-20	16,581,980.05	1,375,283.06	26° 09' 02.7200"N	97° 18' 28.7704"W
TCN-21	16,582,031.66	1,375,285.85	26° 09' 03.2309"N	97° 18' 28.7344"W
TCN-22	16,582,082.55	1,375,293.57	26° 09' 03.7341"N	97° 18' 28.6445"W
TCN-23	16,582,132.05	1,375,306.36	26° 09' 04.2232"N	97° 18' 28.4990"W
TCN-24	16,582,179.91	1,375,323.86	26° 09' 04.6955"N	97° 18' 28.3019"W
TCN-25	16,582,226.50	1,375,344.95	26° 09' 05.1550"N	97° 18' 28.0656"W
TCN-26	16,582,272.25	1,375,368.44	26° 09' 05.6058"N	97° 18' 27.8032"W
TCN-27	16,582,317.57	1,375,393.12	26° 09' 06.0524"N	97° 18' 27.5277"W
TCN-28	16,582,146.98	1,374,870.94	26° 09' 04.4117"N	97° 18' 33.2754"W
TCN-29	16,582,173.93	1,374,803.38	26° 09' 04.6850"N	97° 18' 34.0140"W
TCN-30	16,582,176.97	1,374,781.44	26° 09' 04.7171"N	97° 18' 34.2544"W

TIDAL CREEK NORTH ALIGNMENT (CONTINUED)				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
TCN-31	16,582,177.25	1,374,760.53	26° 09' 04.7219"N	97° 18' 34.4839"W
TCN-32	16,582,171.84	1,374,726.66	26° 09' 04.6715"N	97° 18' 34.8561"W
TCN-33	16,582,163.37	1,374,693.12	26° 09' 04.5907"N	97° 18' 35.2251"W
TCN-34	16,582,155.42	1,374,671.87	26° 09' 04.5140"N	97° 18' 35.4591"W
TCN-35	16,582,134.24	1,374,631.41	26° 09' 04.3079"N	97° 18' 35.9052"W
TCN-36	16,582,107.22	1,374,593.22	26° 09' 04.0439"N	97° 18' 36.3271"W
TCN-37	16,582,075.82	1,374,556.73	26° 09' 03.7363"N	97° 18' 36.7308"W
TCN-38	16,582,041.50	1,374,521.37	26° 09' 03.3998"N	97° 18' 37.1224"W
TCN-39	16,582,005.72	1,374,486.57	26° 09' 03.0487"N	97° 18' 37.5079"W

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

SHEET 17 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

TIDAL CREEK SOUTH ALIGNMENT				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
TCS-01	16,580,700.98	1,378,299.12	26° 08' 49.7693"N	97° 17' 55.8074"W
TCS-02	16,580,789.36	1,378,012.44	26° 08' 50.6716"N	97° 17' 58.9440"W
TCS-03	16,580,811.55	1,377,914.93	26° 08' 50.9006"N	97° 18' 00.0117"W
TCS-04	16,580,841.62	1,377,717.20	26° 08' 51.2170"N	97° 18' 02.1782"W
TCS-05	16,580,853.89	1,377,617.96	26° 08' 51.3478"N	97° 18' 03.2660"W
TCS-06	16,580,882.47	1,377,073.05	26° 08' 51.6821"N	97° 18' 09.2423"W
TCS-07	16,580,889.63	1,376,965.16	26° 08' 51.7632"N	97° 18' 10.4254"W
TCS-08	16,580,896.80	1,376,857.27	26° 08' 51.8443"N	97° 18' 11.6086"W
TCS-09	16,580,895.14	1,376,730.29	26° 08' 51.8398"N	97° 18' 13.0021"W
TCS-10	16,580,894.24	1,376,709.12	26° 08' 51.8329"N	97° 18' 13.2346"W
TCS-11	16,580,864.55	1,375,990.51	26° 08' 51.6062"N	97° 18' 21.1230"W
TCS-12	16,580,840.66	1,375,412.11	26° 08' 51.4238"N	97° 18' 27.4724"W
TCS-13	16,580,815.03	1,374,792.13	26° 08' 51.2279"N	97° 18' 34.2781"W
TCS-14	16,580,814.28	1,374,773.63	26° 08' 51.2222"N	97° 18' 34.4813"W
TCS-15	16,580,796.25	1,374,337.47	26° 08' 51.0845"N	97° 18' 39.2692"W
TCS-16	16,580,873.23	1,376,931.21	26° 08' 51.6040"N	97° 18' 10.7997"W
TCS-17	16,580,854.07	1,376,873.06	26° 08' 51.4196"N	97° 18' 11.4398"W
TCS-18	16,580,822.95	1,376,823.57	26° 08' 51.1161"N	97° 18' 11.9861"W
TCS-19	16,580,780.14	1,376,782.57	26° 08' 50.6959"N	97° 18' 12.4405"W
TCS-20	16,580,727.95	1,376,748.36	26° 08' 50.1824"N	97° 18' 12.8213"W
TCS-21	16,580,668.75	1,376,719.24	26° 08' 49.5987"N	97° 18' 13.1469"W
TCS-22	16,580,604.86	1,376,693.53	26° 08' 48.9684"N	97° 18' 13.4358"W
TCS-23	16,580,538.63	1,376,669.51	26° 08' 48.3148"N	97° 18' 13.7062"W
TCS-24	16,580,918.98	1,376,603.99	26° 08' 52.0877"N	97° 18' 14.3856"W
TCS-25	16,580,929.68	1,376,575.77	26° 08' 52.1963"N	97° 18' 14.6941"W
TCS-26	16,580,960.54	1,376,526.13	26° 08' 52.5067"N	97° 18' 15.2357"W
TCS-27	16,581,003.15	1,376,484.91	26° 08' 52.9325"N	97° 18' 15.6836"W
TCS-28	16,581,055.15	1,376,450.43	26° 08' 53.4508"N	97° 18' 16.0565"W
TCS-29	16,581,114.21	1,376,421.02	26° 08' 54.0384"N	97° 18' 16.3731"W
TCS-30	16,581,177.97	1,376,394.97	26° 08' 54.6723"N	97° 18' 16.6522"W

TIDAL CREEK SOUTH ALIGNMENT (CONTINUED)				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
TCS-31	16,581,244.07	1,376,370.62	26° 08' 55.3293"N	97° 18' 16.9126"W
TCS-32	16,580,840.23	1,375,884.08	26° 08' 51.3753"N	97° 18' 22.2935"W
TCS-33	16,580,829.24	1,375,855.97	26° 08' 51.2692"N	97° 18' 22.6031"W
TCS-34	16,580,797.87	1,375,806.64	26° 08' 50.9631"N	97° 18' 23.1476"W
TCS-35	16,580,754.85	1,375,765.85	26° 08' 50.5409"N	97° 18' 23.5996"W
TCS-36	16,580,702.50	1,375,731.91	26° 08' 50.0255"N	97° 18' 23.9775"W
TCS-37	16,580,643.14	1,375,703.10	26° 08' 49.4404"N	97° 18' 24.2998"W
TCS-38	16,580,579.13	1,375,677.71	26° 08' 48.8088"N	97° 18' 24.5851"W
TCS-39	16,580,512.77	1,375,654.02	26° 08' 48.1539"N	97° 18' 24.8519"W
TCS-40	16,580,848.26	1,375,300.26	26° 08' 51.5095"N	97° 18' 28.6989"W
TCS-41	16,580,862.59	1,375,239.37	26° 08' 51.6571"N	97° 18' 29.3656"W
TCS-42	16,580,873.28	1,375,211.16	26° 08' 51.7657"N	97° 18' 29.6741"W
TCS-43	16,580,904.15	1,375,161.51	26° 08' 52.0760"N	97° 18' 30.2157"W
TCS-44	16,580,946.75	1,375,120.29	26° 08' 52.5018"N	97° 18' 30.6636"W
TCS-45	16,580,998.76	1,375,085.82	26° 08' 53.0201"N	97° 18' 31.0365"W
TCS-46	16,581,057.82	1,375,056.40	26° 08' 53.6077"N	97° 18' 31.3531"W
TCS-47	16,581,121.57	1,375,030.36	26° 08' 54.2416"N	97° 18' 31.6323"W
TCS-48	16,581,181.51	1,375,007.07	26° 08' 54.8373"N	97° 18' 31.8816"W
TCS-49	16,580,798.53	1,374,696.80	26° 08' 51.0734"N	97° 18' 35.3259"W
TCS-50	16,580,789.90	1,374,666.34	26° 08' 50.9909"N	97° 18' 35.6610"W
TCS-51	16,580,778.92	1,374,638.23	26° 08' 50.8847"N	97° 18' 35.9706"W
TCS-52	16,580,747.55	1,374,588.91	26° 08' 50.5786"N	97° 18' 36.5151"W
TCS-53	16,580,704.53	1,374,548.12	26° 08' 50.1564"N	97° 18' 36.9671"W
TCS-54	16,580,652.18	1,374,514.18	26° 08' 49.6410"N	97° 18' 37.3450"W
TCS-55	16,580,592.82	1,374,485.37	26° 08' 49.0559"N	97° 18' 37.6673"W
TCS-56	16,580,528.80	1,374,459.97	26° 08' 48.4243"N	97° 18' 37.9530"W
TCS-57	16,580,462.45	1,374,436.29	26° 08' 47.7694"N	97° 18' 38.2193"W
TCS-58	16,580,803.85	1,374,225.62	26° 08' 51.1701"N	97° 18' 40.4957"W
TCS-59	16,580,818.19	1,374,164.57	26° 08' 51.3178"N	97° 18' 41.1641"W
TCS-60	16,580,828.89	1,374,136.35	26° 08' 51.4264"N	97° 18' 41.4727"W

(CONTINUED ON SHEET 19)

BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

SHEET 18 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

TIDAL CREEK SOUTH ALIGNMENT (CONTINUED FROM SHEET 18)				
PI NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE
TCS-61	16,580,859.75	1,374,086.71	26° 08' 51.7367"N	97° 18' 42.0142"W
TCS-62	16,580,902.36	1,374,045.49	26° 08' 52.1625"N	97° 18' 42.4622"W
TCS-63	16,580,954.36	1,374,011.01	26° 08' 52.6807"N	97° 18' 42.8351"W
TCS-64	16,581,013.42	1,373,981.60	26° 08' 53.2684"N	97° 18' 43.1518"W
TCS-65	16,581,077.18	1,373,955.55	26° 08' 53.9022"N	97° 18' 43.4309"W
TCS-66	16,581,137.11	1,373,932.27	26° 08' 54.4979"N	97° 18' 43.6802"W
TCS-67	16,580,790.43	1,374,193.96	26° 08' 51.0402"N	97° 18' 40.8445"W
TCS-68	16,580,773.79	1,374,097.82	26° 08' 50.8844"N	97° 18' 41.9011"W
TCS-69	16,580,754.19	1,374,039.25	26° 08' 50.6956"N	97° 18' 42.5458"W
TCS-70	16,580,722.82	1,373,989.93	26° 08' 50.3896"N	97° 18' 43.0904"W
TCS-71	16,580,679.80	1,373,949.14	26° 08' 49.9673"N	97° 18' 43.5423"W
TCS-72	16,580,627.44	1,373,915.20	26° 08' 49.4520"N	97° 18' 43.9202"W
TCS-73	16,580,568.09	1,373,886.39	26° 08' 48.8668"N	97° 18' 44.2425"W
TCS-74	16,580,504.07	1,373,860.99	26° 08' 48.2352"N	97° 18' 44.5278"W
TCS-75	16,580,437.72	1,373,837.31	26° 08' 47.5803"N	97° 18' 44.7945"W

STRUCTURE REMOVAL COORDINATES					
ST NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE	DESCRIPTION
ST-01	16,582,749.97	1,374,627.70	26° 09' 10.4063"N	97° 18' 35.8823"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-02	16,582,755.15	1,374,849.31	26° 09' 10.4369"N	97° 18' 33.4499"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-03	16,582,764.23	1,375,057.71	26° 09' 10.5073"N	97° 18' 31.1620"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-04	16,582,776.96	1,375,268.34	26° 09' 10.6137"N	97° 18' 28.8494"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-05	16,582,777.66	1,375,481.76	26° 09' 10.6007"N	97° 18' 26.5073"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-06	16,581,590.94	1,375,498.79	26° 08' 58.8462"N	97° 18' 26.4434"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-07	16,581,581.54	1,375,389.57	26° 08' 58.7633"N	97° 18' 27.6429"W	WOODEN PIER
ST-08	16,581,577.50	1,375,304.93	26° 08' 58.7312"N	97° 18' 28.5721"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-09	16,581,557.94	1,375,096.07	26° 08' 58.5571"N	97° 18' 30.8660"W	CONCRETE BOX CULVERT TROUGH DIKE
ST-10	16,581,575.31	1,375,028.48	26° 08' 58.7354"N	97° 18' 31.6060"W	WOODEN PIER
ST-11	16,581,557.89	1,374,912.60	26° 08' 58.5737"N	97° 18' 32.8793"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-12	16,581,552.40	1,374,723.36	26° 08' 58.5370"N	97° 18' 34.9565"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-13	16,581,549.34	1,374,644.34	26° 08' 58.5141"N	97° 18' 35.8239"W	WOODEN PIER
ST-14	16,581,550.13	1,374,540.42	26° 08' 58.5316"N	97° 18' 36.9641"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-15	16,581,498.18	1,376,156.23	26° 08' 57.8660"N	97° 18' 19.2388"W	CONCRETE BOX CULVERT AND CANAL CROSSING ROAD
ST-16	16,581,529.28	1,376,924.00	26° 08' 58.1019"N	97° 18' 10.8105"W	CONCRETE/WOODEN WIER AND WOODEN PIER CROSSING CANAL
ST-17	16,581,544.55	1,376,982.61	26° 08' 58.2476"N	97° 18' 10.1658"W	WOODEN PIER AND METAL PILINGS CROSSING CANAL
ST-18	16,581,268.24	1,373,471.05	26° 08' 55.8396"N	97° 18' 48.7278"W	PVC DRAINAGE PIPES THROUGH DIKE AND WOODEN PIER
ST-19	16,581,285.91	1,373,539.76	26° 08' 56.0082"N	97° 18' 47.9720"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-20	16,581,286.40	1,373,593.08	26° 08' 56.0081"N	97° 18' 47.3869"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-21	16,581,290.94	1,373,680.37	26° 08' 56.0449"N	97° 18' 46.4285"W	CONCRETE BOX CULVERT TROUGH DIKE AND WOODEN PIER
ST-22	16,581,288.22	1,373,797.79	26° 08' 56.0071"N	97° 18' 45.1403"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-23	16,581,291.79	1,373,868.47	26° 08' 56.0358"N	97° 18' 44.3644"W	WOODEN PIER
ST-24	16,581,296.89	1,374,215.28	26° 08' 56.0540"N	97° 18' 40.5582"W	PVC DRAINAGE PIPES THROUGH DIKE AND WOODEN PIER
ST-25	16,581,314.21	1,374,315.99	26° 08' 56.2161"N	97° 18' 39.4513"W	CONCRETE BOX CULVERT TROUGH DIKE
ST-26	16,581,302.12	1,374,375.29	26° 08' 56.0908"N	97° 18' 38.8019"W	PVC DRAINAGE PIPES THROUGH DIKE AND WOODEN PIER
ST-27	16,581,321.89	1,374,878.76	26° 08' 56.2396"N	97° 18' 33.2751"W	WOODEN PIER
ST-28	16,581,342.51	1,375,156.36	26° 08' 56.4179"N	97° 18' 30.2268"W	WOODEN PIER
ST-29	16,581,334.17	1,375,222.90	26° 08' 56.3291"N	97° 18' 29.4975"W	WOODEN PIER
ST-30	16,581,359.56	1,375,533.06	26° 08' 56.5515"N	97° 18' 26.0913"W	CONCRETE BOX CULVERT TROUGH DIKE
(CONTINUED ON SHEET 21)					

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

STRUCTURE REMOVAL COORDINATES (CONTINUED FROM SHEET 20)					
ST NUMBER	NORTHING	EASTING	LATITUDE	LONGITUDE	DESCRIPTION
ST-31	16,581,349.58	1,375,630.14	26° 08' 56.4436"N	97° 18' 25.0271"W	WOODEN PIER
ST-32	16,581,381.81	1,376,063.49	26° 08' 56.7222"N	97° 18' 20.2685"W	CONCRETE BOX CULVERT TROUGH DIKE / CONCRETE STAND PIPES
ST-33	16,581,369.83	1,376,402.70	26° 08' 56.5717"N	97° 18' 16.5475"W	PVC DRAINAGE PIPES THROUGH DIKE AND WOODEN PIER
ST-34	16,581,376.89	1,376,661.54	26° 08' 56.6173"N	97° 18' 13.7065"W	WOODEN PIER
ST-35	16,581,398.65	1,376,788.49	26° 08' 56.8209"N	97° 18' 12.3112"W	CONCRETE BOX CULVERT TROUGH DIKE
ST-36	16,581,386.53	1,376,870.69	26° 08' 56.6932"N	97° 18' 11.4104"W	WOODEN PIER
ST-37	16,581,207.43	1,377,239.67	26° 08' 54.8848"N	97° 18' 07.3802"W	WOODEN PIER
ST-38	16,581,010.50	1,377,510.22	26° 08' 52.9090"N	97° 18' 04.4318"W	WOODEN PIER
ST-39	16,580,411.79	1,377,186.23	26° 08' 47.0100"N	97° 18' 08.0494"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-40	16,580,400.86	1,376,763.12	26° 08' 46.9415"N	97° 18' 12.6933"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-41	16,580,380.85	1,376,329.01	26° 08' 46.7841"N	97° 18' 17.4589"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-42	16,580,363.00	1,375,901.33	26° 08' 46.6474"N	97° 18' 22.1537"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-43	16,580,339.94	1,375,472.52	26° 08' 46.4592"N	97° 18' 26.8614"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-44	16,580,329.77	1,375,044.83	26° 08' 46.3985"N	97° 18' 31.5555"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-45	16,580,308.79	1,374,440.67	26° 08' 46.2471"N	97° 18' 38.1871"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-46	16,580,304.73	1,374,341.07	26° 08' 46.2162"N	97° 18' 39.2805"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-47	16,580,302.31	1,374,240.26	26° 08' 46.2017"N	97° 18' 40.3869"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-48	16,580,296.09	1,373,984.80	26° 08' 46.1639"N	97° 18' 43.1907"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-49	16,580,276.59	1,373,743.45	26° 08' 45.9933"N	97° 18' 45.8410"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-50	16,580,267.10	1,373,409.31	26° 08' 45.9304"N	97° 18' 49.5086"W	PVC DRAINAGE PIPES THROUGH DIKE
ST-51	16,580,583.61	1,378,278.72	26° 08' 48.6088"N	97° 17' 56.0436"W	EARTHEN LEVEE / CONCRETE SHORELINE PROTECTION / CONCRETE BOX CULVERT

BY	DESCRIPTION	DATE

DRAWN BY: STEVE DARTEZ

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

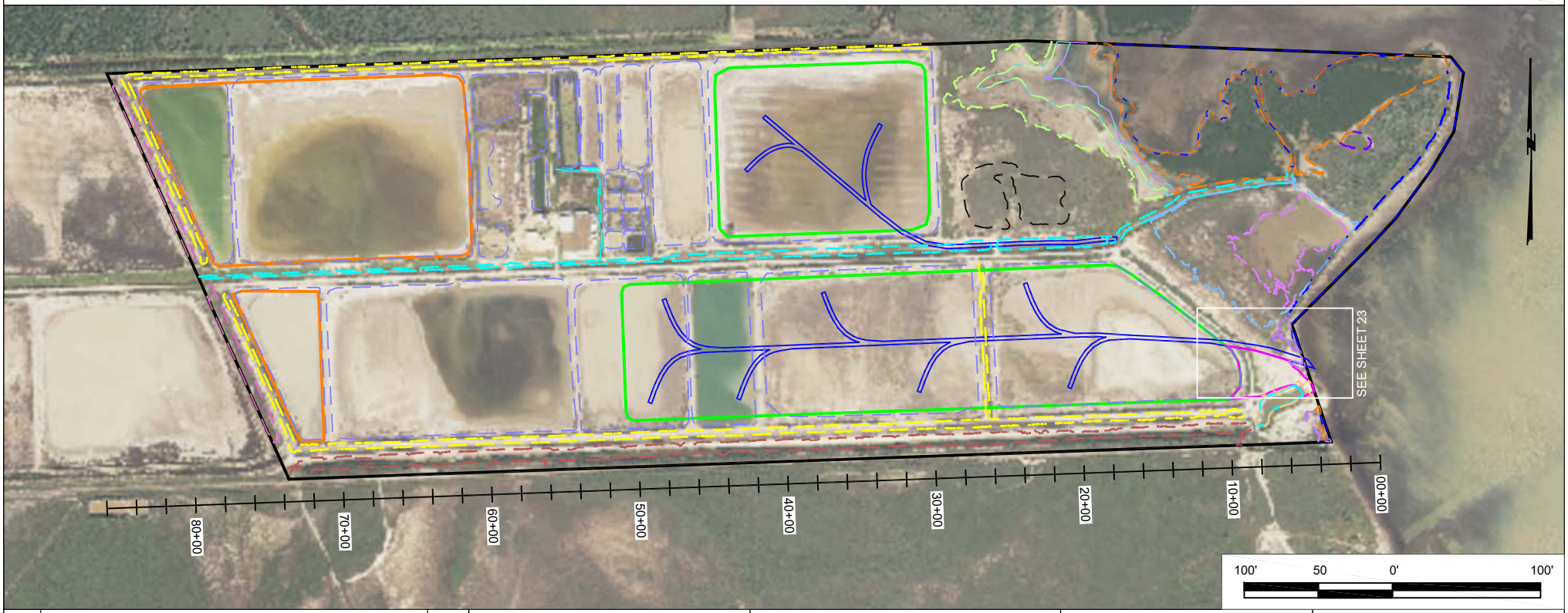
TEXAS LNG BROWNSVILLE, LLC

ALIGNMENT AND COORDINATE TABLES

DATE: OCTOBER 2021

LEGEND

- RESTORATION AREAS
- DISPOSAL AREA
- TIDAL CREEKS
- DREDGE SPOIL / BERM DEGRADE AREA
- DREDGE SPOIL / BERM DISPOSAL AREA
- PROPERTY BOUNDARY
- IMPOUNDED DITCH (RIVERINE - R2UBFx)
- IMPOUNDED DITCH (FRESHWATER - PUBFx)
- IMPOUNDED DITCH (FRESHWATER EMERGENT WETLANDS - PEM1Fx)
- IMPOUNDED BASIN (LAKE - L2USKx)
- CENTRAL DRAINAGE (RIVERINE - R2UBFx)
- WETLANDS (FRESHWATER EMERGENT - PEM1Sx)
- WETLANDS (ESTUARINE - MARINE - E2USP)
- WETLANDS (ESTUARINE - MARINE - E2AB1N)
- WETLANDS (ESTUARINE - MARINE - E2USN)
- WETLANDS (ESTUARINE - MARINE - E2SS3N)
- WETLANDS (ESTUARINE - MARINE - E2EM1P)
- WETLANDS (ESTUARINE - MARINE - E2EM1A)
- WETLANDS (ESTUARINE - MARINE DEEP WATER - E1AB3L)
- FLATS (ESTUARINE - MARINE - E2USM)
- INLET (POND - E1ABLx)



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

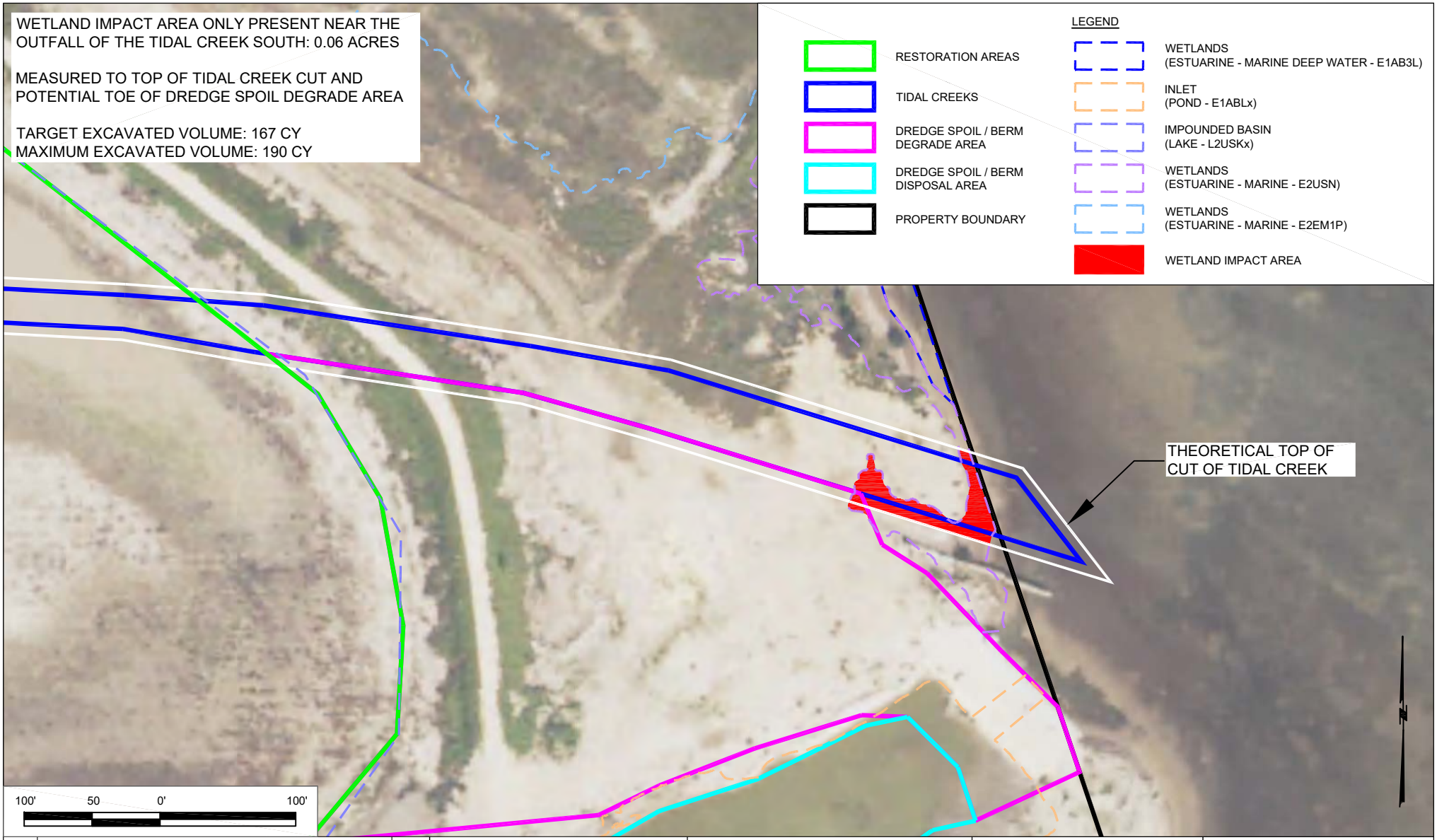
JURISDICTIONAL WETLAND IMPACT OVERVIEW MAP

DATE: OCTOBER 2021

SHEET 22 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452



BY	DESCRIPTION	DATE

COASTAL ENGINEERING CONSULTANTS, INC.
PH: (225) 523-7403
1211 N. RANGE AVE, SUITE E
DENHAM, SPRINGS, LA 70726

Ecosystem Investment Partners

LAGUNA MADRE PERMITTEE RESPONSIBLE MITIGATION

TEXAS LNG BROWNSVILLE, LLC

JURISDICTIONAL WETLAND IMPACT INSET MAP

DATE: OCTOBER 2021

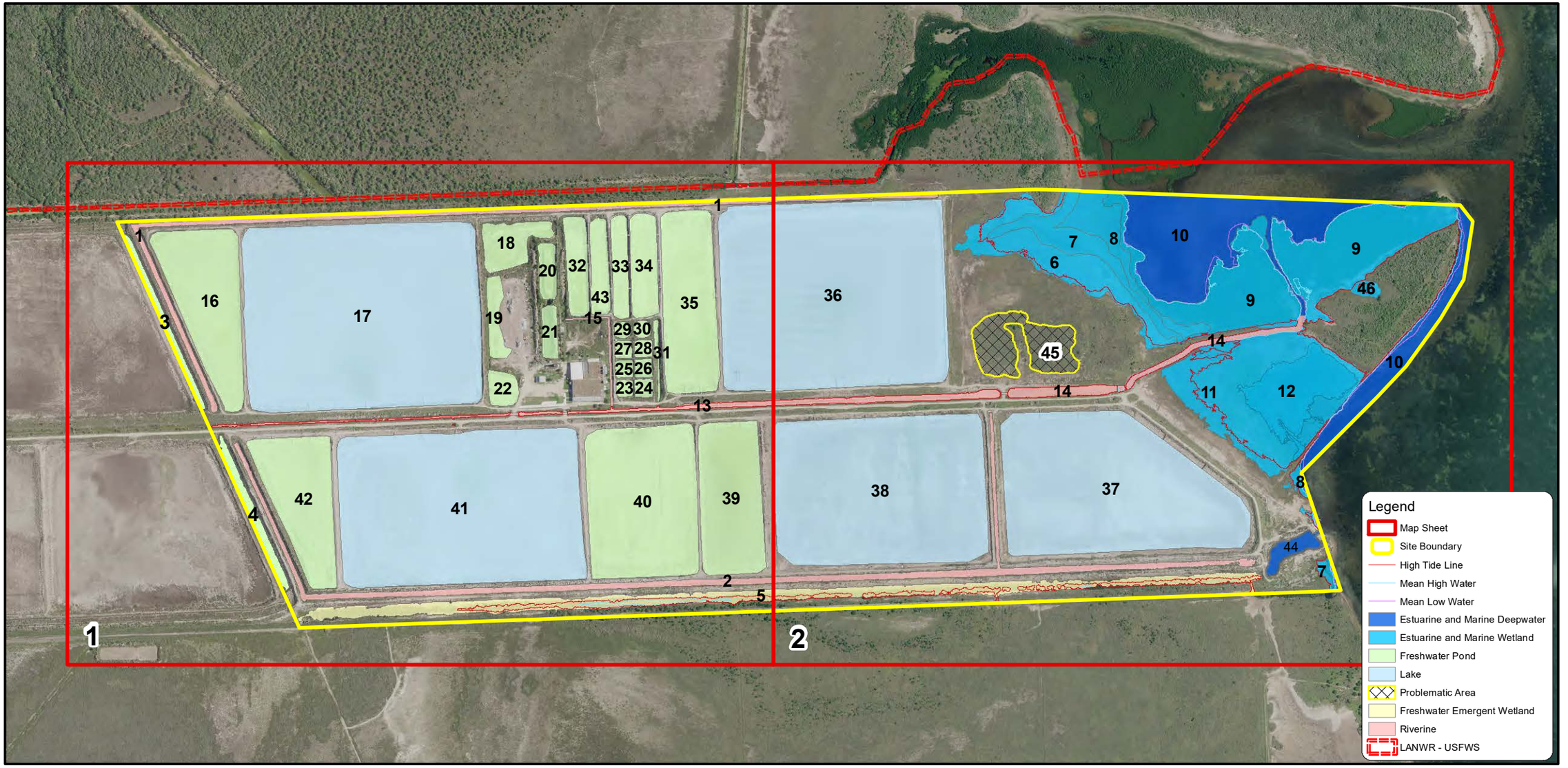
SHEET 23 OF 23

DRAWN BY: STEVE DARTEZ

DESIGNED BY: MICHAEL T. POFF, P.E.
LICENSE NUMBER: 125452

APPENDIX D

Mitigation LMPRM Wetland Delineation Maps



AMBIOTEC GROUP

Ecosystem Investment Partners

Laguna Madre Permittee Responsible Mitigation

Wetland Index Map

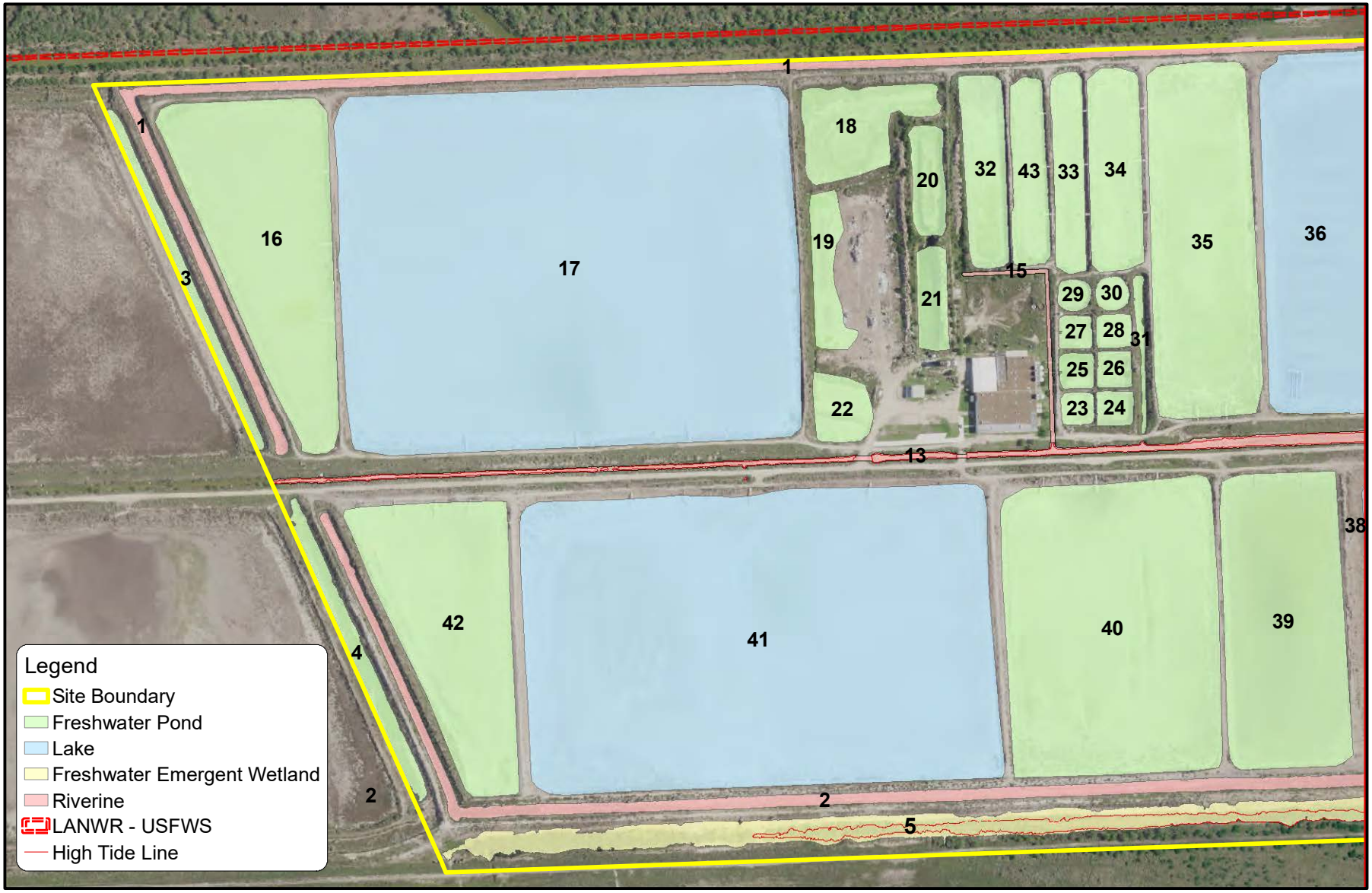
Appendix D

Image: National Aerial Imagery Program (2020)

Wetland ID numbers correlate to wetland attributes in **Table 1**.

0 362.5 725 1,450 2,175 2,900 Feet

N



AMBIOTEC GROUP

Ecosystem Investment Partners

Laguna Madre Permittee Responsible Mitigation

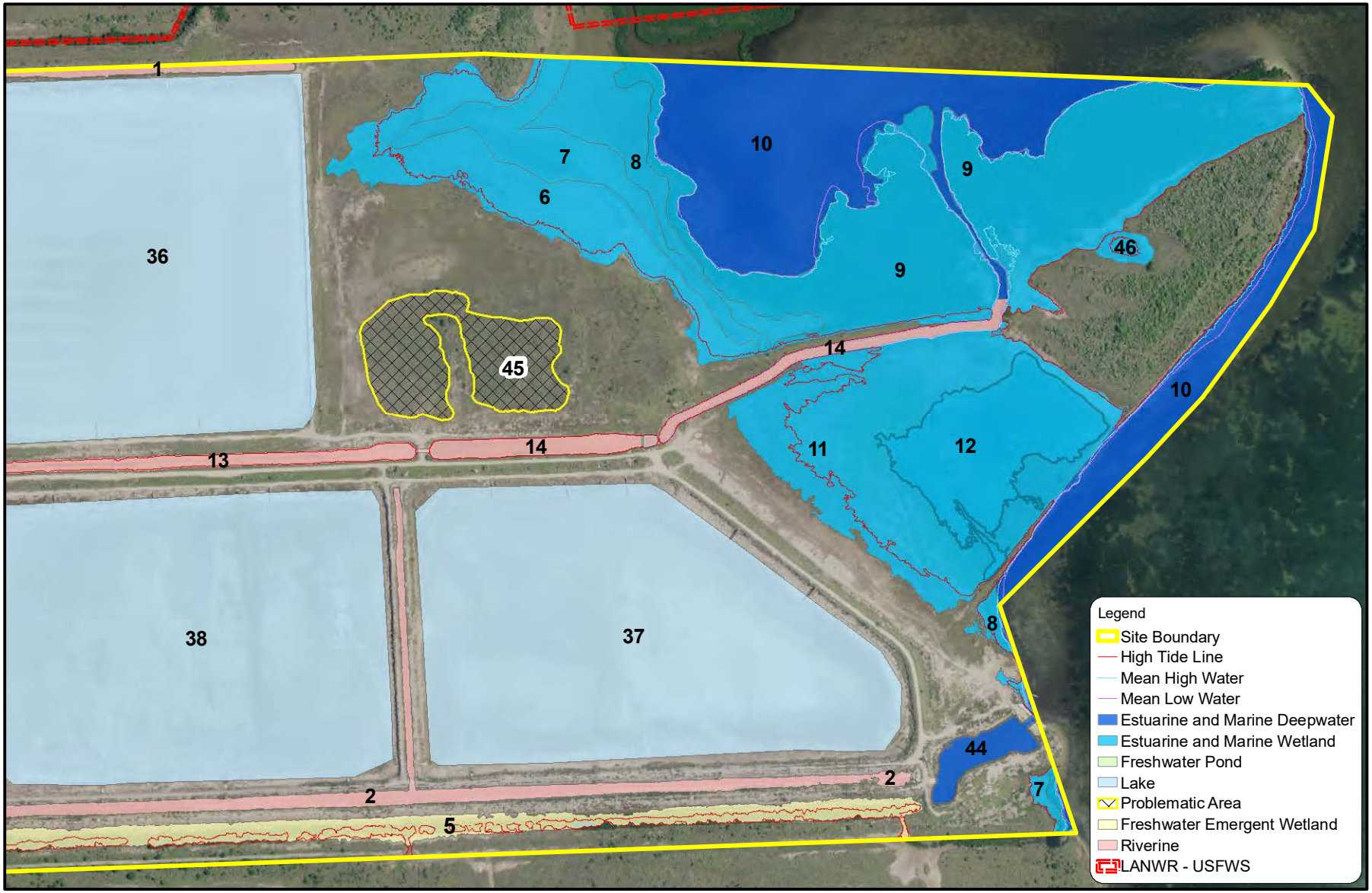
Wetland Mapsheet 1

0 190 380 760 1,140 1,520 Feet

Image: National Aerial Imagery Program (2020)

Wetland ID numbers correlate to wetland attributes in **Table 1**.

N



AMBIOTEC GROUP

Ecosystem Investment Partners

Laguna Madre Permittee Responsible Mitigation

Wetland Mapsheet 2

0 190 380 760 1,140 1,520 Feet

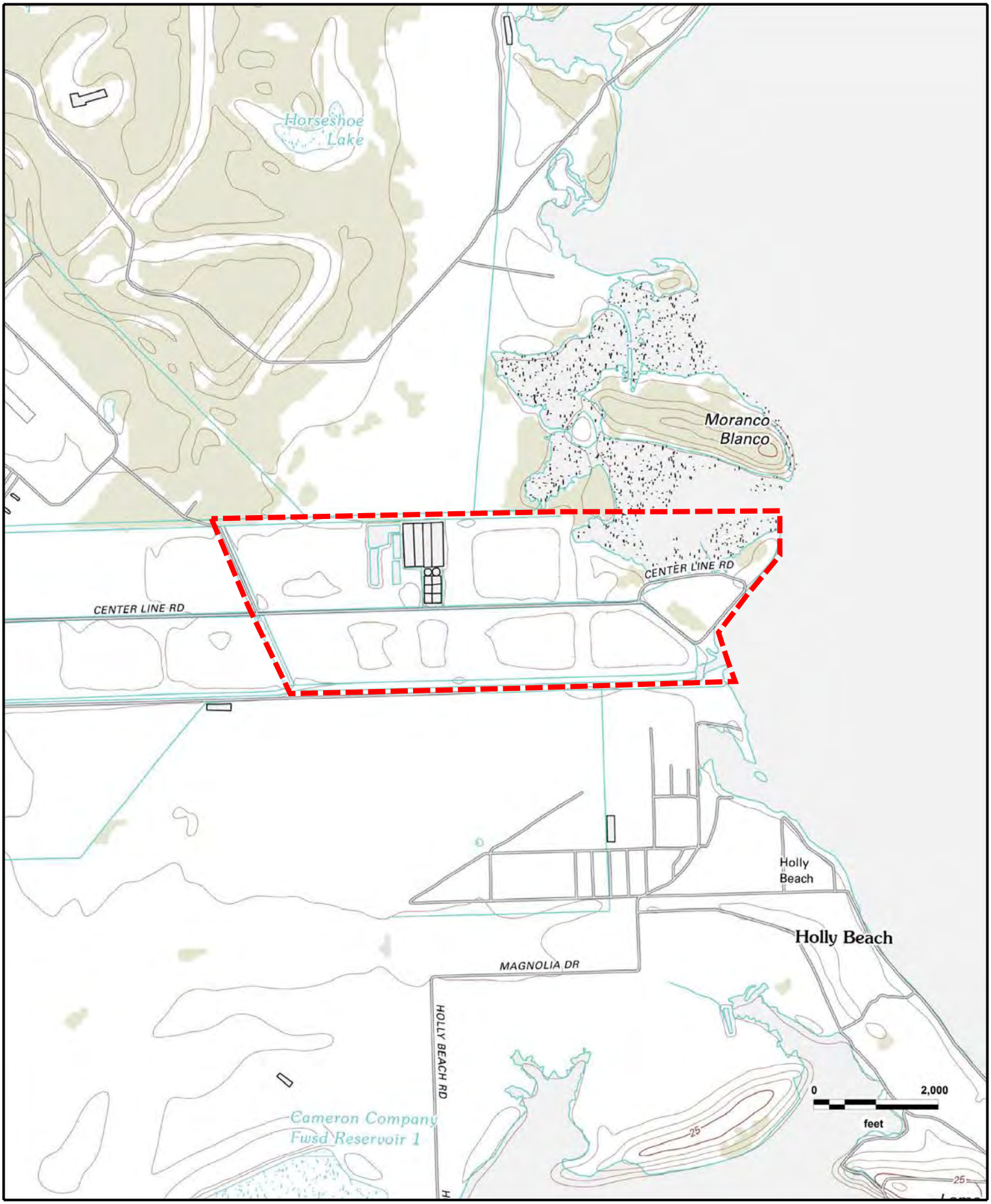
Image: National Aerial Imagery Program (2020)

Wetland ID numbers correlate to wetland attributes in **Table 1**.

N

APPENDIX E

Mitigation LMPRM Historic Topographic Maps

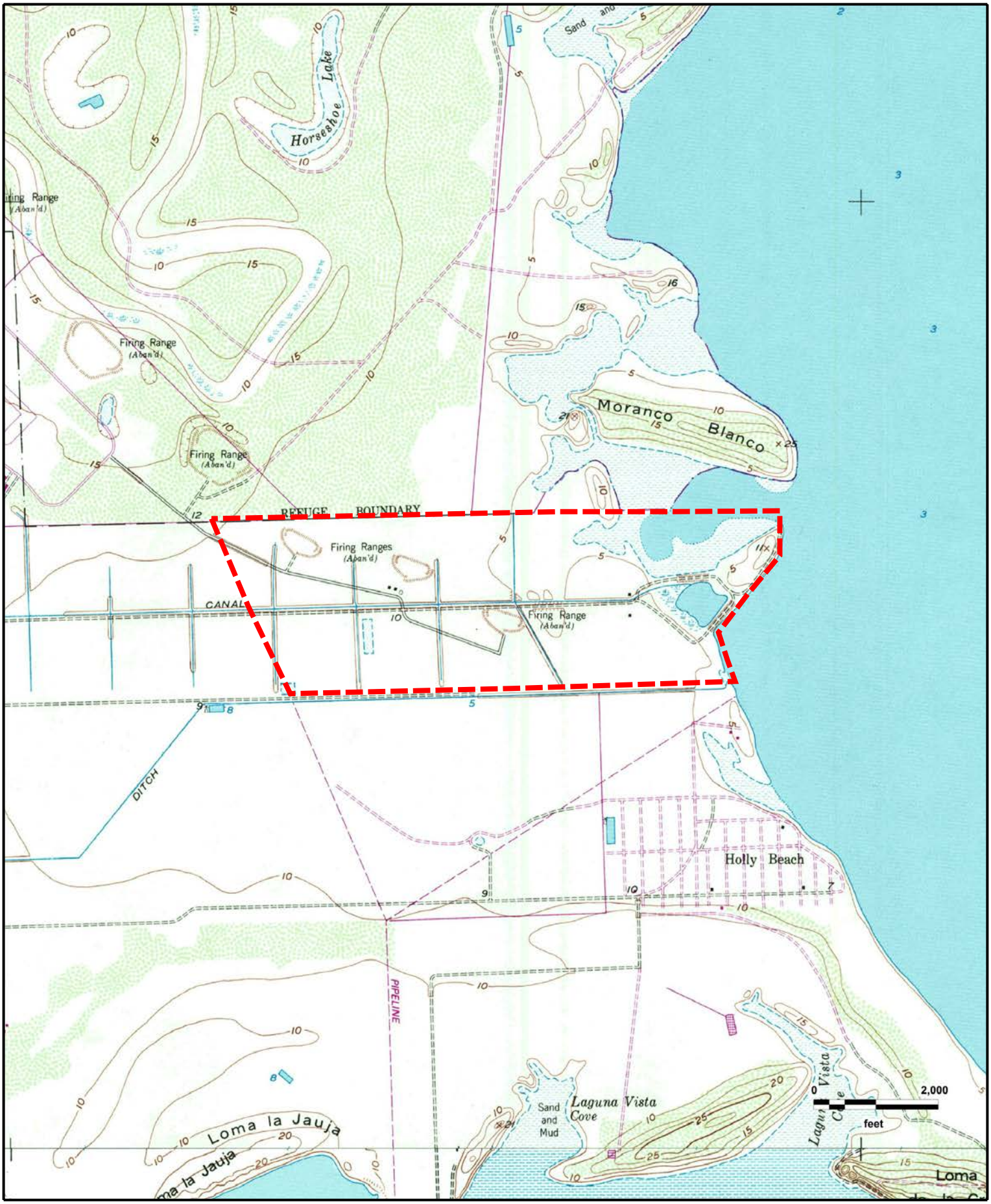


N
W E
S

Laguna Madre Permittee Responsible Mitigation
LA COMA, TX (2013), LAGUNA VISTA, TX (2013)

GeoSearch

JOB #: 400181 - 03/05/2021

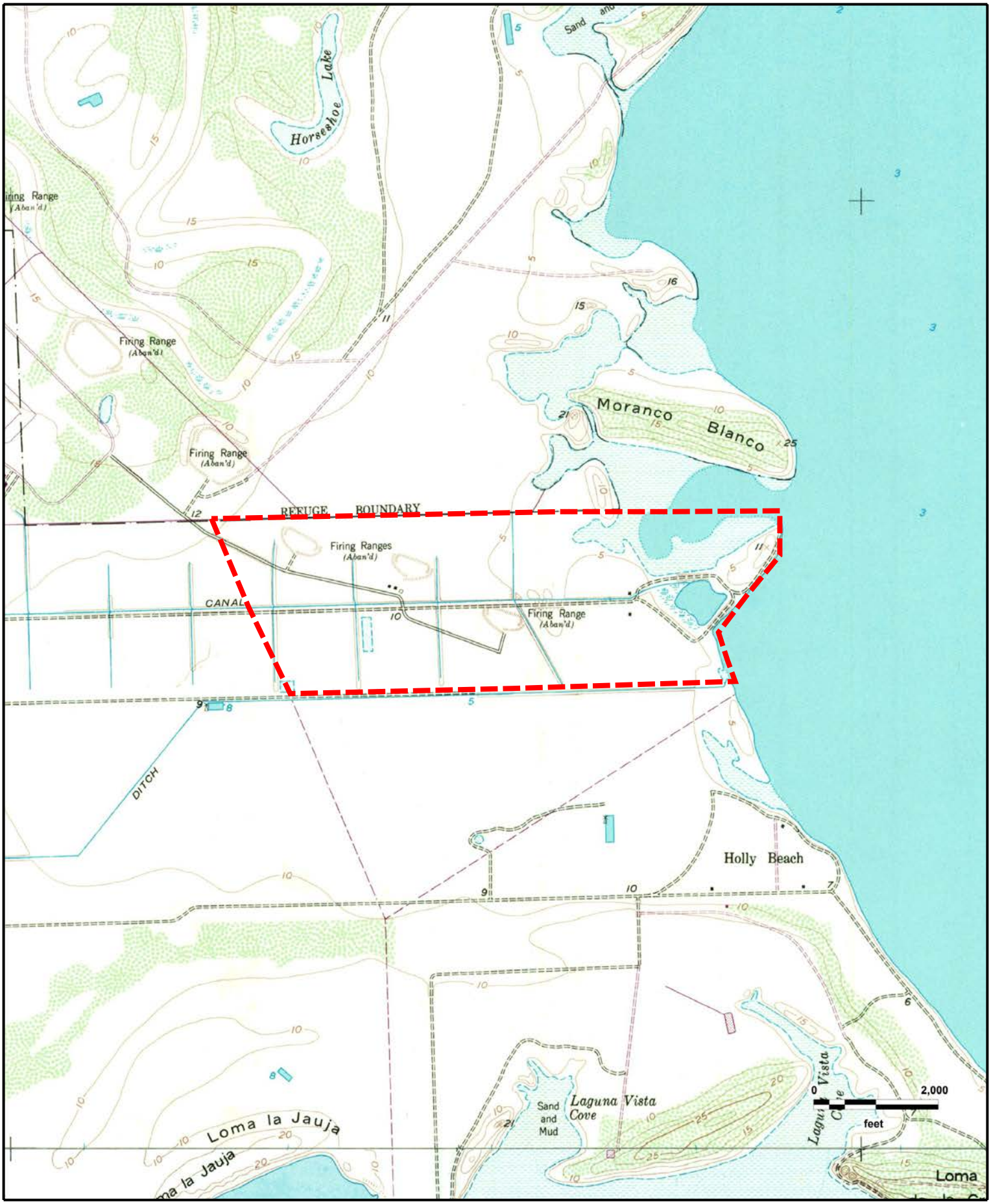


N
W E
S

Laguna Madre Permittee Responsible Mitigation
LA COMA, TX (1983), LAGUNA VISTA, TX (1983)

GeoSearch

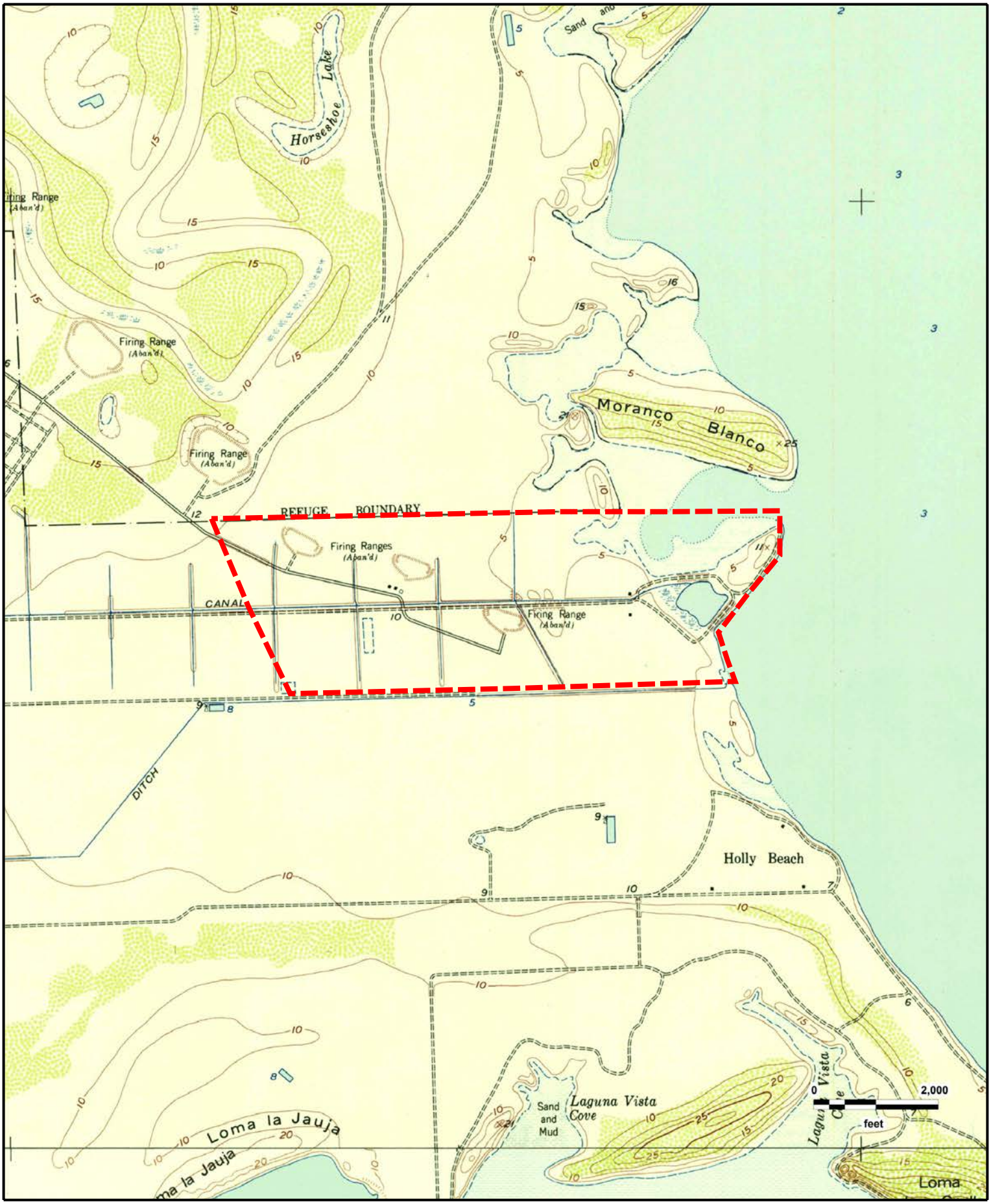
JOB #: 400181 - 03/05/2021



Laguna Madre Permittee Responsible Mitigation
LA COMA, TX (1970), LAGUNA VISTA, TX (1970)

GeoSearch

JOB #: 400181 - 03/05/2021

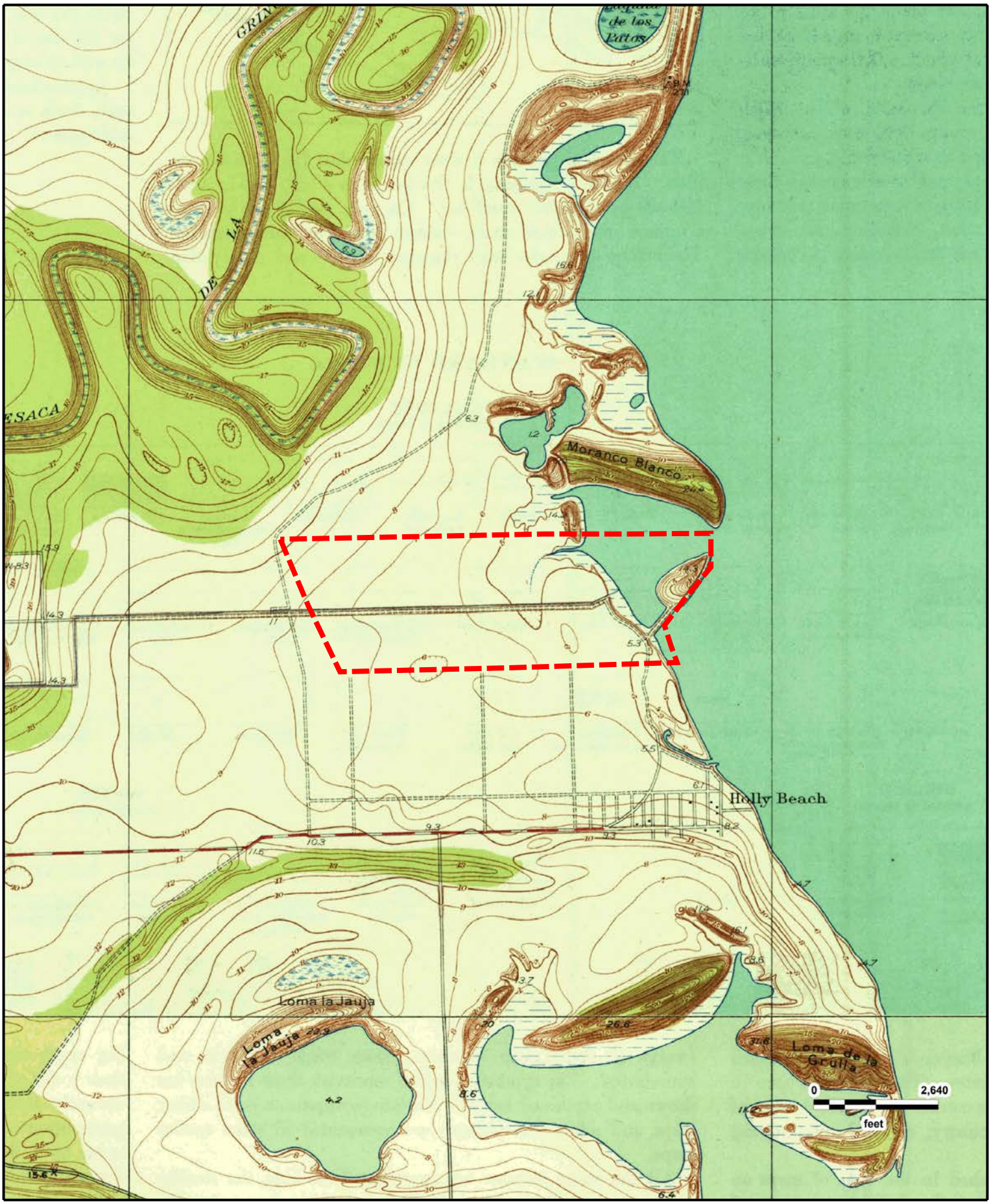


N
W E
S

Laguna Madre Permittee Responsible Mitigation
LA COMA, TX (1955), LAGUNA VISTA, TX (1955)

GeoSearch

JOB #: 400181 - 03/05/2021

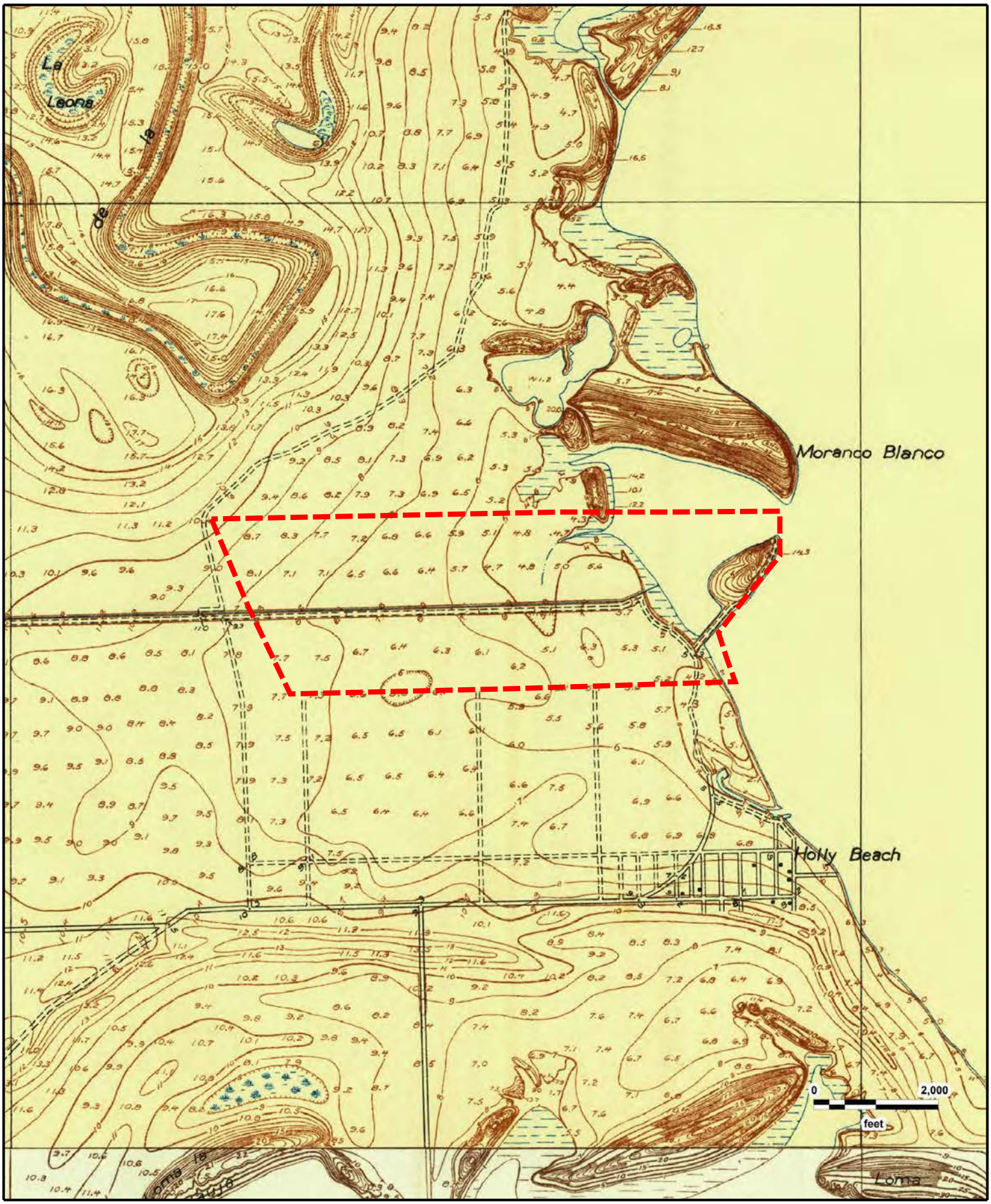


N
W E
S

Laguna Madre Permittee Responsible Mitigation
LA COMA, TX (1934), LAGUNA VISTA, TX (1936)

GeoSearch

JOB #: 400181 - 03/05/2021

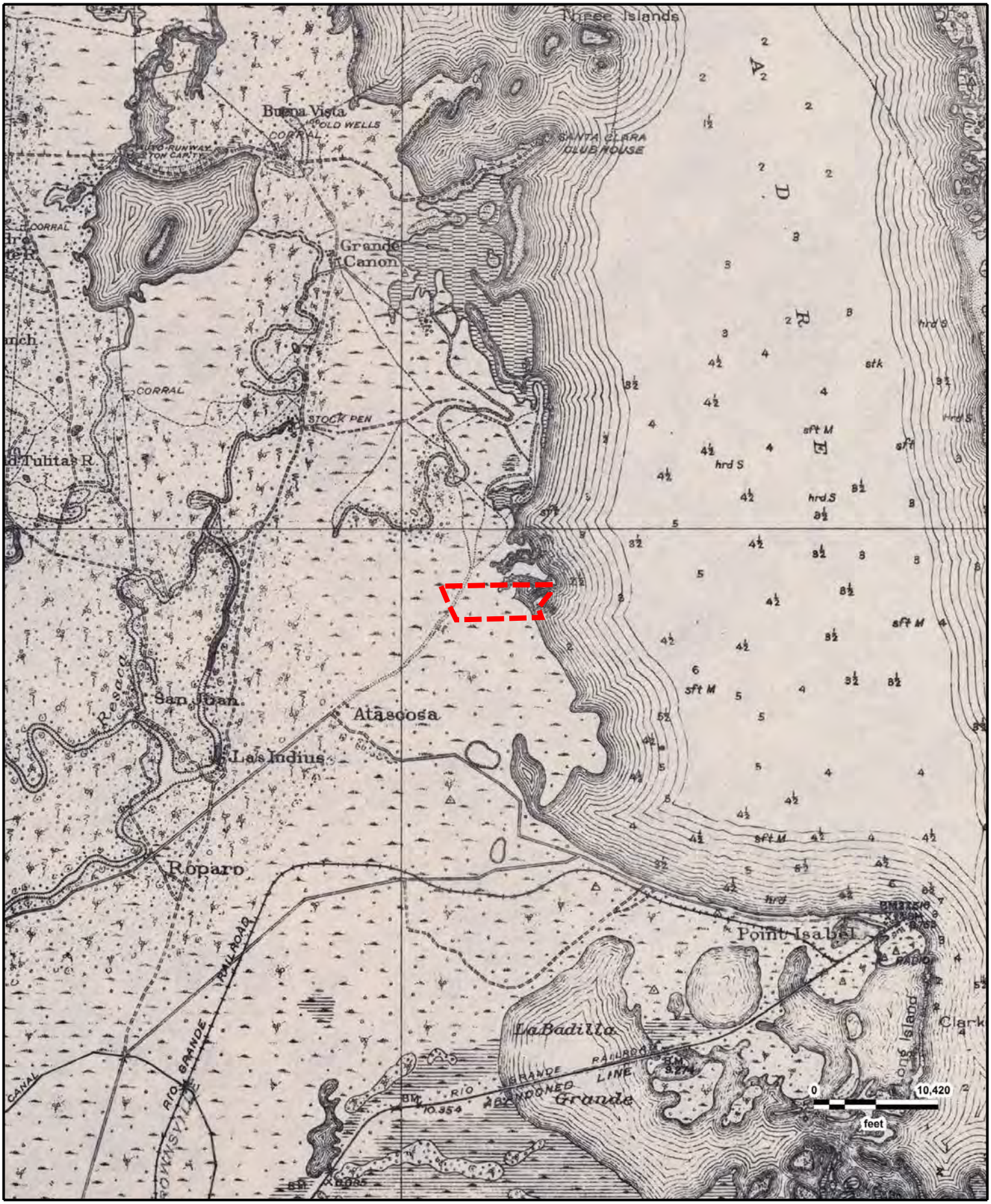


N
W E
S

Laguna Madre Permittee Responsible Mitigation
LA COMA, TX (1929), LAGUNA VISTA, TX (1929)

GeoSearch

JOB #: 400181 - 03/05/2021



N
W E
S

Laguna Madre Permittee Responsible Mitigation
POINT ISABEL, TX (1922)

GeoSearch

JOB #: 400181 - 03/05/2021

APPENDIX F

FEMA Fire Insurance Rate Map

NOTES TO USERS

...is for use in administering the National Flood Insurance Program. It does ...ssarily identify all areas subject to flooding, particularly from local drainage ...small size. The **community map repository** should be consulted for ...updated or additional flood hazard information.

...n more detailed information in areas where **Base Flood Elevations** ...nd/or **floodways** have been determined, users are encouraged to consult ...d Profiles and Floodway Data and/or Summary of Stillwater Elevations ...ntained within the Flood Insurance Study (FIS) report that accompanies ...M. Users should be aware that BFEs shown on the FIRM represent ...whole-foot elevations. These BFEs are intended for flood insurance rating ...s only and should not be used as the sole source of flood elevation ...on. Accordingly, flood elevation data presented in the FIS report should ...ed in conjunction with the FIRM for purposes of construction and/or ...n management.

...Base Flood Elevations shown on this map apply only landward of 0.0' ...herican Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be ...al coastal flood elevations are also provided in the Summary of Stillwater ...s table in the Flood Insurance Study Report for this jurisdiction. Elevations ...n the Summary of Stillwater Elevations table should be used for ...tion, and/or floodplain management purposes when they are higher than ...tions shown on this FIRM.

...ies of the **floodways** were computed at cross sections and interpolated ... cross sections. The floodways were based on hydraulic considerations ...ard to requirements of the National Flood Insurance Program. Floodway ...nd other pertinent floodway data are provided in the Flood Insurance Study ...r this jurisdiction.

...areas not in Special Flood Hazard Areas may be protected by **flood ...structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood ...e Study report for information on flood control structures in this jurisdiction.

...**ection** used in the preparation of this map was Texas State Plane. Zone ...The **horizontal datum** was NAD83, GRS80 spheroid. Differences in ...pheroid, projection or State Plane zones used in the production of FIRMs ...ent jurisdictions may result in slight positional differences in map features ...risdiction boundaries. These differences do not affect the accuracy of this ...

...evations on this map are referenced to the North American Vertical Datum ... These flood elevations must be compared to structure and ground ...s referenced to the same **vertical datum**. For information regarding ...on between the National Geodetic Vertical Datum of 1929 and the North ...n Vertical Datum of 1988, visit the National Geodetic Survey website at ...w.ngs.noaa.gov or contact the National Geodetic Survey at the following ...

...rmation Services ...NGS12 ...Geodetic Survey, SSMC-3, #9202 ...l-West Highway ...ring, Maryland 20910-3282 ...3-3242

...n current elevation, description, and/or location information for **bench** ...hown on this map, please contact the Information Services Branch of the ...Geodetic Survey at **(301) 713-3242**, or visit their website at ...w.ngs.noaa.gov/.

...ap information shown on this FIRM was derived from multiple sources. ...rmation was compiled from the U.S. Geological Survey, 1989; National ...Survey, 2004; Cameron County Appraisal District, 2011; and the Texas ...Resources Information System, 2010. Additional information was ...mmetrically compiled at a scale of 1:6,000 from National Agriculture ...Program aerial photography dated 2010.

...reflects more detailed and up-to-date **stream channel configurations** ...e shown on the previous FIRM for this jurisdiction. The floodplains and ...s that were transferred from the previous FIRM may have been adjusted ...m to these new stream channel configurations. As a result, the Flood ...and Floodway Data tables in the Flood Insurance Study report (which ...authoritative hydraulic data) may reflect stream channel distances that ...n what is shown on this map.

...**te limits** shown on this map are based on the best data available at the ...ublication. Because changes due to annexations or de-annexations may ...urred after this map was published, map users should contact appropriate ...ity officials to verify current corporate limit locations.

...efer to the separately printed **Map Index** for an overview map of the ...howing the layout of map panels, community map repository addresses, ...sting of Communities table containing National Flood Insurance Program ...r each community as well as a listing of the panels on which each ...ity is located.

...Zone category has been divided by a **Limit of Moderate Wave Action** ... The LIMWA represents the approximate landward limit of the 1.5-foot ... wave. The effects of wave hazards between the VE Zone and the LIMWA ...een the shoreline and the LIMWA for areas where VE Zones are not ...l) will be similar to, but less severe than those in the VE Zone.

...mation on available products associated with this FIRM visit the **FEMA ...vice Center** (MSC) website at http://msc.fema.gov. Available products ...ude previously issued Letters of Map Change, a Flood Insurance Study ...and/or digital versions of this map. Many of these products can be ordered ...ed directly from the MSC website.

...ve **questions about this map**, how to order products or the National ...surance Program in general, please call the FEMA Map Information ...e at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at ...w.fema.gov/national-flood-insurance-program.

COASTAL BARRIER ...SOURCE SYSTEM (CBRS) LEGEND

...) CBRS Area
...NSURANCE NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR ...NTIALLY IMPROVED ON OR AFTER OCTOBER 1, 1983. IN ...ATED CBRS AREAS.

...) CBRS Area
...NSURANCE NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR ...NTIALLY IMPROVED ON OR AFTER NOVEMBER 16, 1990. IN ...ATED CBRS AREAS.

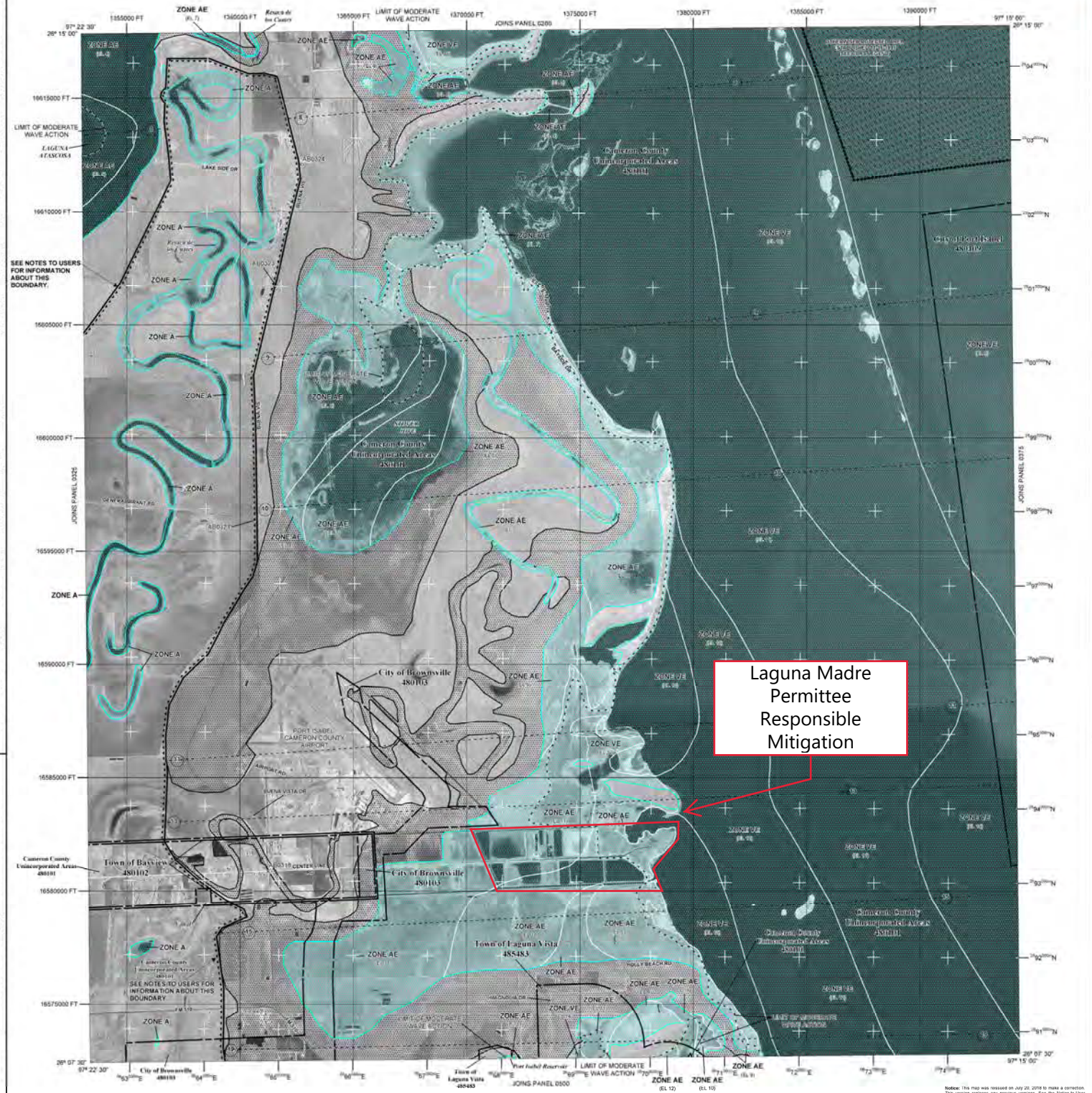
...91 CBRS Area
...NSURANCE NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR ...NTIALLY IMPROVED ON OR AFTER NOVEMBER 16, 1991. IN ...ATED CBRS AREAS.

...91 Otherwise Protected Area (OPA)
...NSURANCE NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR ...NTIALLY IMPROVED ON OR AFTER NOVEMBER 16, 1991. IN ...ATED OPAs WITHIN THE CBRS.

...ies of the John H. Chafee Coastal Barrier Resources System (CBRS) ...n this FIRM were transferred from the official CBRS source map(s) ...rea and are depicted on this FIRM for informational purposes only. ...cial CBRS maps are enacted by Congress via the Coastal Barrier ...s Act, as amended, and maintained by the U.S. Fish and Wildlife ...FWS). The official CBRS maps used to determine whether or not an ... located within the CBRS are available for download at ...w.fws.gov. For an official determination of whether or not an area is ...within the CBRS, or for any questions regarding the CBRS, please ...the FWS field office for this area at (361) 994-9005.

...ITION: The levee, dike, or other structure that impacts flood hazards ...this boundary has not been shown to comply with Section 65.10 of the ...Regulations. As such, this FIRM panel will be revised at a later date to ...the flood hazard information associated with this structure.

...od hazard data inside this boundary on the FIRM panel has been re- ...ed from the previous effective (nearest) FIRM for this area after being ...ted from NGVD 29 to NAVD 88.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT ... INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is th... that has a 1% chance of being equaled or exceeded in any given year. ... Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. ... of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. Th... Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A — No Base Flood Elevations determined.
ZONE AE — Base Flood Elevations determined.
ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base ... Elevations determined.
ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping t... average depths determined. For areas of alluvial fan flooding, v... also determined.
ZONE AR — Special Flood Hazard Area formerly protected from the 1% ... chance flood by a flood control system that was subse... decertified. Zone AR indicates that the former flood control sy... being restored to provide protection from the 1% annual cha... greater flood.
ZONE A99 — Area to be protected from 1% annual chance flood by a ... Flood protection system under construction; no Base Flood El... determined.
ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood ... determined.
ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood El... determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that ... ... free of encroachment so that the 1% annual chance flood can be carried ... ... increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chanc... with average depths of less than 1 foot or with drainage areas ... 1 square mile; and areas protected by levees from 1% annual ... flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard ...

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Limit of Moderate Wave Action
Boundary dividing Special Flood Hazard Area Zones and ... boundary dividing Special Flood Hazard Areas of different ... Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; ... elevation in feet*
*Referenced to the North American Vertical Datum of 1988
A — A — Cross section line
23 — 23 — Transect line
Culvert, Flume, Pressback or Aqueduct
Road or Railroad Bridge
Footbridge
97° 07' 30", 32° 22' 30" — Geographic coordinates referenced to the North American ... Datum of 1983 (NAD 83), Western Hemisphere
4000000 mE — 1000-meter Universal Transverse Mercator grid values, Zone ...
600000 FT — 5000-foot grid ticks: Texas State Plane coordinate system, ... South Zone (FIPS 4205), Lambert Conformal Conic Projection
2853535 — Bench mark (see explanation in Notes to Users section of this ... FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD ... INSURANCE RATE MAP PANEL ... FEBRUARY 16, 2018

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Com... Map History table located in the Flood Insurance Study report for this juris...

To determine if flood insurance is available in this community, contact your in... agent or call the National Flood Insurance Program at 1-800-6...

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0350F

FIRM

FLOOD INSURANCE RATE M...

CAMERON COUNTY, ...
TEXAS
AND INCORPORATED ARE...

PANEL 350 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANE...
BAYVIEW, TOWN OF	480102	0350
BROWNSVILLE, CITY OF	480103	0350
CAMERON COUNTY	480101	0350
LAGUNA VISTA, TOWN OF	485483	0350
PORT ISABEL, CITY OF	480109	0350

NOTE:

THIS MAP INCLUDES BOUNDARIES OF THE ... BARRIER RESOURCES SYSTEM ESTABLISHED ... COASTAL BARRIER RESOURCES ACT OF 1... SUBSEQUENT YEARS. SEE EXPLANATION ...

Notice to Users: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the community.

MAP NUM...
48061C0...

EFFECTIVE D...
FEBRUARY 16, ...

Federal Emergency Management ...

Notice: This map was reissued on July 20, 2018 to make a correction. This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

APPENDIX G

LMPRM Easements Map

(Document is pending completion of site surveys)

SUPPORTING DOCUMENTATION

COASTAL ENGINEERING CONSULTANTS INC.

Coastal and Marine Engineering
Environmental and Geological Services
Land and Marine Survey and Mapping
Website: www.coastalengineering.com

MEMORANDUM

TO: **Stephanie Freed**

COPY: **M. Conn, S. Dartez, B. Borne, V. Alymov**

FROM: **Michael Poff**

DATE: **October 11, 2021**

SUBJECT: **Hydrologic Modeling of Laguna Madre Wetland Mitigation Bank**

CEC FILE NO. **20.901**

1 Introduction

Coastal Engineering Consultants (CEC) was tasked to perform hydrologic modeling to assist in the design of the tidal creeks within the Project area in Cameron County, Texas (Figure 1) to promote intertidal flushing and healthy habitat sustainability by utilizing the U.S. Army Corps of Engineers' (USACE) ADvanced CIRCulation (ADCIRC) model for oceanic, coastal and estuarine waters. The model input data included existing topographic and bathymetric data, tide gauge data within the Project vicinity, and the Project design survey data. The model was run for the existing and design conditions.

2 Model Setup and Verification

2.1 Model Description

ADCIRC is a hydrodynamic model for solving time dependent free surface circulation and transport problems in two and three dimensions (Luettich et al., 1992). The model utilizes the finite element method in space allowing the use of highly flexible, unstructured grids. The model is capable of modeling tides and wind driven circulation, analyzing hurricane storm surge and inundation and has been applied in dredging feasibility and material disposal studies. ADCIRC version 50.99.13 as part of the Surface-water Modeling System (SMS) 11.2 computer program was used in this Study.

2.2 Model Grid Designs

CEC implemented a modeling approach with two model domains. The first larger domain included Gulf of Mexico, Brazos Santiago Pass, Laguna Madre and Brownsville Ship Channel. The grid generated for this domain is presented in Figure 2 and only includes water cells. The large grid was used to simulate tide propagation from the Gulf into Laguna Madre through the pass. An output station was created in the lagoon near the Project area which was used as a boundary

condition for the smaller domain that covered the area. The grid generated over the smaller Project area domain is presented in Figure 3. It included both water and ground cells. The two-domain approach was applied to save on computational time to run the model. The larger domain grid had larger grid spacing, which ranged from 45 feet near the Project area to over 6500 feet along the open boundary in the Gulf, while the smaller grid had smaller grid spacing ranging from 18 feet within the proposed tidal flat areas to 150 feet in the lagoon.

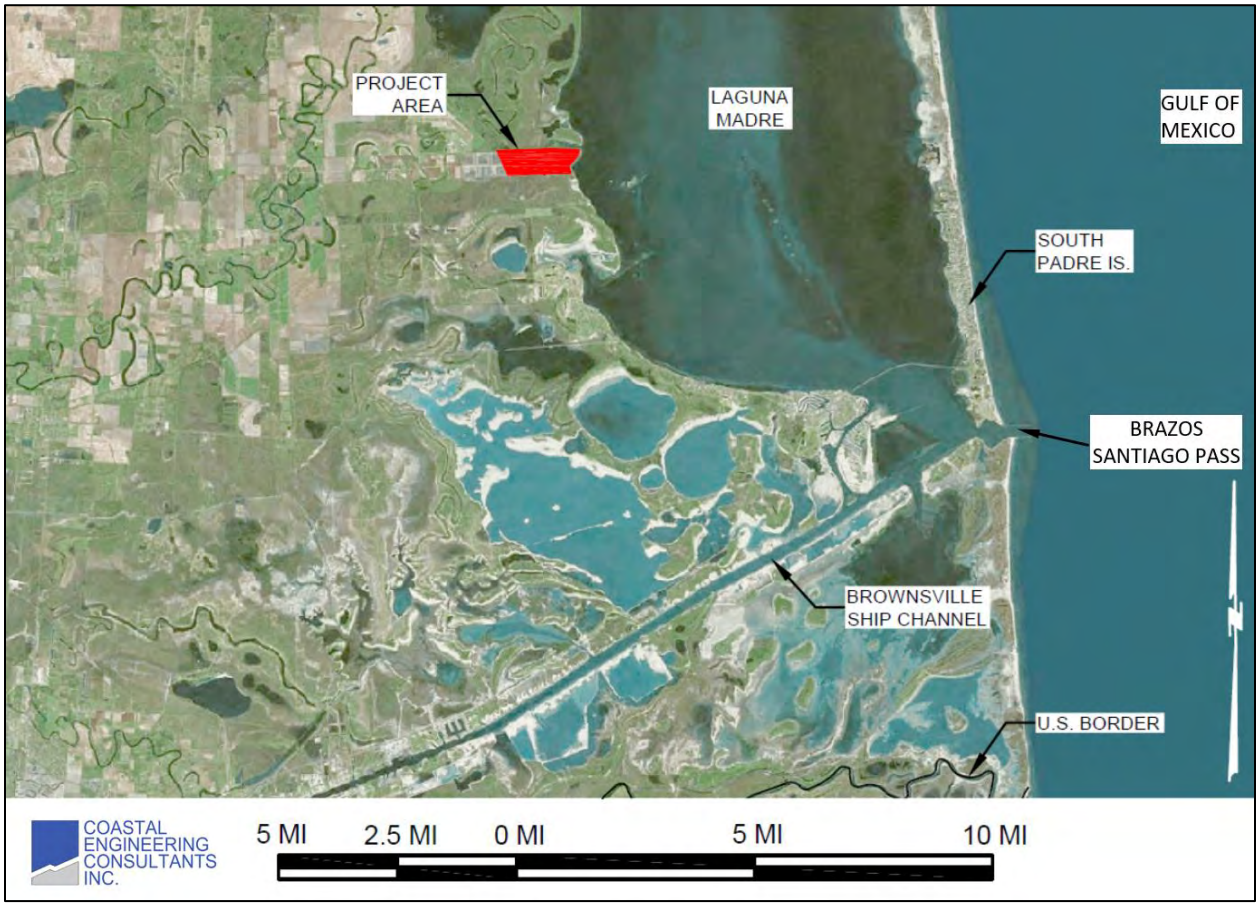


Figure 1. Project Location Map, Cameron County, TX.

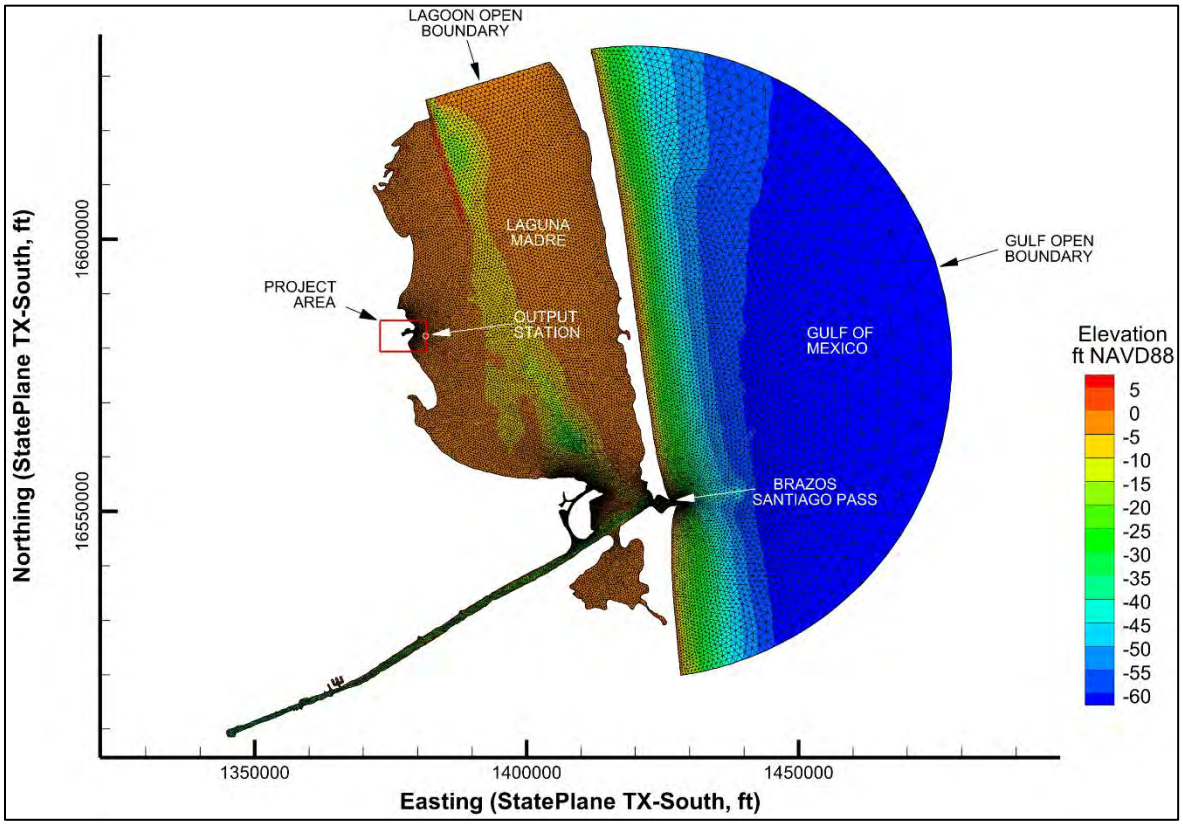


Figure 2. Larger Domain Grid.

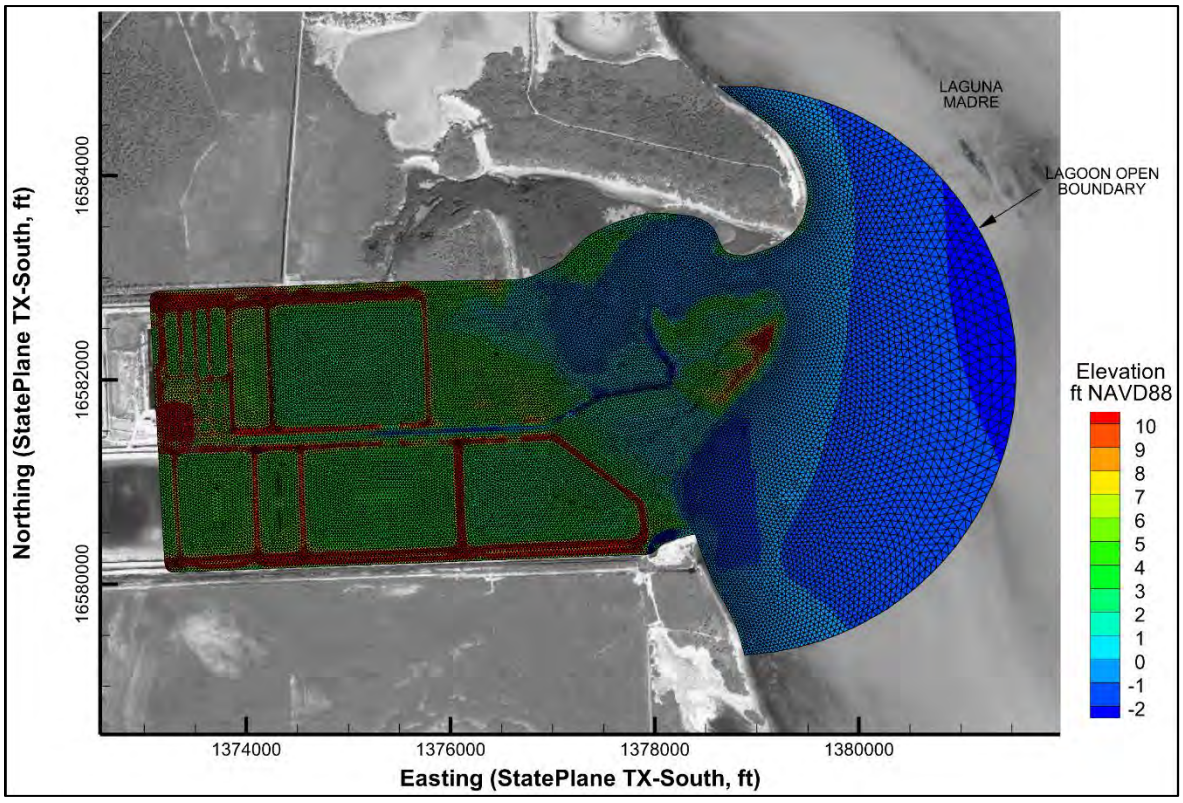


Figure 3. Project Area Grid: Existing Conditions.

2.3 Model Grid Topography and Bathymetry

The larger domain elevations referenced to North American Datum of 1988 (NAVD88) were based on the digital nautical chart bathymetric data for Laguna Madre and Gulf of Mexico. The smaller domain elevations referenced to NAVD88 for existing conditions at Project site were based on the design survey conducted by EMC in May 2021 (EMC, 2021) combined with seagrass survey conducted by Belaire Environmental in October 2020 (Belaire Environmental, 2020), 2018 LiDAR survey, and digital nautical chart bathymetric data for Laguna Madre. The seagrass survey and the 2018 LiDAR data were collected using the Virtual Reference Station (VRS) technique for horizontal and vertical control. VRS determines the positional correction factor utilizing the National Oceanic and Atmospheric Administration (NOAA) Continuously Operating Reference Stations Network (CORS). During the 2021 survey, EMC submitted the base station observation data referenced to the National Geodetic Survey (NGS) survey monument AB4188 near the Project site to the NGS Online Positioning User Service (OPUS) for validation. The OPUS calculations use the same CORS stations as VRS to perform the assessment. OPUS returned that a solution could not be accurately determined for the Project site due to the irregular triangulation of the CORS. It was decided through professional judgment that the published NGS survey monument AB4188 values would be used to horizontal and positional control for the Project. The CORS reported elevation for the survey monument AB4188 was 0.28 ft higher than the published elevation on monument datasheets. Therefore, the 2020 seagrass and 2018 LiDAR surveys were adjusted by -0.28 ft.

2.4 Water Level Data

The water level data used in the model were obtained from the NOAA data portal for tides and currents (https://tidesandcurrents.noaa.gov/map/). Three tide stations presented in Figure 4 were available within the larger model domain: Brazos Santiago, Port Isabel and Realitos Peninsula.

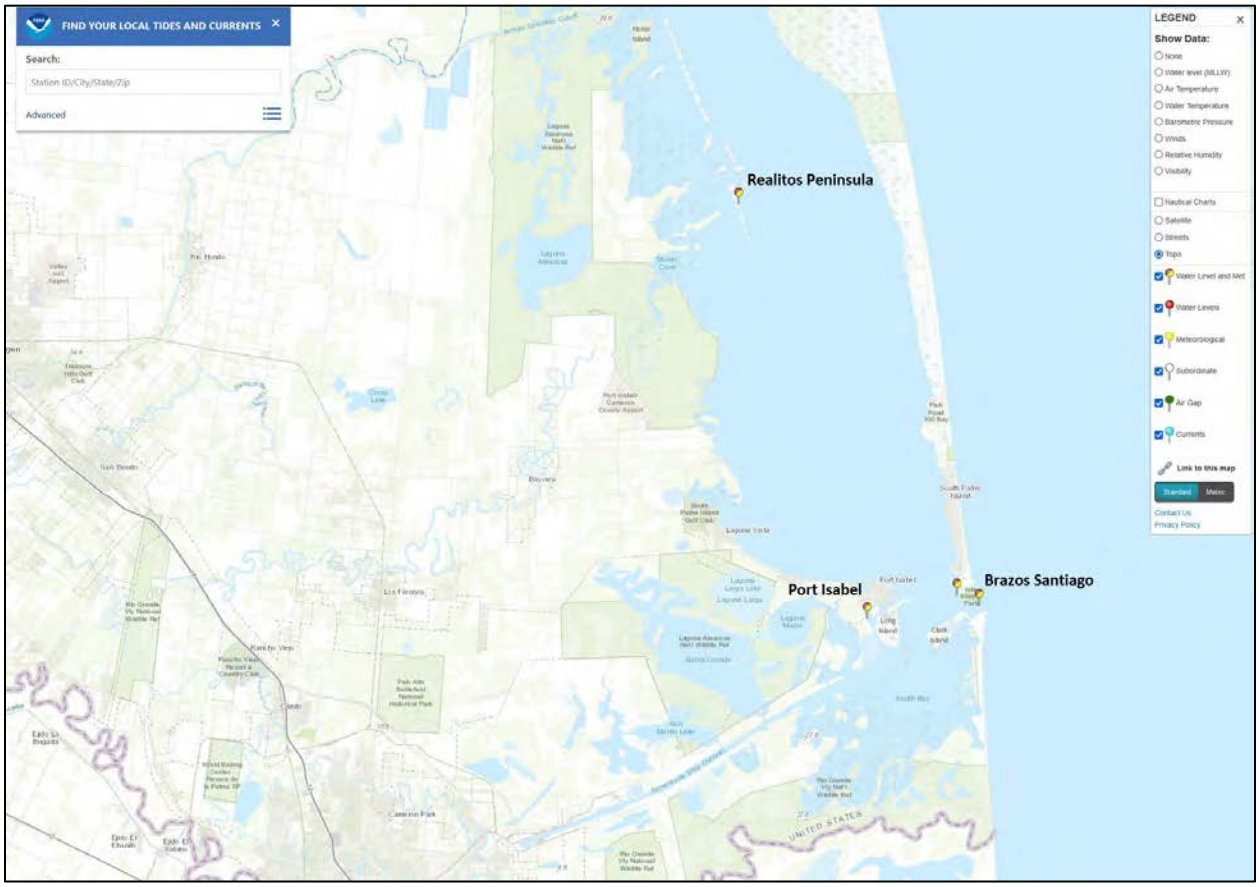


Figure 4. Tide Station Location Map (source https://tidesandcurrents.noaa.gov/map/).

An eighteen-month long tidal record at Brazos Santiago Inlet station spanning from January 1, 2020 through June 30, 2021 presented in Figure 5 was analyzed to identify three 30-day periods representative of 1) low tide "winter" period, January 1-30, 2021, when the tide ranged between -2.0 and +0.9 feet NAVD88, 2) high tide "summer" period, May 1-30, 2021, when the tide ranged between -1.5 and +2.2 feet NAVD88, and 3) "storm" period, September 1-30, 2020, when the tide ranged between –0.8 and +2.7 feet NAVD88.

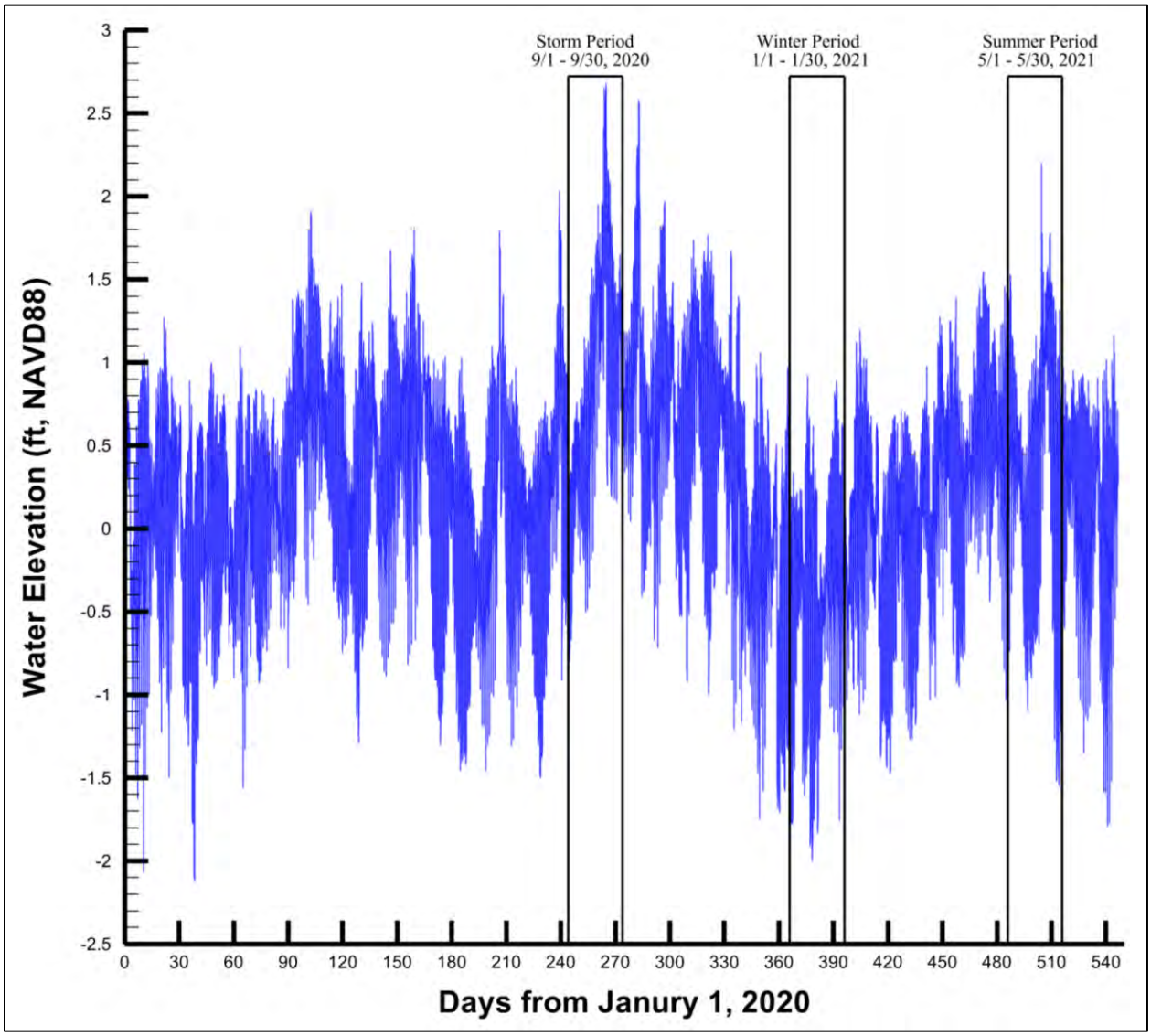


Figure 5. Water Level Record at NOAA's Brazos Santiago Tide Station with Three Representative Periods for Modeling.

2.5 Model Verification

The larger domain grid was used for a model verification run to compare modeled water elevations to measured water elevations. The 30-day storm period, September 1-30, 2020, was chosen for the run with the Brazos Santiago tidal record being used as the boundary condition at the model's open boundary in the Gulf and the Realitos Peninsula tidal record being used as the boundary condition at the model's open boundary in the lagoon. The general model parameters are presented in Figure 6. The model time step was 0.3 seconds.

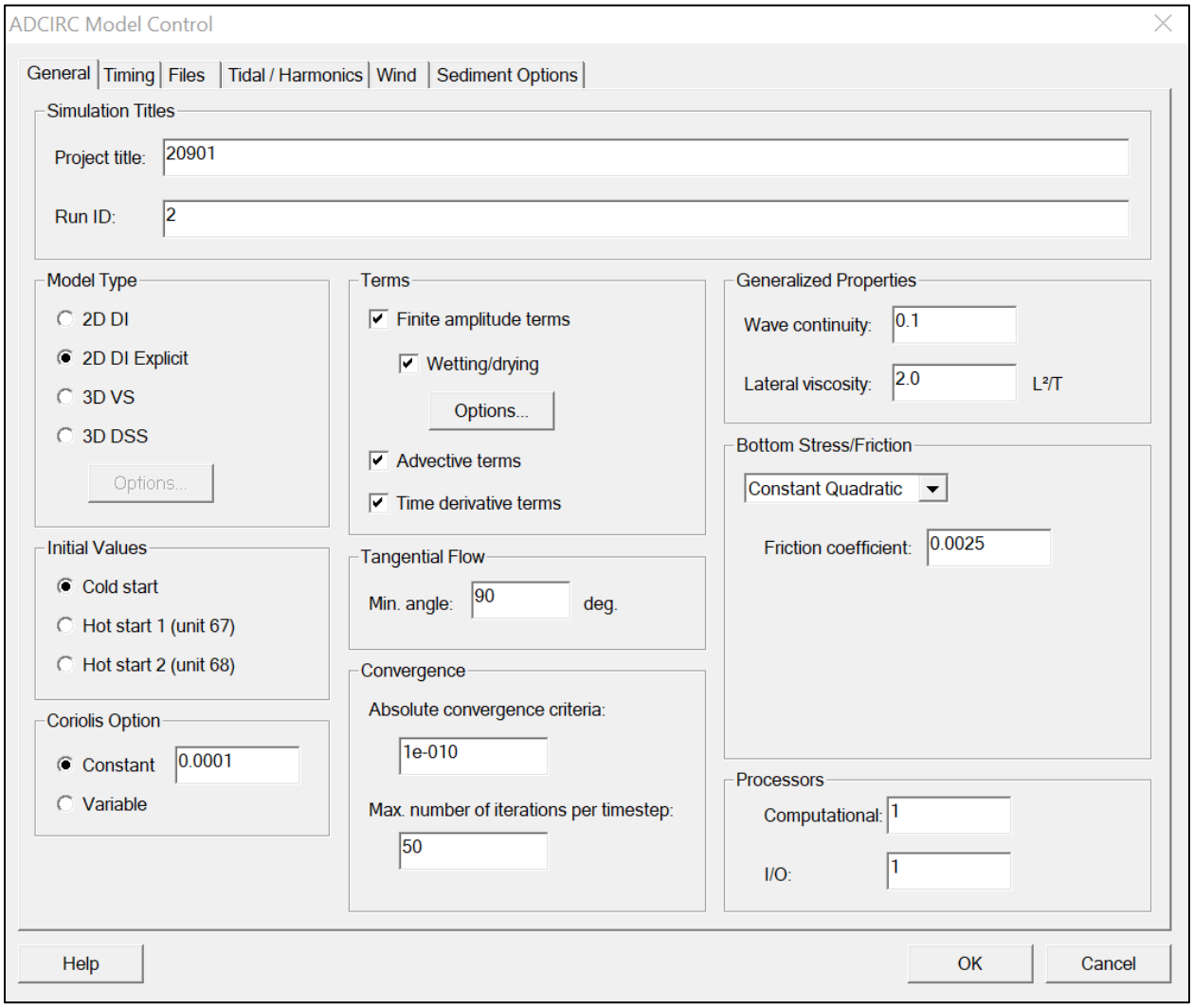


Figure 6. ADCIRC Model General Parameters.

During the run, a model output file was created with water elevations at three locations corresponding to the NOAA Tide Station locations at Brazos Santiago Pass, Port Isabel and Realitos Peninsula (Figure 4). The output was created for the entire duration of the 30-day simulation at 10-minute intervals. Figures 7 through 9 present comparisons of measured versus simulated water levels at the three locations. A good agreement was observed between the Brazos Santiago Pass and Realitos Peninsula locations. At Port Isabel, the modeled high tide peaks were approximately 0.4 feet lower competed to measured while the modeled low tide troughs were approximately 0.2 feet lower. This may be a result of inaccurate or outdated bathymetric data in the vicinity of Port Isabel or the fact that the station is located in a narrow channel and the cell spacing of the larger domain grid was too coarse in this location for accurate computation of the flow through the channel.

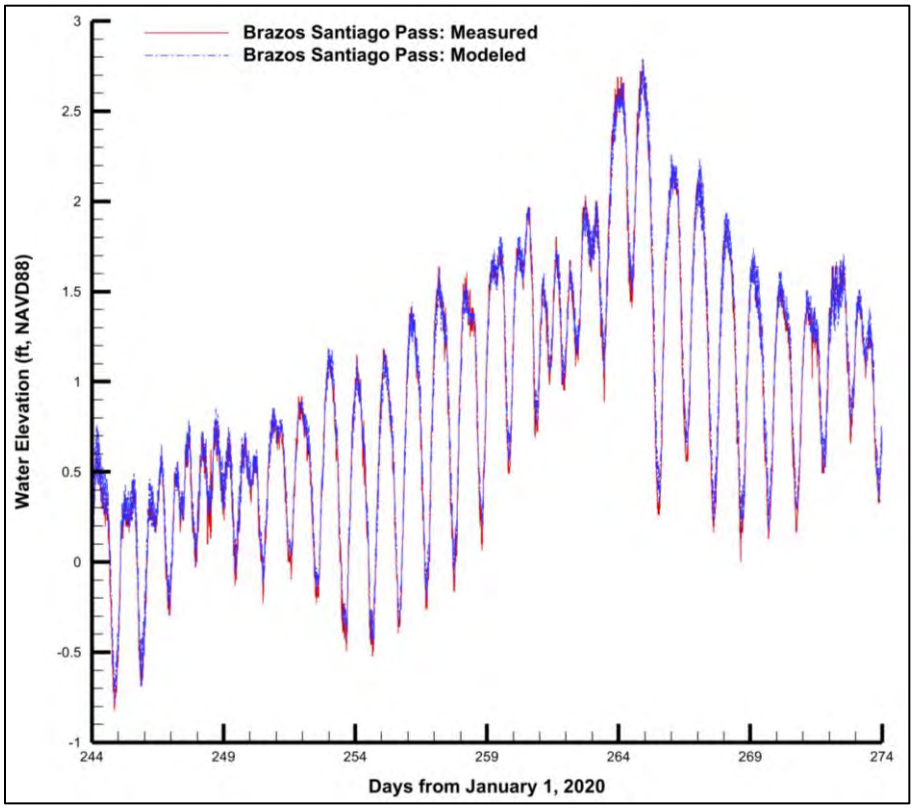


Figure 7. Modeled vs. Measured Water Elevation at Brazos Santiago Pass, September 1 – 30, 2020.

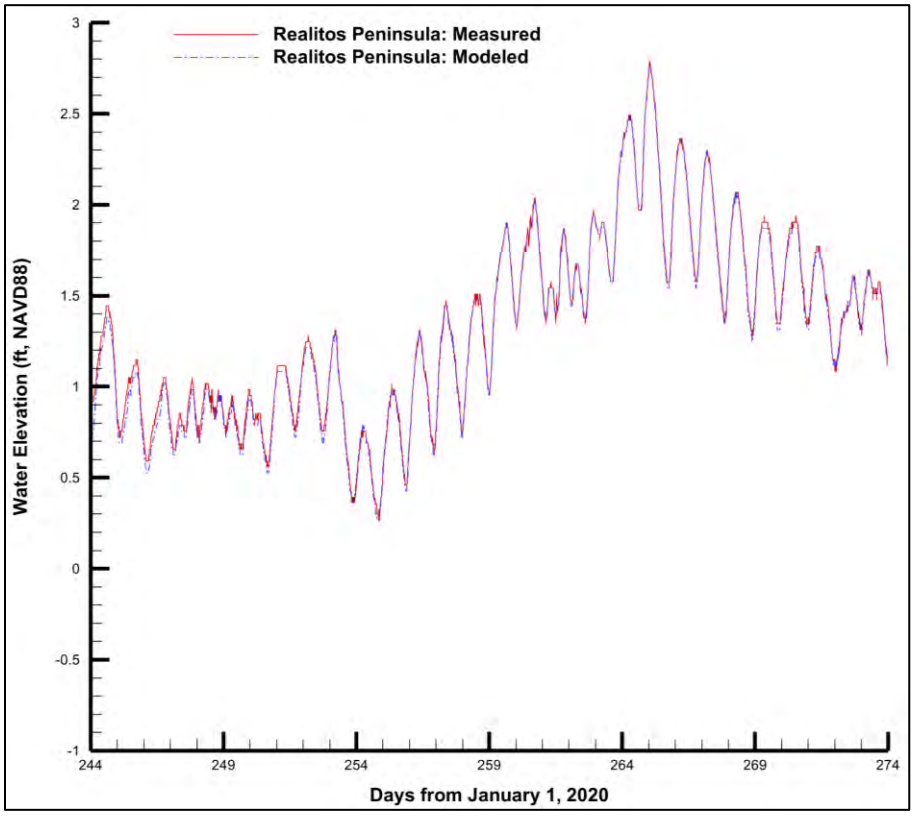


Figure 8. Modeled vs. Measured Water Elevation at Realitos Peninsula, September 1 – 30, 2020.

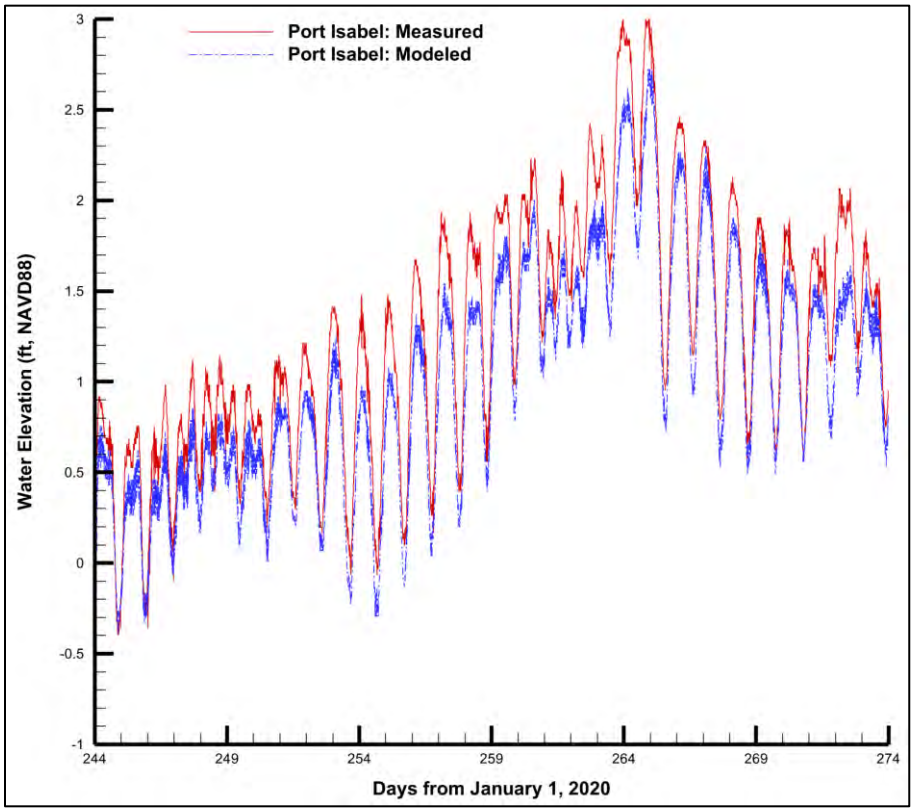


Figure 9. Modeled vs. Measured Water Elevation at Port Isabel, September 1 – 30, 2020.

3 Model Simulations: Existing Conditions

3.1 Description

Three 30-day simulations of the larger domain grid were performed for the winter, summer and storm periods. During each simulation, an output file was created with modeled water levels at the output station in Laguna Madre (Figure 2). This output was used to force the smaller domain grid simulations of the Project area. As a result, three 30-day simulations of the smaller domain grid were performed for the winter, summer and storm periods as well. The smaller domain grid had ten output stations: one along the open boundary, one over the existing tidal mud flat, two within the proposed tidal mud flat north of the existing tributary channel and six within the proposed tidal mud flat south of the channel. These output stations are presented in Figure 10. The existing tidal mud flat location has an elevation of approximately +0.6 feet NAVD88.

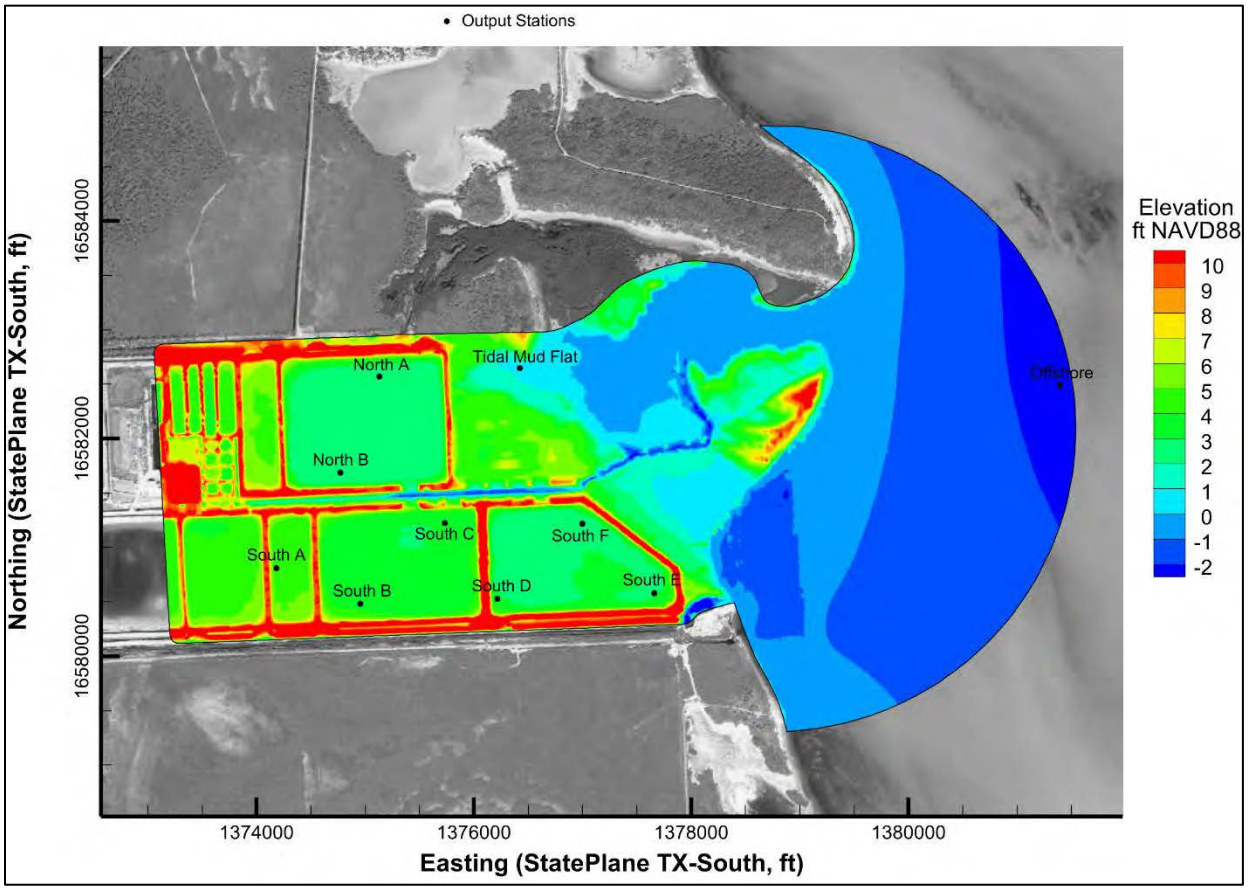


Figure 10. Project Area Grid with Output Station Locations: Existing Conditions.

3.2 Winter Period, January 1 – 30, 2021

Figure 11 presents a snapshot of water elevations over the Project area existing conditions at high tide during the January 1-30, 2021 period. The existing tidal mud flat was inundated with a water elevation of approximately +0.9 feet NAVD88.

The continuous time series of modeled water elevations at the existing tidal mud flat output station location over the entire 30-day simulation at 10-minute intervals is presented in Figure 12. The tidal mud flat was dry almost the entire duration of the simulation with the exception of one occurrence when the water elevations ranged between +0.8 and +1.1 feet NAVD88.

The time series was analyzed to compute how frequently the existing tidal mud flat was inundated versus dry. During the January 1-30, 2021 simulation period, inundation occurred 1.4% of the time.

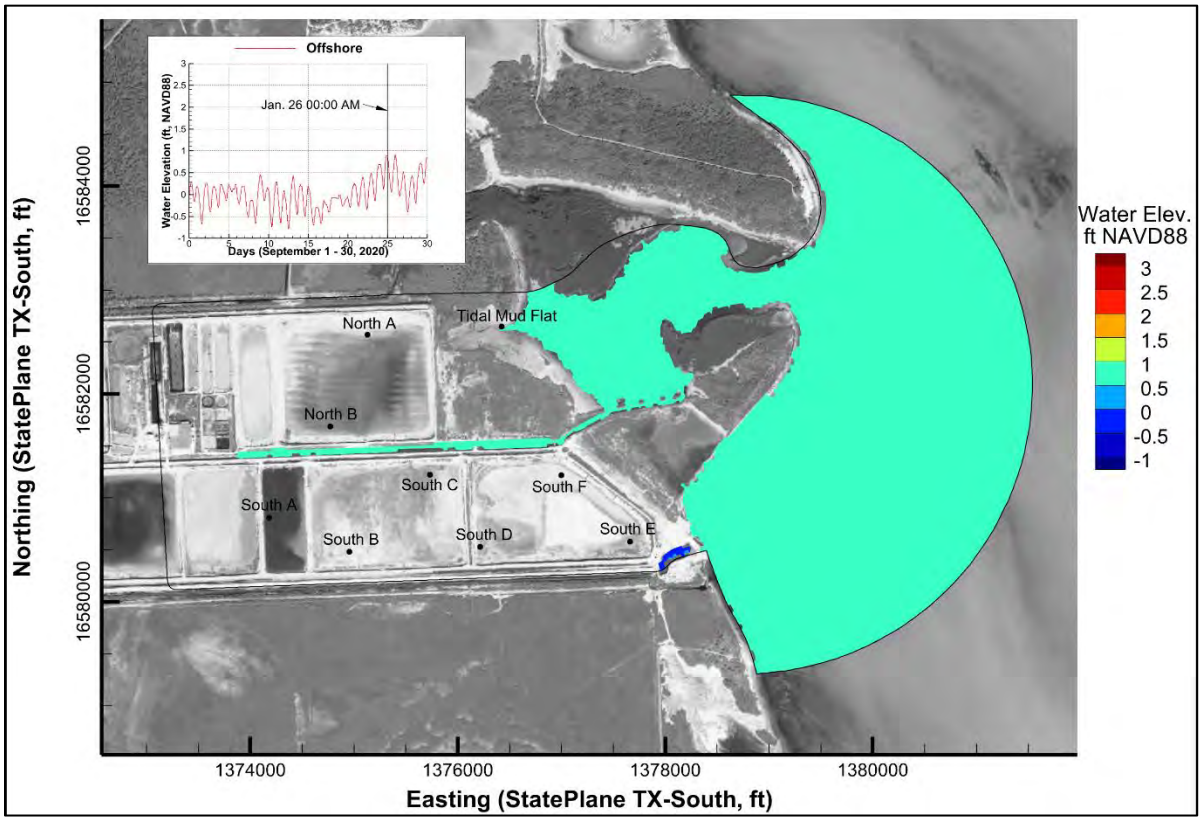


Figure 11. Existing Conditions: Modeled Water Elevation January 26, 2021 00:00 AM.

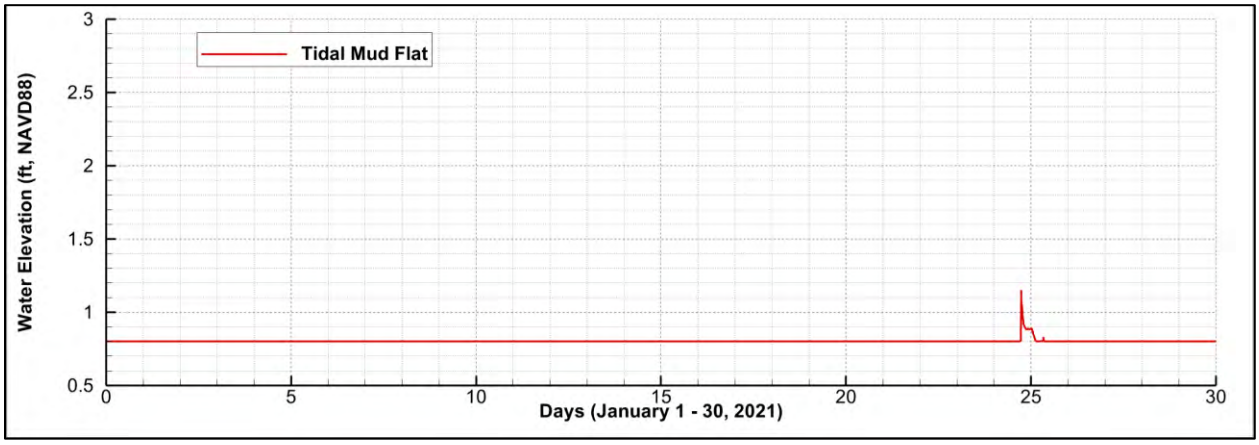


Figure 12. Existing Conditions: Modeled Water Elevations January 1-30, 2021.

3.3 Summer Period, May 1 – 30, 2021

Figure 13 presents a snapshot of water elevations over the Project area existing conditions at high tide during the May 1 – 30, 2021 period. The existing tidal mud was inundated with a water elevation of approximately +1.7 feet NAVD88.

The continuous time series of modeled water elevations at the existing tidal mud flat output station location over the entire 30-day simulation at 10-minute intervals is presented in Figure 14. The tidal

mud flat was frequently inundated during the simulation period with water elevations ranging between +0.8 and +1.9 feet NAVD88.

The time series was analyzed to compute how frequently the existing tidal mud flat was inundated versus dry. During the May 1 – 30, 2021 simulation period, inundation occurred 50.9% of the time.

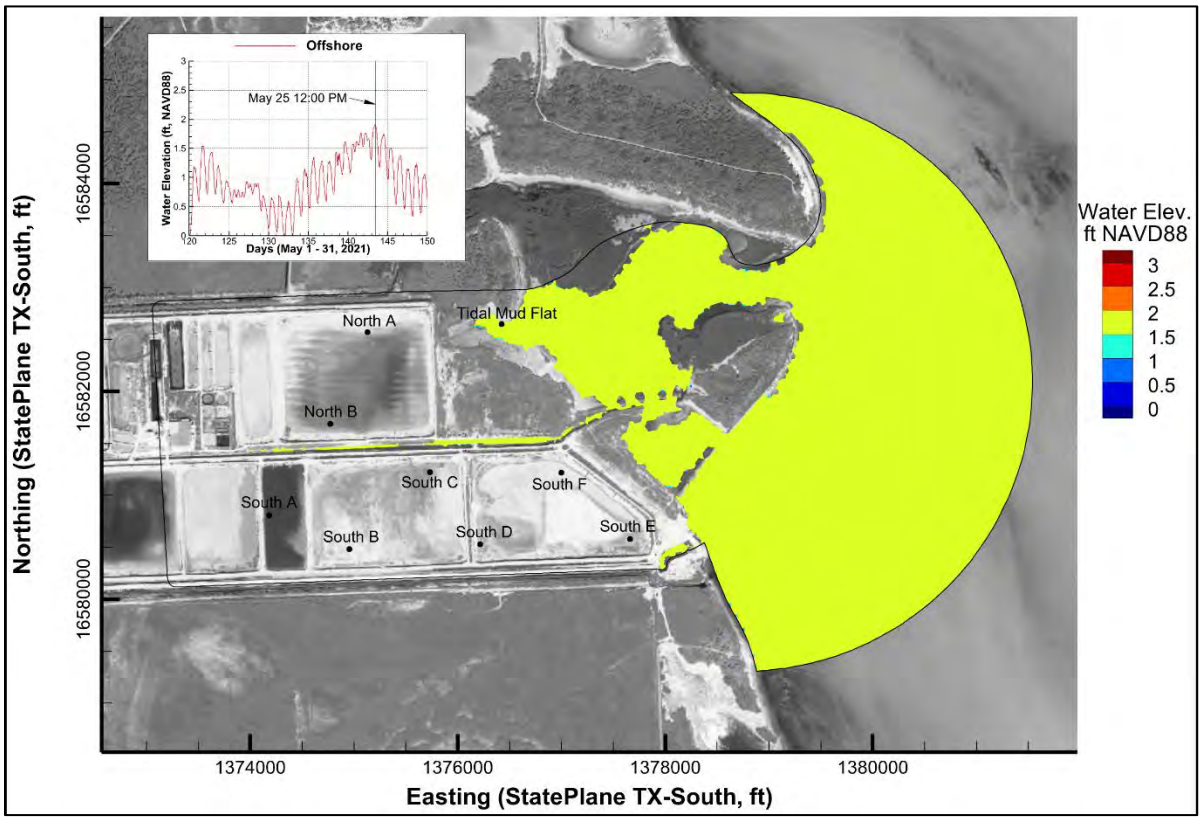


Figure 13. Existing Conditions: Modeled Water Elevation May 25, 2021 12:00 PM.

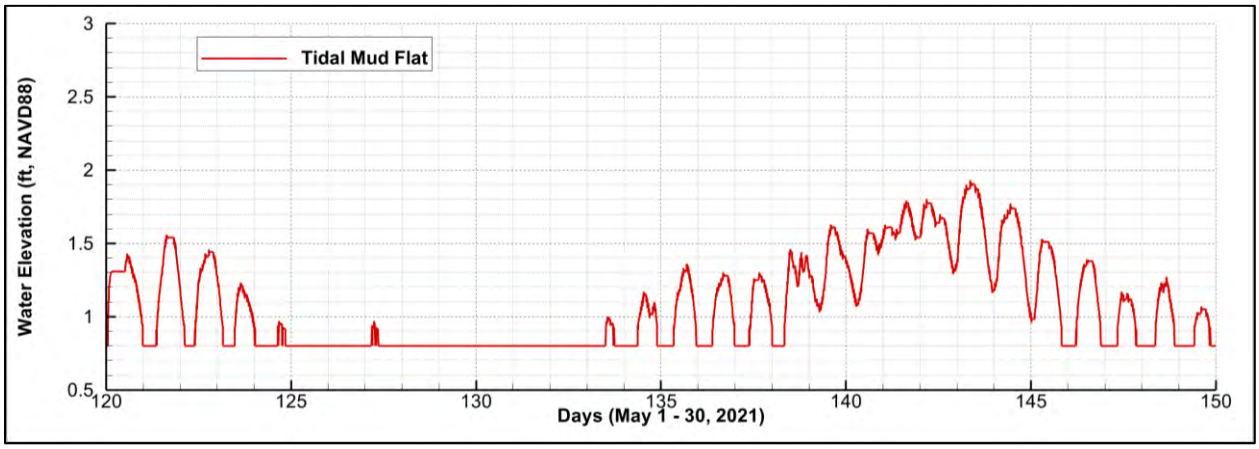


Figure 14. Existing Conditions: Modeled Water Elevations May 1-30, 2021.

3.4 Storm Period, September 1 – 30, 2020

Figure 15 presents a snapshot of water elevations over the Project area existing conditions at high tide during the September 1 – 30, 2020 period. The existing tidal mud flat was inundated with a water elevation of approximately +2.7 feet NAVD88.

The continuous time series of modeled water elevations at the existing tidal mud flat output station location over the entire 30-day simulation at 10-minute intervals is presented in Figure 16. The tidal mud flat was mostly inundated during the simulation period with water elevations ranging between +0.8 and +2.7 feet NAVD88.

The time series was analyzed to compute how frequently the existing tidal mud flat was inundated versus dry. During the September 1 – 30, 2020 simulation period, inundation occurred 65.7% of the time.

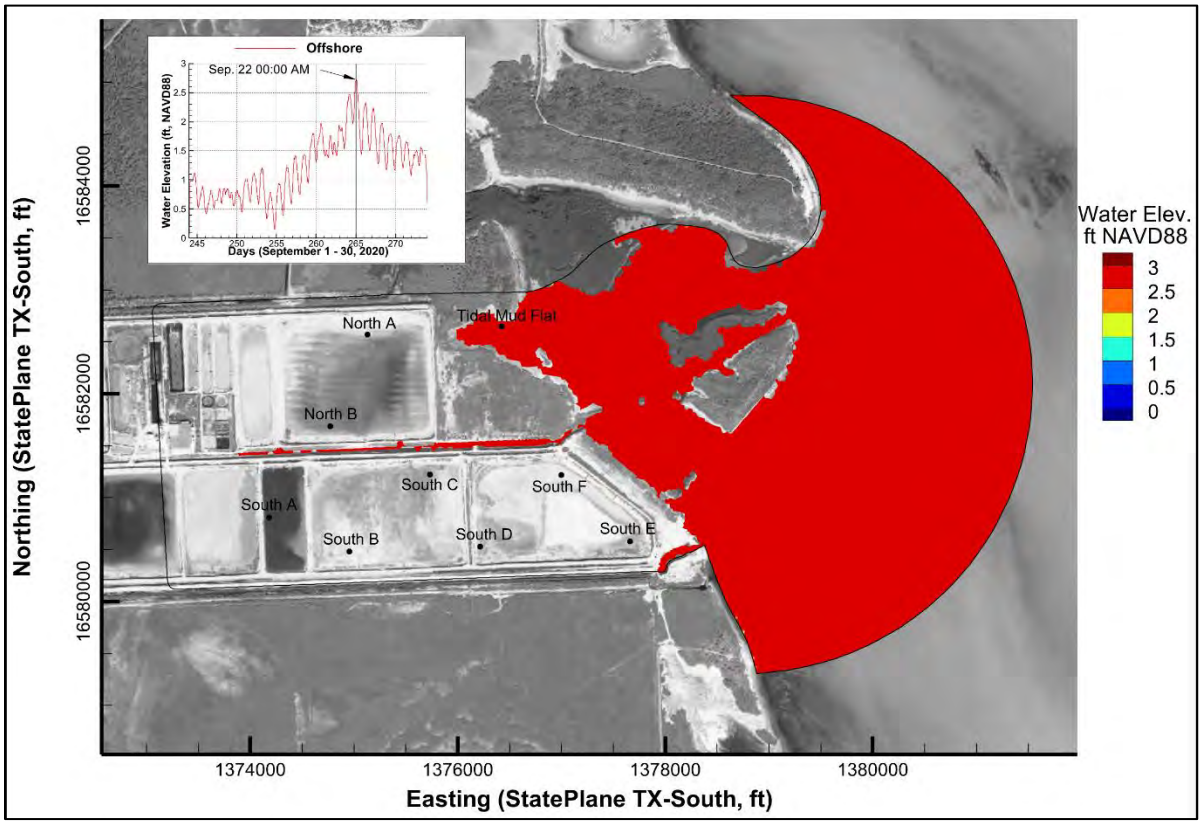


Figure 15. Existing Conditions: Modeled Water Elevation September 22, 2020 00:00 AM.

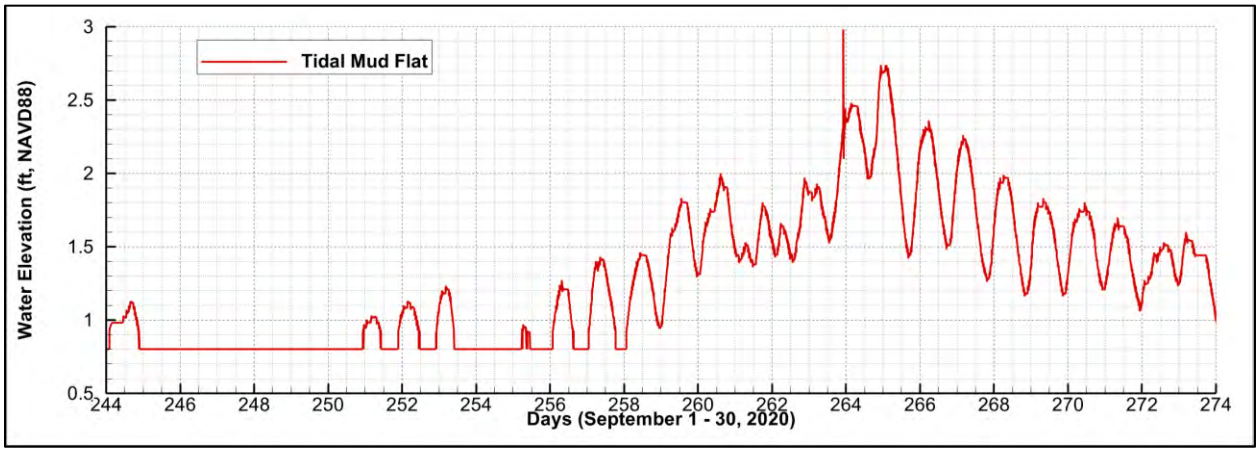


Figure 16. Existing Conditions: Modeled Water Elevations September 1-30, 2020.

4 Model Simulations: Project Design Conditions

4.1 Description

The smaller domain Project area grid was modified to incorporate Project area design conditions which included grading the proposed tidal flat creation areas to +0.6 feet NAVD88 and building 25-foot wide tributary channels cut to -2.5 feet NAVD88 to propagate tide from Laguna Madre to the tidal flat creation areas. To accurately resolve the 25-foot channels, the smaller domain grid was refined within the channels reducing the minimum spacing from 18 feet in the original existing conditions grid to 3 feet in the Project design conditions grid. The grid is presented in Figure 11. Figure 12 presents the grid with ten output stations in the exact same locations created for the existing conditions grid.

Three 30-day simulations were performed for the winter, summer and storm periods. The results of these simulations were compared to the corresponding simulations of the existing conditions.

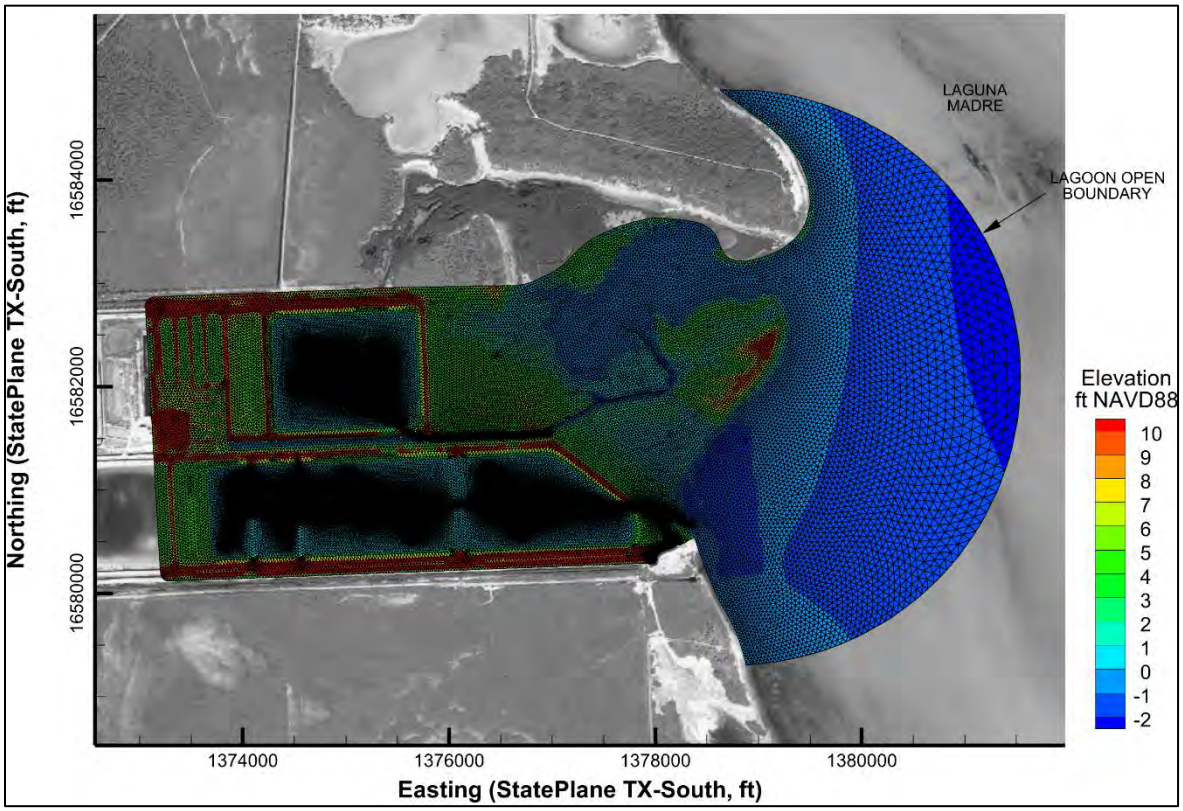


Figure 17. Project Area Grid: Project Design Conditions.

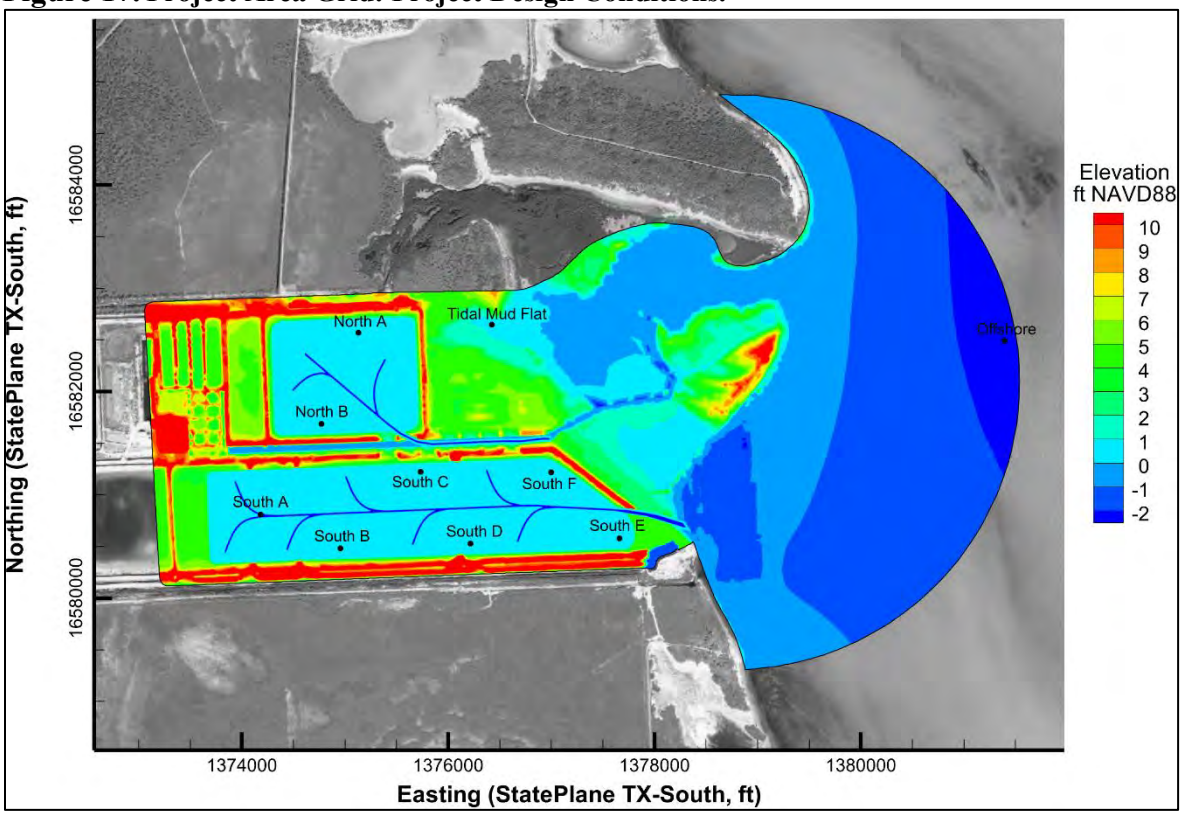


Figure 18. Project Area Grid with Output Station Locations: Project Design Conditions.

4.2 Winter Period, January 1-30, 2021

Figures 19 and 20 present snapshots of water elevations over the Project area design conditions at low and high tide during the January 1-30, 2021 period, respectively. During the low tide occurrence, the tidal flat creation areas were dry as well as the location of the existing tidal flat. During the high tide occurrence, both the existing tidal mud flat and the tidal flat creation areas were inundated with a water elevation of approximately +0.9 feet NAVD88.

The continuous time series of modeled water elevations over the entire 30-day simulation at 10-minute intervals are presented in Figure 21. It illustrates that the water elevations at all output locations within the tidal flat creation areas were similar to those of the existing tidal mud flat location. The tidal flats were dry almost the entire duration of the simulation with the exception of one occurrence when the water elevations ranged between +0.8 and +1.1 feet NAVD88. It should be noted that the ADCIRC model had a wetting/drying parameter which regulates when a computation cell goes wet from being dry and vise versa. By default, the parameter was set to 0.05 meters which was equivalent to 0.2 feet. This implies that even though the existing tidal mud flat and Project design tidal flat creation areas were at +0.6 feet NAVD88, they remained dry unless the water elevations exceeded +0.8 feet NAVD88.

The time series were analyzed to compute how frequently the tidal flat creation areas were inundated versus dry. During the January 1-30, 2021 simulation period, inundation occurred 1.3% of the time.

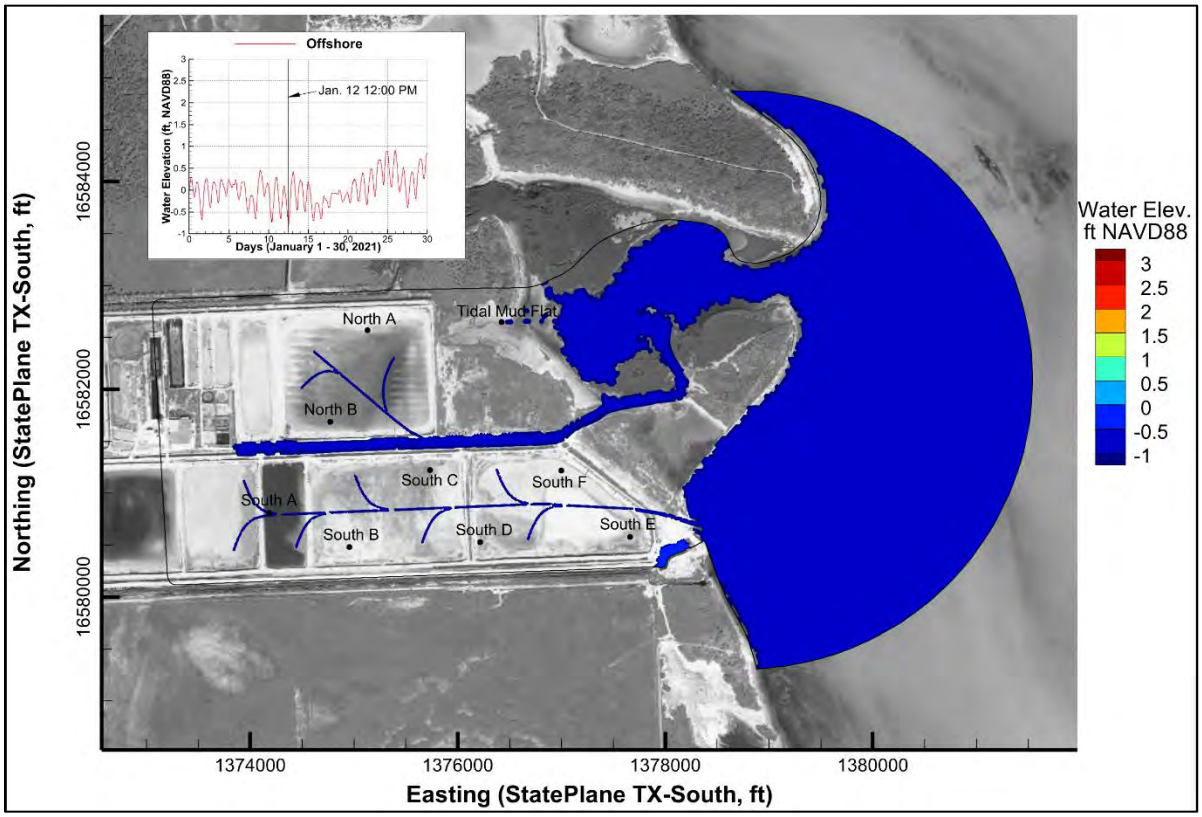


Figure 19. Project Design: Modeled Water Elevation January 12, 2021 12:00 PM.

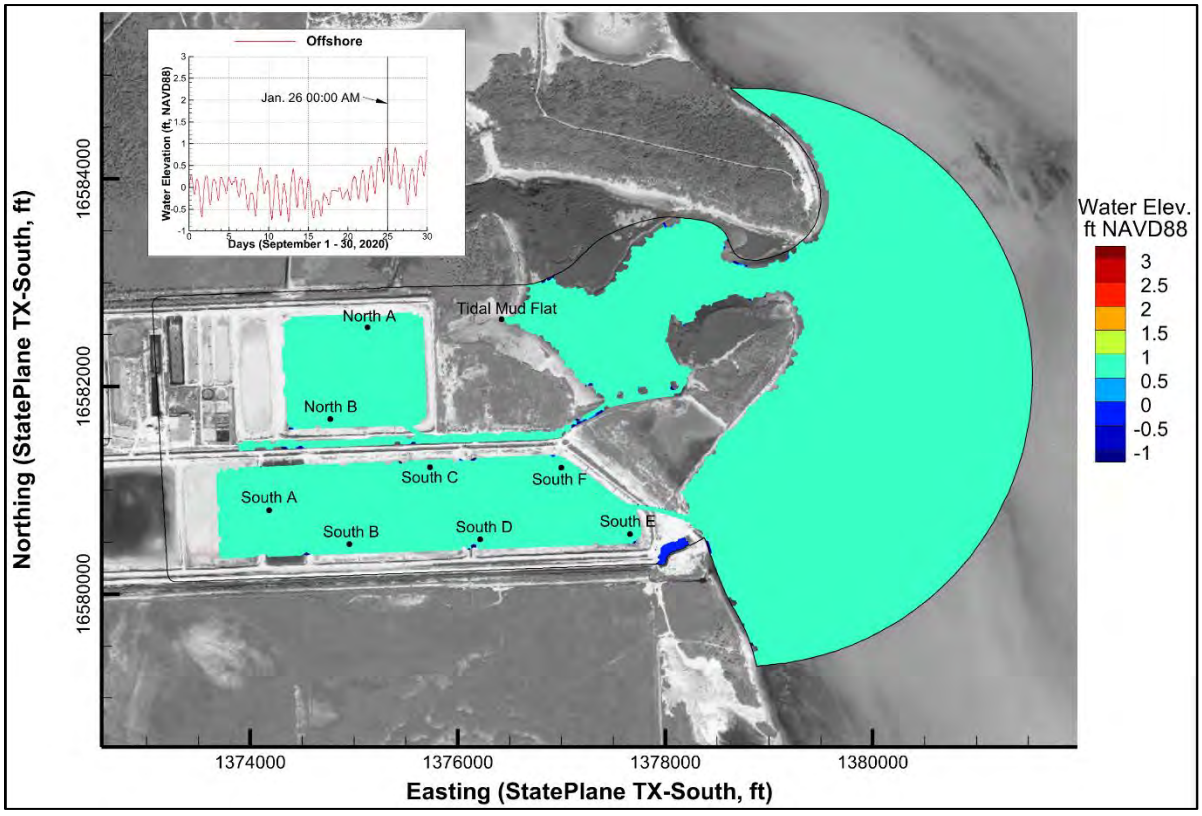


Figure 20. Project Design: Modeled Water Elevation January 26, 2021 00:00 AM.

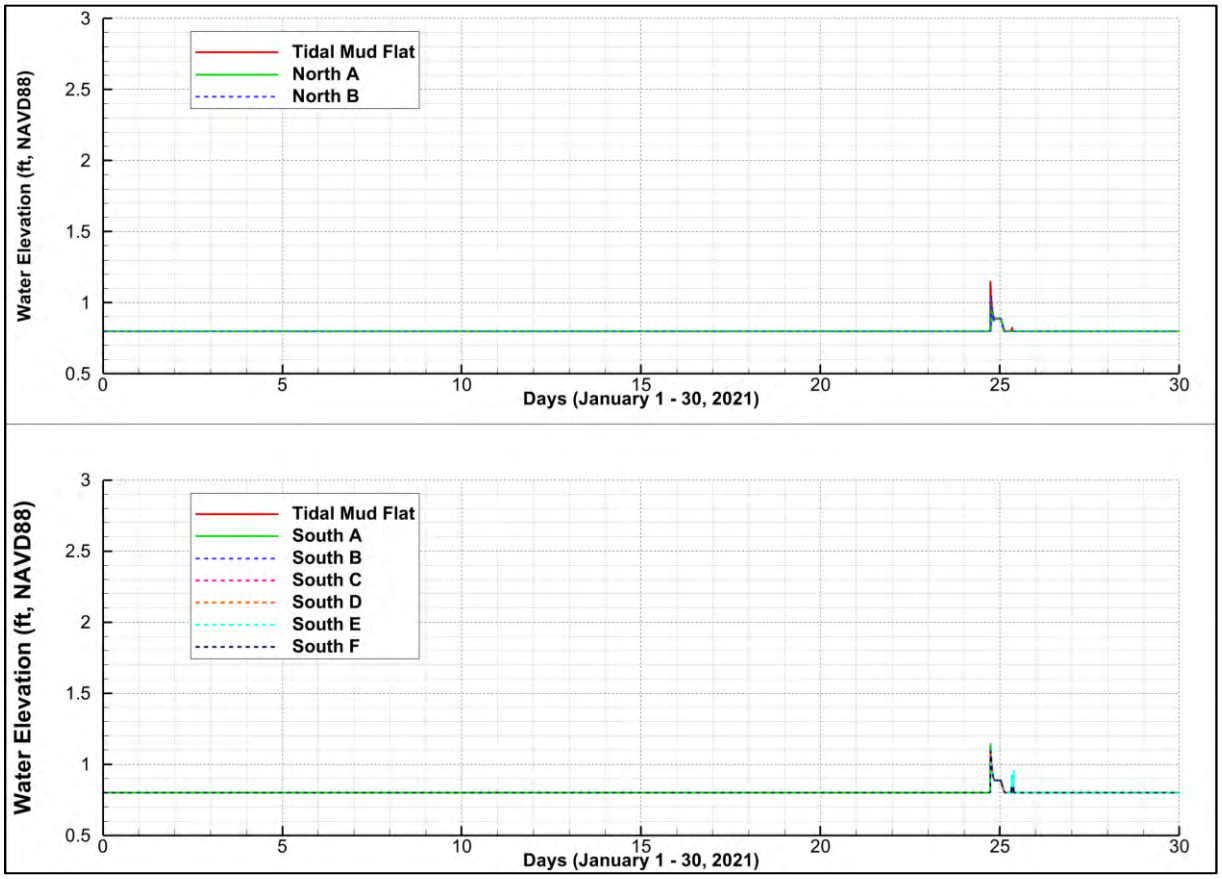


Figure 21. Project Design: Modeled Water Elevations January 1-30, 2021.

4.3 Summer Period, May 1-30, 2021

Figures 22 and 23 present snapshots of water elevations over the Project area design conditions at low and high tide during the May 1-30, 2021 period, respectively. During the low tide occurrence, the existing tidal mud flat location was dry while the majority of the tidal flat creation areas had a water elevation of +0.8 feet NAVD88. As previously noted, due to the ADCIRC wetting drying parameter of 0.2 feet, the computational cells within the tidal flat creation areas which were at +0.6 feet NAVD88 were dry unless the water elevations exceeded +0.8 feet NAVD88. Therefore, the areas that appear to be inundated in Figure 22 can technically be considered dry. During the high tide occurrence, both the existing tidal mud flat and the tidal flat creation areas were inundated with a water elevation of approximately +1.7 feet NAVD88.

Continuous time series of modeled water elevations over the entire 30-day simulation at 10-minute intervals are presented in Figure 24. The water elevations at all output locations within the tidal flat creation areas were similar to those of the existing tidal mud flat location. The tidal flats were mostly inundated during the simulation period with water elevations ranging between +0.8 and +1.9 feet NAVD88.

The time series were analyzed to compute how frequently the tidal flat creation areas were inundated versus dry. During the May 1-30, 2021 simulation period, inundation occurred 65.0% of the time.

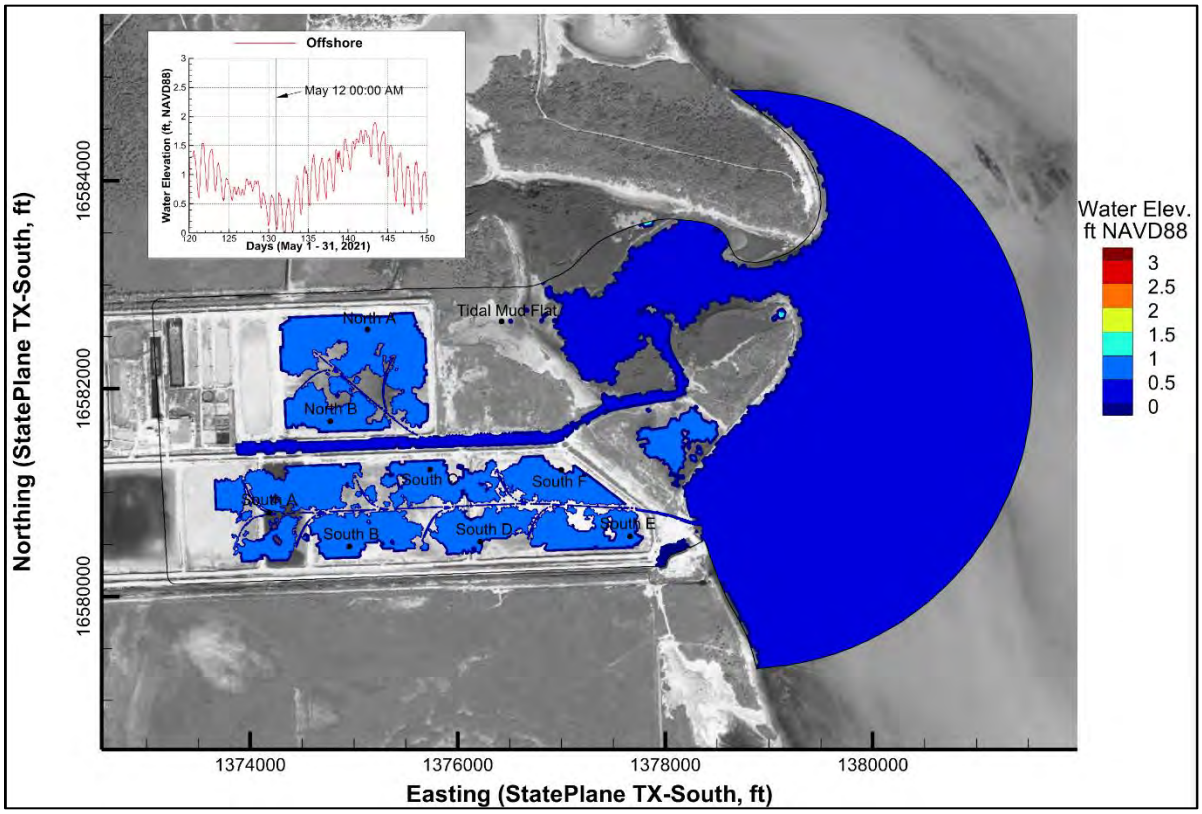


Figure 22. Project Design: Modeled Water Elevation May 12, 2021 00:00 AM.

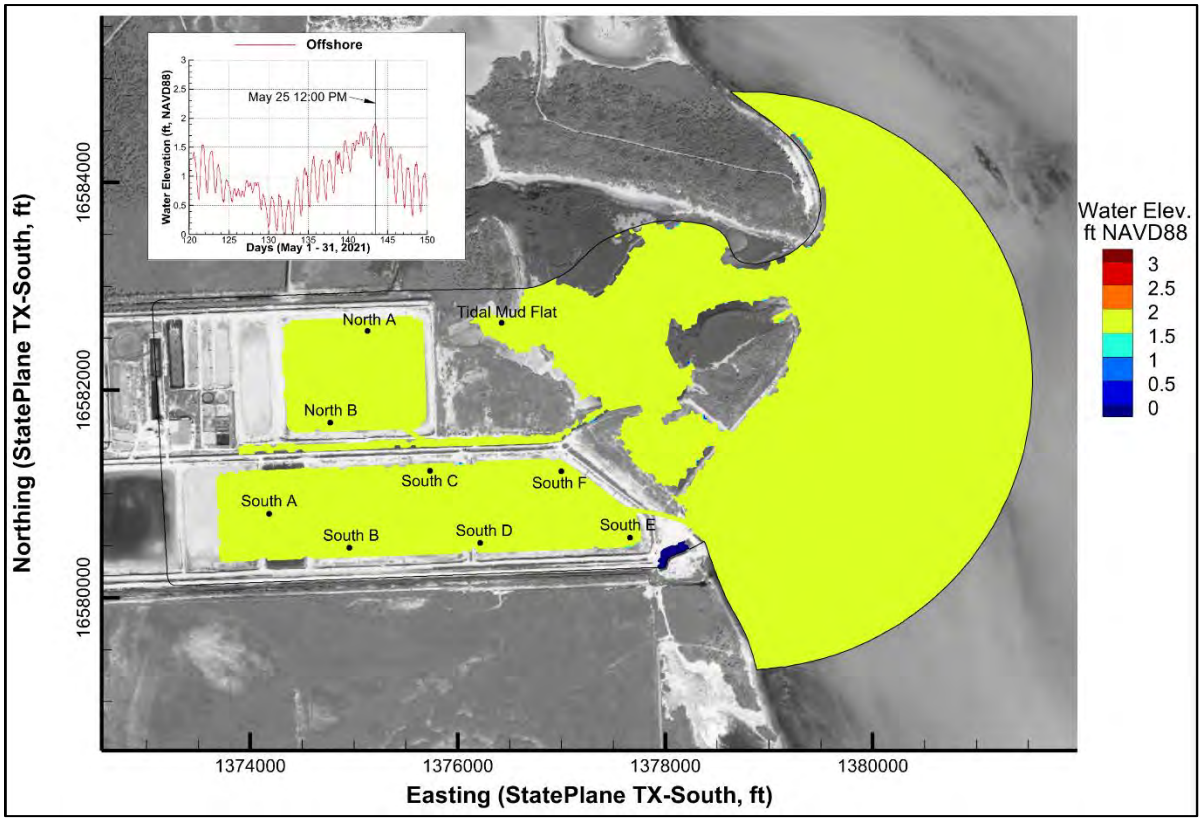


Figure 23. Project Design: Modeled Water Elevation May 25, 2021 12:00 PM.

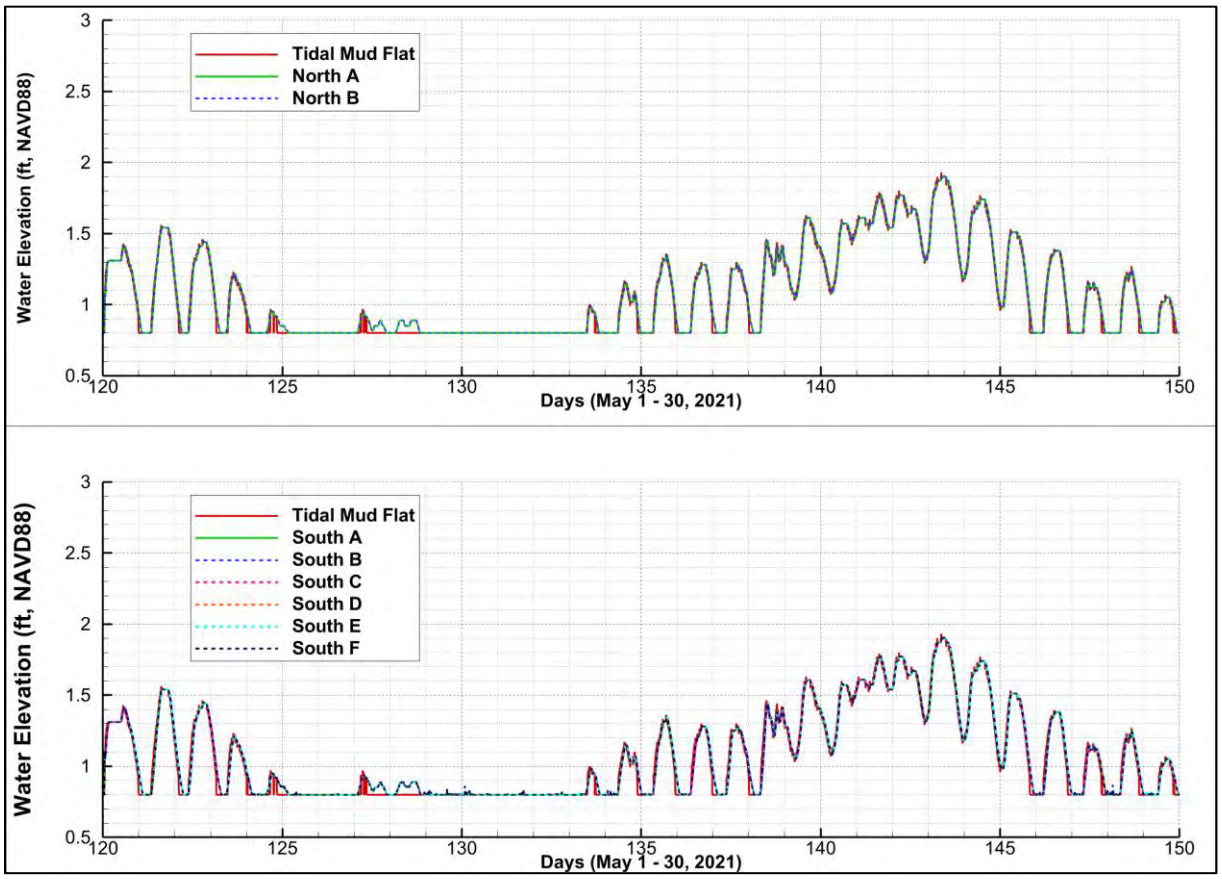


Figure 24. Project Design: Modeled Water Elevations May 1-30, 2021.

4.4 Storm Period, September 1-30, 2020

Figures 25 and 26 present snapshots of water elevations over the Project design conditions at low and high tide during the September 1-30, 2020 period, respectively. During the low tide occurrence, the existing tidal mud flat location was dry while the majority of the tidal flat creation areas had a water elevation of +0.8 feet NAVD88. As previously noted, due to the ADCIRC wetting drying parameter of 0.2 feet, the computational cells within the tidal flat creation areas which were at +0.6 feet NAVD88 were dry unless the water elevations exceeded +0.8 feet NAVD88. Therefore, the areas that appear to be inundated in Figure 25 can technically be considered dry. During the high tide occurrence, both the existing tidal mud flat and the tidal flat creation areas were inundated with a water elevation of approximately +2.7 feet NAVD88.

Continuous time series of modeled water elevations over the entire 30-day simulation at 10-minute intervals are presented in Figure 27. The water elevations at all output locations within the tidal flat creation areas were similar to those of the existing tidal mud flat location. The tidal flats were mostly inundated during the simulation period with water elevations ranging between +0.8 and +2.7 feet NAVD88.

The time series were analyzed to compute how frequently the tidal flat creation areas were inundated versus dry. During the September 1-30, 2020 simulation period, inundation occurred 75.1% of the time.

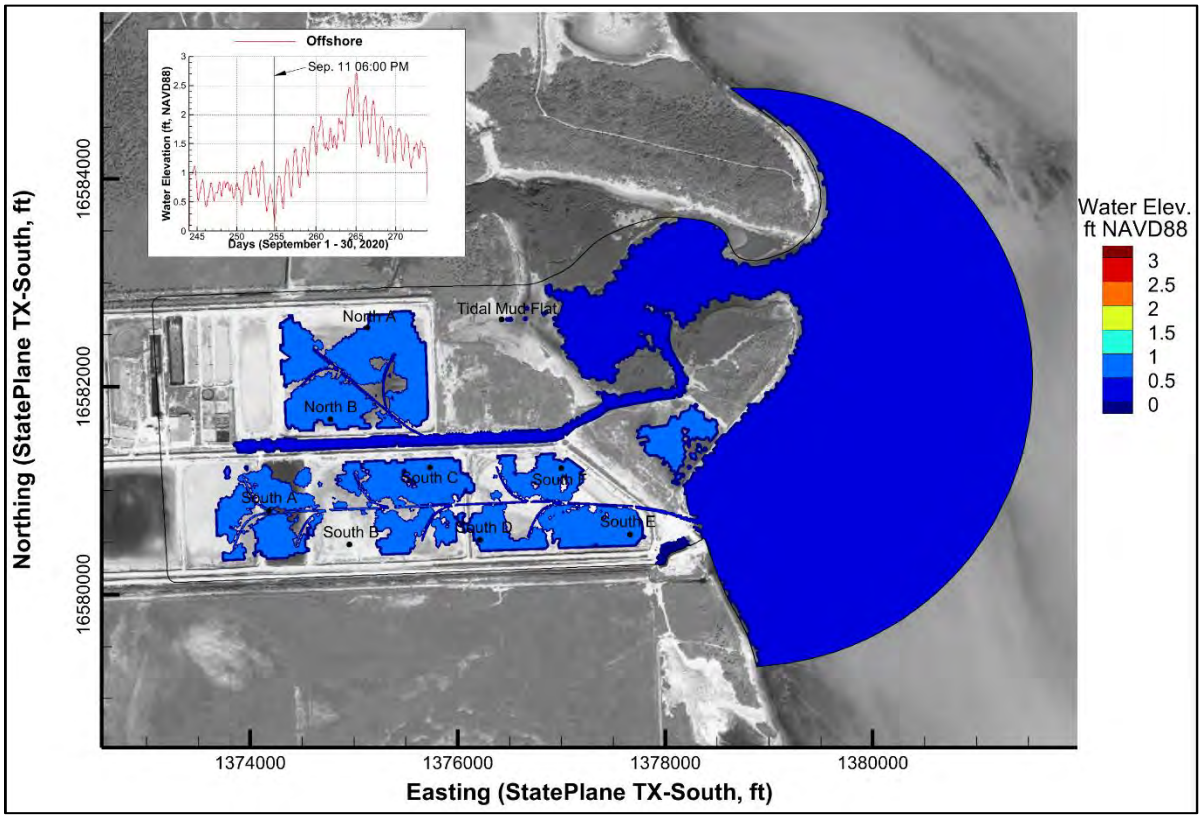


Figure 25. Project Design: Modeled Water Elevation September 11, 2020 06:00 PM.

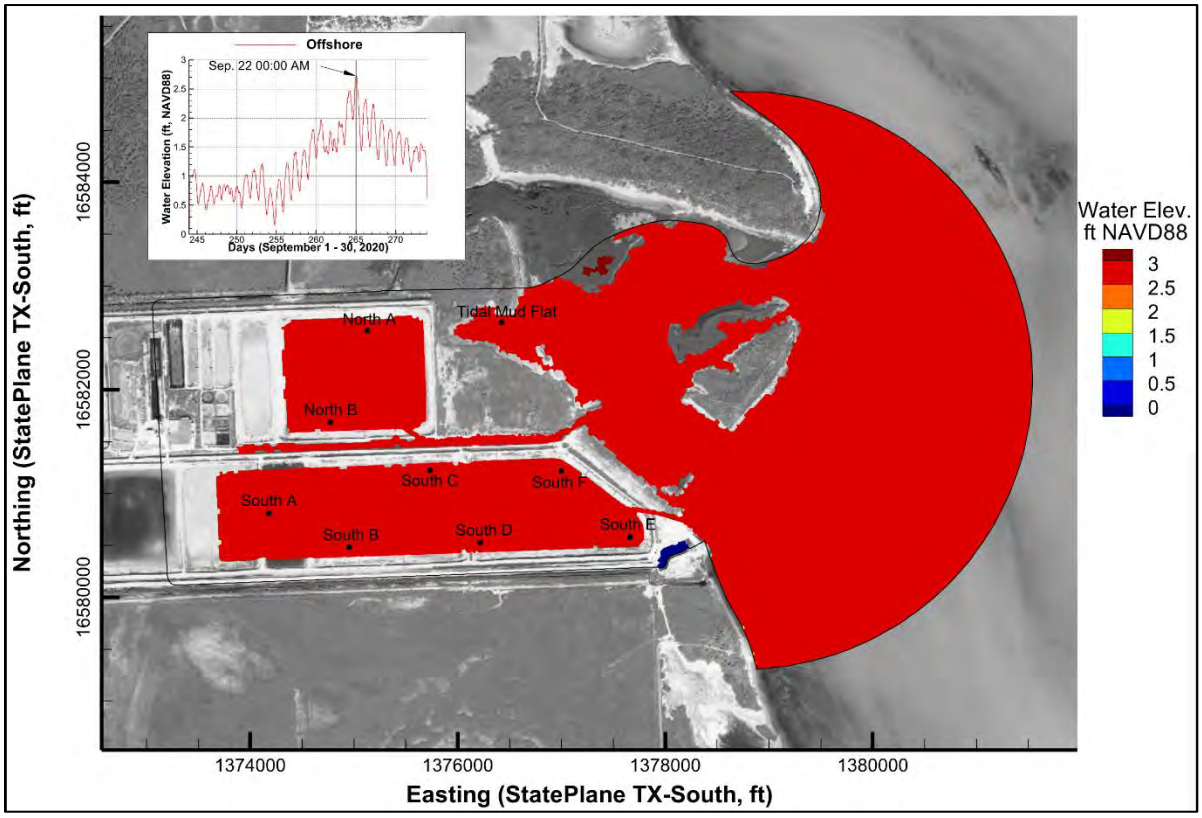


Figure 26. Project Design: Modeled Water Elevation September 22, 2020 00:00 AM.

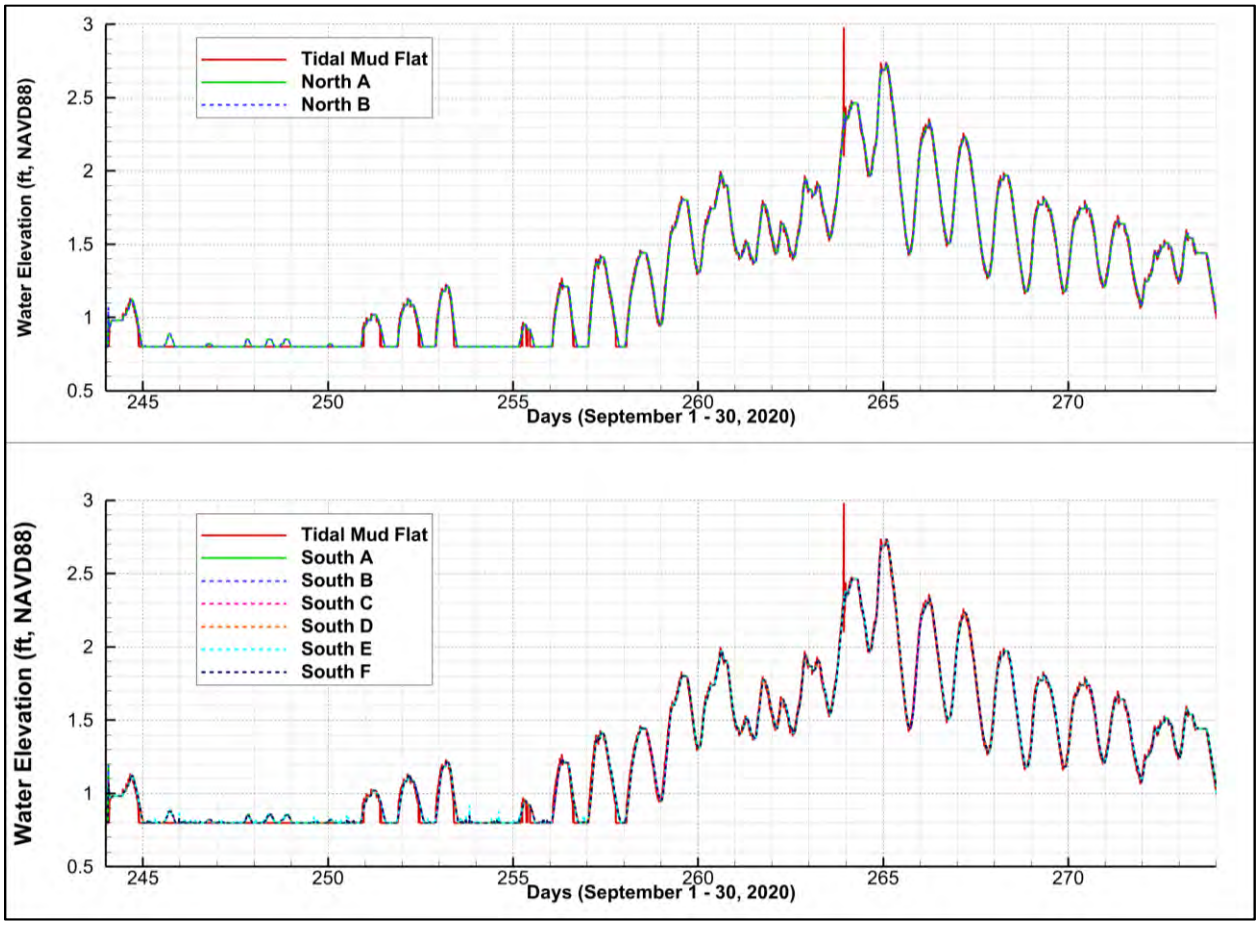


Figure 27. Project Design: Modeled Water Elevations September 1-30, 2020.

5 Conclusions

CEC performed hydrologic modeling of the Project area using the ADCIRC model. The model was run for both the Project area existing and design conditions over three 30-day periods representing low tide range winter, high tide range summer and storm periods. The computed water elevations over the existing tidal mud flat were compared to the predicted water elevations in the Project tidal flat creation areas to estimate how well the Project design is expected to perform.

During the winter period, January 1-30, 2020, the existing tidal mud flat whose ground elevation was approximately +0.6 feet NAVD88 was inundated only 1.4% of the time due to low tide conditions that ranged from -2.0 to +0.9 feet NAVD88. The predicted water elevations within the tidal flat creation areas had patterns similar to the existing tidal mud flat and were inundated 1.3% of the time.

During the summer period, May 1-30, 2021, when the tide ranged between -1.5 and +2.2 feet NAVD88, the existing tidal mud flat was inundated 50.9% of the time while the tidal flat creation areas were inundated 65.0% of the time.

During the storm period, September 1-30, 2020, when the tide ranged between –0.8 and +2.7 feet NAVD88, the existing tidal mud flat was inundated 65.7% of the time while the tidal flat creation areas were inundated 75.1% of the time.

Overall, the predicted water elevations in the Project tidal flat creation areas had similar inundation characteristics of the existing tidal mud flat. Based on this, CEC anticipates that the Project design will yield the goals and objectives in promoting intertidal flushing and healthy habitat sustainability.

6 References

Belaire Environmental, Inc. 2021: Seagrass Survey Report, 2020.

EMC, Inc. 2021: EIP Santuario Costero Aquatic Survey Summary Report, June 2021.

Luettich, R., Westerink, J. J., and Scheffner, N. W. 1992: ADCIRC: An Advanced Three-Dimensional Circulation Model for Shelves, Coasts and Estuaries, Report 1: Theory and Methodology of ADCIRC-2DDI and ADCIRC-3DL. Dredging Research Program Technical Report DRP-92-6, U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

U.S. Geological Survey. 2018: South Texas LiDAR survey collected on February 23, 2018. Obtained from the Texas Natural Resources Information System (www.data.tnris.org).