



LEGACY WETLANDS

ATKINS

Member of the SNC-Lavalin Group

Habitat Creation Plan for the Legacy Wetlands at Sullivan Ranch

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Draft

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ACRONYMS AND ABBREVIATIONS

AgCIS	Agricultural Applied Climate Information System
bgs	Below ground surface
EL	Elevation
FEMA	Federal Emergency Management Agency
ft	Foot/feet
GBF	Galveston Bay Foundation
GLO	Texas General Land Office
HUC	Hydrologic Unit Code
LWSR	Legacy Wetlands at Sullivan Ranch
MSMA	Moist Soil Management Area
NAVD88	North American Vertical Datum of 1988
NHD	USGS National Hydrography Dataset
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
Proposed Project	The Legacy Wetlands at Sullivan Ranch Project
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

INTRODUCTION

Galveston Bay is the largest and most productive estuary on the Texas coast. Galveston Island contributes to this highly productive estuary providing habitat for countless fish and wildlife, including migratory birds. Subsidence, sea level rise, land use practices and development have contributed to drastic reductions in highly productive habitats across the bay system, including Galveston Island. Between 1950 and 2002, Galveston Island lost 32 percent of its estuarine marsh, tidal flats were reduced by 61 percent, palustrine marshes were reduced by 50 percent, and beaches have decreased by 30 percent (White et al. 2004). The loss of these habitats results in decreased habitat availability and a loss in productivity for the countless animals.

In 2017, the Texas General Land Office (GLO) conducted the Galveston Upland Sand Source Assessment Feasibility Study to identify potential sources of sand sources suitable for beach restoration projects on the island. Property owned by TNI Investments, LTD and managed by the Sullivan Land & Cattle Company (Sullivan Ranch) was identified as a viable sand source for beach restoration projects on Galveston Island. The study estimated that over one million cubic yards of beach quality sand is potentially available on the property, which is currently a working cattle ranch.

In 2022, the Sullivan Ranch embarked on the journey to create the Legacy Wetlands at Sullivan Ranch (LWSR) to design and permit activities that would create and conserve habitats in critical need on Galveston Island as well as provide beach quality sand for beach restoration activities. Part of this process aimed to assess which threats were currently impacting wetlands and other wildlife habitat on the LWSR and create a plan to address those impacts. The LWSR aims to conserve and create valuable barrier island nontidal, freshwater wetlands and brackish water wetlands as well as create and enhance upland habitats. These habitats are key resting and feeding areas for a variety of coastal birds including waterfowl, wading birds, and neotropical migrant bird species.

OBJECTIVES

The LWSR Project (Proposed Project) is located on a private ranch in Galveston County, between Sportsman Road and Homrighaus Road and between Gangs Bayou and 8 Mile Road. Subsidence, sea level rise, land use practices, and terrain modifications have impacted the property leading to increased saltwater intrusion and a loss of wildlife habitat.

The project goals and objectives are to protect and enhance non-tidal, freshwater wetlands, provide habitat for a variety of wildlife, enhance existing saltwater fringe marsh to act as a buffer to high tides and storm surges, and to provide beach-quality sand currently on the property to support projects with the city, state and park board.

ENVIRONMENTAL BASELINE INFORMATION

The Proposed Project encompasses 379 acres southwest of the Galveston Causeway, west of Sweetwater Lake and east of Gangs Bayou. The Proposed Project is abutted by 8 Mile Road (Anderson Ways Road) on the east, Homrighaus Road on the south, and an unnamed gravel drive on the west (Exhibit 1). Land use in the vicinity is primarily residential, agricultural, or undeveloped areas. Undeveloped areas include herbaceous wetlands, open water, and grasslands/herbaceous vegetation (MultiResolution Land Characteristics Consortium 2019 and City of Galveston 2022). The predominant land use within the project area is agricultural (livestock grazing) or undeveloped areas (tidally influenced wetlands).

The project area falls within the Western Gulf Coastal Plain Mid-Coast Barrier Islands and Coastal Marshes (34h) ecoregion (Griffith et al. 2004). This portion of the Texas coast is subhumid compared to the humid climate to the northeast and to the semiarid climate to the south. Annual precipitation

increases to the northeast, ranging from 34 to 46 inches (Griffith et al. 2004). Monthly climate data was collected by the U.S Department of Agriculture and Natural Resource Conservation Service's (USDA/NRCS) Agricultural Applied Climate Information System (AgACIS) at the Galveston Scholes Field Station from 1981 to 2010 (USDA/NRCS 2022a). Precipitation is typically most abundant in September. Monthly mean average temperature ranges from 56.0°F – 85.9°F, with the hottest months from June through September and coldest from December through February (USDA/NRCS 2022a).

According to the U.S. Geological Survey (USGS) National Hydrography Dataset (NHD), there are no mapped waterbodies within the project area (USGS 2022) (Figure 4, Appendix A). The survey area is within the Dickinson Bayou Watershed (Hydrologic Unit Code [HUC] 120402040200) (USGS 2022). According to the Federal Emergency Management Agency (FEMA) Flood Map Center, the survey area is within floodplain Zone VE (1% annual chance), designated 100-year flood hazard with a base elevation of 14 feet (FEMA 2019) (Figure 5, Appendix A). Although the NHD did not identify waterbodies within the survey area, the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) identified 16 freshwater emergent wetlands, eight forested/shrub wetlands, 14 freshwater ponds, and three lakes located within the survey area (Figure 4, Appendix A) (USFWS 2022).

In the Mid-Coast Barrier Islands and Coastal Marshes ecoregion, smooth cordgrass (*Spartina alterniflora*), marshhay cordgrass (*Spartina patens*), and gulf saltgrass (*Distichlis spicata*) dominate in more saline zones. Other native vegetation is mainly grassland composed of seacoast bluestem (*Schizachyrium scoparium*), sea-oats (*Uniola paniculata*), common reed (*Phragmites australis*), gulfdune paspalum (*Paspalum monostachyum*), and morning-glory (*Ipomoea imperati*). Some areas have clumps of sweetbay (*Laurus nobilis*), redbay (*Persea borbonia*), and dwarf southern live oak trees (*Quercus virginiana*). Salt marsh and wind-tidal flats are mostly confined to the back side of the barrier island with fresh or brackish marshes associated with river-mouth delta areas (Griffith et al. 2004).

HABITAT WORK PLAN

The LWSR will procure the financial resources, planning, and scientific professional services required to successfully restore, enhance, create, and protect wetland habitat (estuarine and palustrine), open water, and uplands on the project site. The LWSR will perform all restoration, enhancement, creation, and preservation activities discussed below.

Habitat Framework Development

LWSR seeks to enhance or create wetlands and wildlife habitat at the Legacy Wetland site through the creation and enhancement of freshwater and low salinity wetlands, enhancement of the coastal prairie, creation of oak mottle habitat and the protection of tidal salt flat habitat. During the planning phase, LWSR, through their consultant, coordinated with the Galveston Bay Foundation (GBF) to identify a suitable reference site for the Proposed Project. The purpose of this reference site is to better inform what could be expected of nearby plant communities that are out of agricultural production and establish targets for restoration. The Sweetwater Preserve is a GBF property to the east of the Sullivan Ranch and is owned and managed by GBF. The plant communities of the Sweetwater Preserve include estuarine elustrine wetlands, estuarine shrub-scrub wetlands and upland coastal shrub scrub habitats. Dominant plant species found on the reference site includes black needle rush (*Juncus roemerianus*), leafy three-square (*Shonoplectus robustus*), smooth cordgrass (*Spartina alterniflora*), marsh hay cordgrass (*Spartina patens*), marsh elder (*Iva frutescens*), sea ox-eye daisy (*Borrchia frutescens*), wax myrtle (*Myrica cerifera*), yaupon (*Ilex vomitoria*) amongst other species.

LWSR also coordinated with the American Bird Conservancy to review project features to ensure that they would provide beneficial habitat for various bird species. Through this work, it was determined which areas provide the most suitable habitat to which species. It was decided to classify the property into 5 different habitat types (e.g., tidal salt, oak mottes, ponds, coastal prairie, freshwater

wetlands/moist soil management). Some of the bird species LWSR hopes to provide habitat for are listed below (Table 1).

Table 1 – Bird Species Typically Found in Various Habitat Types

Habitat Type	Typical Bird Species
Tidal Salt Flat	Nesting shorebirds: Wilson’s Plover, Willet; winter & migrant shorebirds: Whimbrel, Long-billed Curlew, Black-bellied Plover
Oak Mottes	Neotropical Migrants
Ponds	Ducks, Coots, wading birds, Shorebirds (foraging)
Coastal Prairie	Eastern Meadowlark, Sparrows, Neotropical Migrants
Freshwater Wetlands/Moist Soil Management	Rails, White Ibis, nesting shorebirds: Black-necked Stilt; winter & migrant shorebirds: Lesser & Greater Yellowlegs

Shorebird Nesting Area Preservation

The project area has approximately 35.1 acres of tidal flats, largely devoid of vegetation. These areas serve as important nesting and resting areas for species such as Wilson’s Plover, Willet, and various winter and migrant shorebirds. This is a unique habitat that has experienced dramatic losses in recent time. Between 1950 and 2002, 61percent of tidal flats have been lost on Galveston Island. This project will protect and conserve these areas ensuring sensitive bird species have this resting and nesting habitat (Exhibit 4). No construction activities will occur within these areas and equipment will be kept out of these areas to prevent disturbing these species during project construction.

Pond Creation

Four (4) ponds will be created on the property (Exhibit 2). Ponds 1 and 2 will be excavated to -19 feet elevation (EL) and contoured with 4:1 side slopes from 0 to 10 feet in depth and 6:1 side slopes from 10 to 20 feet. The side slopes for Ponds 1 and 2 will allow for a narrow planting zone for wetland plantings. Pond 3 will be excavated to -9 feet EL for a maximum depth of 10 feet. Pond 3 will have much wider shelves than Ponds 1 and 2 to allow for enhanced wetland plantings. Pond 4 will be excavated to -4 feet EL for a maximum depth of 5 feet and have wide, gentle, shelves for enhanced wetland plantings. All ponds will maintain a permanent pool elevation from groundwater sources approximately three to four feet below ground surface elevations due to groundwater connectivity. Groundwater elevations were observed at around 3-4 feet below ground surface (bgs) elevations in 2002 at a Piezometer installed adjacent to Pond 3 (Table 2). Rainfall will be another source of water. Pond 1 may receive tidal inflows during high tide events.

Table 2 – Depth to Groundwater at Piezometer Well

Surface Elevation (ft NAVD88)	Date	Depth to Groundwater (ft)	Groundwater Elevation (ft NAVD88*)
3.83	6/14/2022	3.82	0.01
3.83	7/11/2022	3.11	0.72
3.83	8/9/2022	3.87	-0.04
*North American Vertical Datum of 1988 (NAVD88)			

Pond 1 is expected to maintain a salt marsh estuarine plant community around its fringe given its depth and tidal influence. Ponds 2, 3 and 4 will have limited tidal influence. Pond 2 is expected to sustain a brackish plant community given its depth. Ponds 3 and 4 will be able to maintain a palustrine or brackish plant community given their depth and groundwater connection.

Thin Layer Placement Marsh Nourishment

A portion of the non-beach quality sand excavated for this project will be beneficially used to raise marsh surface elevations to keep pace with accelerating sea-level rise. The excavated material that is not suitable for beach nourishment will be hydrolyzed and pumped on approximately 22 acres of an existing section of tidal marsh located on the property (Exhibit 4). Placement of this material will not exceed 5 inches thick. Silt booms, silt fencing, and/or coir logs will be placed around the marsh nourishment area to prevent sediment from migrating off the site and reduce turbidity in adjacent waters. This additional layer of sediment will improve marsh re-vegetation (plant cover), and increase marsh biomass, plant stem density, and nutrient uptake into plant tissue.

Hydrology Management and Moist Soil Management Unit

Nuisance high tides occur with greater frequency across Galveston Island. These tides bring saltwater further into interior wetlands, impacting lower salinity wetlands. The project area currently experiences nuisance high tides through a swale on the west side of the property, the wetlands on the north side, and across Sportsmans Road to the east. A berm will be constructed around Ponds 2, 3 and 4 to prevent impacts from nuisance high tides and retain freshwater to keep salinities in each pond and the surrounding wetlands low (Exhibit 3). Retaining rainwater will also supply additional freshwater to the existing groundwater lens beneath the island. Tide gauge data from the Galveston railroad bridge was utilized to determine the elevation of nuisance tides over the past 5 years (Table 3). It was determined that a 4-foot EL would protect the interior of the property from hurricanes and tropical storms that may pass nearby. The City of Galveston defines nuisance tides as ranging from 1.4 to 1.5 ft EL and was at or above 1.5 ft EL over 200 times in 2022 at the Galveston Pier 21 gauge.

Table 3 – Tropical Storm Events and the High Tide Line

Date	Event	Height (ft NAVD88)
9/14/2021	Hurricane Nicholas	4.88
9/20/2021	TS Beta	4.86
8/27/2020	Hurricane Laura	4.55
10/25/2018	Low Pressure/Winds	3.97
8/29/2017	Hurricane Harvey	3.95
10/9/2020	Hurricane Delta	3.80
5/22/2021	Winds/Rainfall	3.71
7/25/2020	Hurricane Hanna	3.68
6/21/2017	TS Cindy	3.65
10/10/2018	Hurricane Michael	3.62

A culvert with a manual water level control structure will be installed through the berm to allow water level manipulation within the bermed area. Stoplogs can be added or removed to achieve target levels based on the season. This structure will be used to create several moist soil management areas (MSMA) (37.10 acres) within the bermed area. There are two cells divided by an existing road with a culvert on the ranch currently. Two additional areas will be created, one along the north shore of Pond 3 and the other adjacent to the water control structure (Exhibit 3). The MSMA will be drained in the spring and summer over a two-to-six-week period to maximize plant diversity. Vegetation management may be conducted on a rotational basis via any number of means (e.g., disking, mowing, prescribed burn, herbicide application) to ensure that all plant communities remain at an early stage of succession that benefits wildlife. The cells will be allowed to flood in September and October. This management

approach will maximize bird species diversity. Dabbling ducks will utilize water depths between 4 to 10 inches, wading birds will prefer areas that are 3-5 inches and shorebirds prefer depths less than 3 inches.

Wetland Planting Plan

While existing plant communities on the site will be preserved to the greatest extent practicable, other areas of the site will be altered from its current condition and will be re-contoured and planted with wetland and aquatic plant communities to provide water quality and wildlife benefits. Herbaceous aquatic plant species will be planted over approximately 63.52 acres along the ponds, swales and moist soil management areas. These plantings will typically be installed as bare root plugs on approximately a 3 foot spacing unless otherwise stated. Plant species selection will be based on tested salinity, elevation at the time of planting and availability of species. Initial planting has the best chance at success if plants species are selected to match the salinity and elevation of current conditions rather than the conceptual plan. The exact placement of the plantings cannot be predicted until the constructed contours of the marsh floor are determined at the time of planting, but it is anticipated that there will be six different planting zones within the ponds. All plantings will be accomplished by a licensed planting specialist selecting from plants of the appropriate cultivar for the geographic location. A list of potential plant species selection can be found in Exhibit 7.

Marsh Margin

This plant zone consists of flowering wetland plants and wetland grasses. These plant species will be introduced into the intermediate flooding zone and over time will find their preferred elevation range. Sprigs will be planted on 2 feet centers to help prevent erosion in this zone. Periodic soil saturation will be required for maintenance of these plant species during their initial development. Plant cover is expected to exceed 50 percent at the end of the first growing season and 70 percent by the second year. Several of these species will provide food and cover for a diverse group of wildlife species, and several will have the additional benefit of providing visual aesthetic enhancement for the large marsh area.

Shallow Emergent Marsh

This plant zone will consist of emergent herbaceous plant species planted in areas with continuously saturated soil. Plants will be planted as bare root plugs on 3-foot centers. Plant cover is expected to exceed 50 percent at the end of their first growing season and 70 percent by the second year. This marsh will provide both water quality benefits and significant habitat for wetland amphibians and birds.

Tall Emergent Marsh

This plant zone consists of as many as four species of tall marsh plants including four bulrush species and giant cutgrass. Plants will be planted on 3 foot centers as bare root plugs. The planting elevation for this zone will be approximately -0.5 foot to 0 foot EL. The plant species will require nearly continuously saturated soil during establishment. Plant cover is expected to exceed 50 percent at the end of their first growing season and 70 percent in subsequent years. These plant species are known to provide excellent habitat for secretive wetland birds such as wrens, sparrows, warblers, and rails. The plants provide large numbers of seeds and cover for nesting and roosting.

Floating and Submerged

Two species of submerged aquatic plants and four species of rooted, floating aquatic plants will be planted in deeper zones up to 3 feet in depth. Plants will be planted on 10-foot centers as bare root plugs or 1 gal containers. These plants will require flooded soil during establishment. Cover will increase over time to at least 50 percent in suitable pond areas. These submerged plants provide a large amount of submerged surface area for growth of periphyton and aquatic insects that serve as the base of the aquatic food chain. Submerged aquatic plants also provide a large amount of oxygen into the water column.

Upper Marsh

This high marsh plant zone will consist of multiple species of coastal salt marsh plants. Bare root plugs will be planted on 3-foot centers for this area. The planting elevation for this zone will be approximately 1 foot to 3 feet EL. Periodic soil saturation will be required for maintenance of these plant species during their initial development. These plant species provide habitat and feeding grounds for coastal birds such as rails and Least Terns.

Tidally Influenced Marsh

This lower marsh plant zone will consist of as many as three species of coastal grasses. The planting elevation for this zone will be approximately 1 foot to 2 feet EL. Bare root plugs planted on 3 foot centers will be used for this zone. Periodic soil saturation will be required for maintenance of these plant species during their initial development. These plant species provide habitat and feeding grounds for coastal birds such as rails, White Ibis, and Black-Necked Stilt.

Upland Planting Plan

There are various upland areas within the project area. Currently, these areas primarily consist of grazing pastures and invasive species. Invasive species will be addressed via an invasive species control program. Grazing practices will be altered under this habitat creation plan and is described below in a Livestock Exclusion plan. The berms created throughout the project will also serve as areas for upland plantings and vegetative screening. Finally, fill will be placed in areas to make them suitable for oak plantings and existing oak trees will be preserved. There will be three zones of upland plantings described as coastal prairie, vegetative screening, and oak mottes (Exhibit 6).

Coastal Prairie

Upland areas surrounding the proposed ponds and along the proposed berms will be planted with a mixture of upland native grass species to provide wildlife cover and erosion control. The coastal prairie areas will be planted with a seed mixture (approx. 20 lbs per acre) and may require periodic irrigation during the first season of establishment. Approximately 10.38 acres of coastal prairie will be created (Exhibit 7).

Neotropical Migrant Bird Habitat

Elevated areas along the proposed berm and bump-outs will be planted with a diverse mixture of tree and shrub species. The tree and shrub species will be provided as container grown. To add to diversity, they will be in 1-, 5-, and 15-gallon sizes. Trunk caliper will range from less than 0.5 inch for the 1-gallon size up to 1.75 inches for the 15-gallon size. The tree and shrub species are all tolerant of periodic saturated soil conditions but not prolonged saturation or flooding. Cover in this zone will be very low during initial years and coastal prairie will be required prior to full establishment. Plant spacing will be decided in the field based upon site conditions, species composition and availability. The tree and shrub species are anticipated to be habitat for neotropical birds. Approximately 1.45 acres of vegetative screening will be created (Exhibit 7).

Oak Mottes

The fill areas will be planted with a mixture of three tree species to form mottes. These stands of trees will be surrounded by coastal prairie. The trees will be spaced apart, allowing for more sunlight to reach the ground and promote the growth of grasses and wildflowers beneath the canopy. This will create a diverse and dynamic ecosystem with a mix of open grasslands and shaded woodland areas. Tree sizes will be in either 5-, 15-, 30- and 45-gallon sizes. Caliper size will range from 0.5 to 3.5 inches. Cover in this zone will be very low during initial years and coastal prairie will be required prior to full establishment. Plant spacing will be decided in the field based upon site conditions, species composition and availability. The trees are anticipated to be habitat for neotropical migrants and are critical stopover

habitat for these species as they migrate. Approximately 16.31 acres of oak mottes will be created (Exhibit 7).

Livestock Exclusion

Livestock exclusion is a widespread restoration technique across the United States to protect and improve wetland areas. The Sullivan Ranch is currently an active cattle ranch and is grazed across its entirety. New fences will be constructed and fencing will be maintained to keep cattle out of the project area and cattle will be relocated to selected pastures (Exhibit 5).

Invasive Species Control Program

Salt cedar (*Tamarix ramosissima*), Macartney rose (*Rosa bracteata*), Brazilian peppertree (*Schinus terebinthifolius*), occur at several locations around the property. Salt cedar can be found along some of the existing wetland fringes and fence rows while Macartney rose and Brazilian peppertree can be found scattered throughout the upland areas and in some of the fences. While these species are undesirable, they provide roosting and nesting habitat for numerous bird species in the absence of more desirable, native vegetation. The planting plan will re-establish and increase native vegetation that can be used for nesting and roosting bird species and a gradual removal of invasive species will occur over several years. The LWSR will utilize a state licensed herbicide applicator to apply an EPA approved aquatic labelled herbicide to conduct foliar application of herbicide (i.e., imazapyr, triclopyr, glyphosate, or some combination thereof) to selectively target some of the invasive species on the property prior to planting and each following year for the first three years.

Maintenance

Due to the presence of salt cedar, Macartney rose, and Brazilian peppertree, the restored areas will be closely monitored for invading non-desirable species, including noxious weeds. Non-desirable species will be targeted with a foliar spot treatment during the late summer or early fall as prescribed by the invasive species control program.

The project area is located within the FEMA floodplain Zone VE (1% annual chance), designated 100-year flood hazard with a base elevation of 14 feet (FEMA 2019). The cause of this flooding would likely be from hurricanes and other tropical storms. These storms could carry debris and wave energy that could impact the berms and hydrologic improvements. Any breaches in the berms will be corrected once site conditions allow for the berm to be reconstructed to its original footprint. Additionally, debris that blocks flow through culverts or water control structure will be removed as soon as practicable.

Fences will be maintained to exclude cattle from the habitat creation areas.

SITE PROTECTION AND IMPLEMENTATION

The LSWR property is owned in fee simple by TNI Investments LTD. Management and implementation of the habitat plan will be conducted through a wholly owned limited liability company (Sullivan Land & Cattle Company, LLC). Sullivan Land & Cattle Company, LLC. will operate at the direction of TNI Investments LTD and will be the entity responsible for executing all aspects of the restoration plan, including meeting the performance standards, and providing for all financial considerations for maintenance and management of the property.

PERFORMANCE STANDARDS

- 50 percent cover of all herbaceous planting areas after year 1. 75 percent cover of all herbaceous planting areas after year 2.

- Reestablishment of native wetland vegetation in marsh management area after year 1.
- 50 percent survivability of all upland plantings through year 3.
- Removal of silt fencing after completion of thin layer placement.

MONITORING PLAN

Monitoring reports (3-year minimum) will be produced on an annual basis. Monitoring reports should be concise and provide sufficient information to describe the site conditions and whether the Proposed Project is meeting its performance standards. The report should include a narrative that provides an overview of site conditions and function, comparison to site conditions at the Sweetwater Preserve reference site, maps and photographs to illustrate site conditions, and quantitative assessment of overall project success. Photographs should be formatted to print on a standard 8.5x11 sheet of paper, dated, and clearly labelled with the direction from which the photo was taken. Maps should show the location of the Proposed Project, habitat types, locations of photographic reference points, and/or features pertinent to the Proposed Project. Additional components of the report are:

- Name of the party responsible for conducting the monitoring and the date(s) of inspection.
- A brief description, including dates, of any management activities taken place on the site.
- A brief description as to whether the site is developing as expected, including a description of the effects resulting from extreme weather events (e.g., named tropical event, drought, severe freeze).
- If performance standards are not being met, identify the reason(s) is not meeting performance standards and description of any proposed adaptive management actions to correct these issues.

ADAPTIVE MANAGEMENT

In the event the Proposed Project, or one of its components, fails to achieve its stated performance standards, the permit applicant will determine the cause for the failure. Adaptive management activities may include corrective actions and additional monitoring of the site.

FINANCIAL ASSURANCE

Sullivan Land & Cattle Company, LLC shall ensure funding is available to implement the approved plan or to implement corrective measures if additional work is required to ensure the success of the activities.

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Exhibits



Exhibit 1 – Habitat Plan Vicinity Map

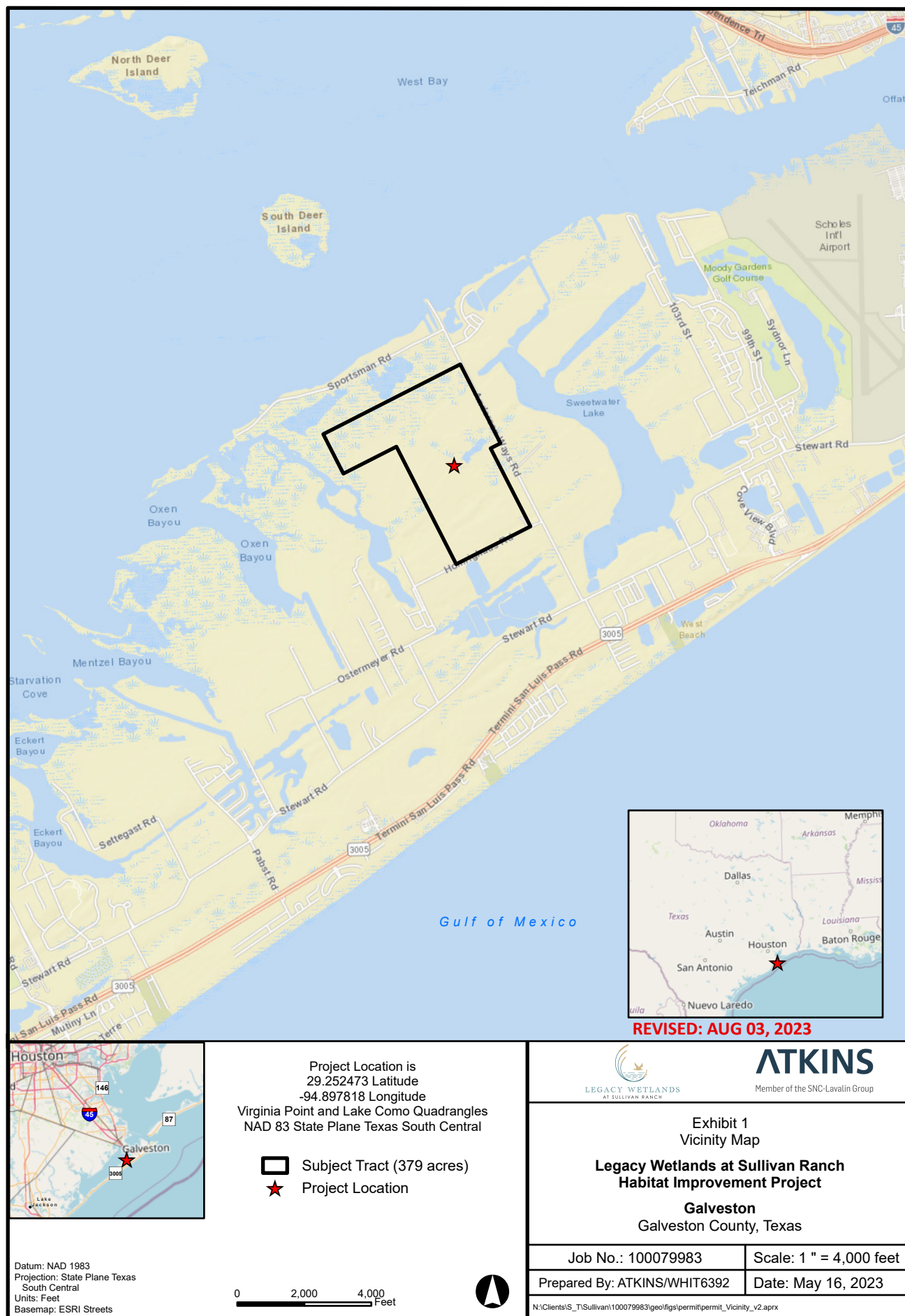


Exhibit 2 – Habitat Plan Overview Map

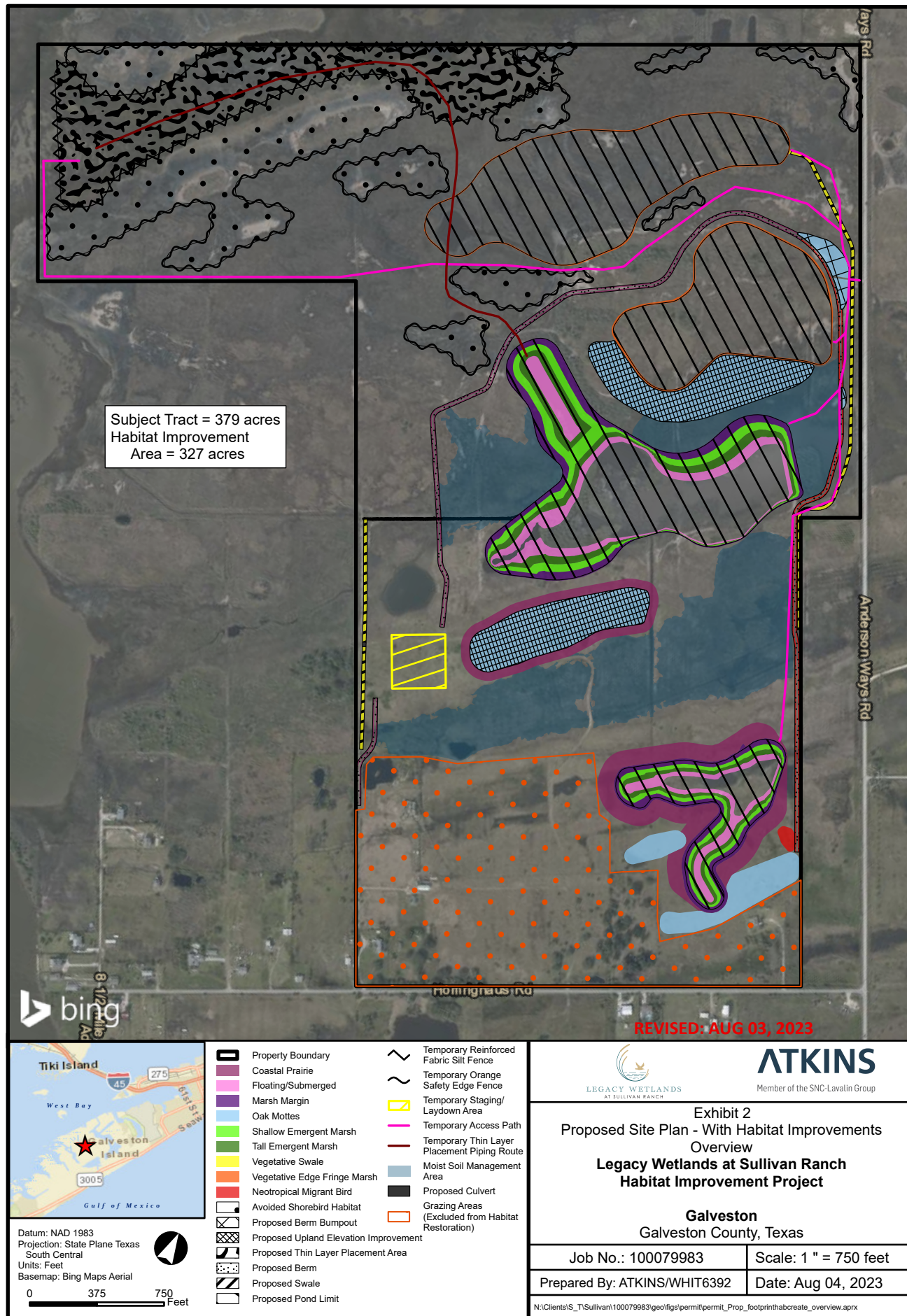


Exhibit 3 – Moist Soil Management Areas

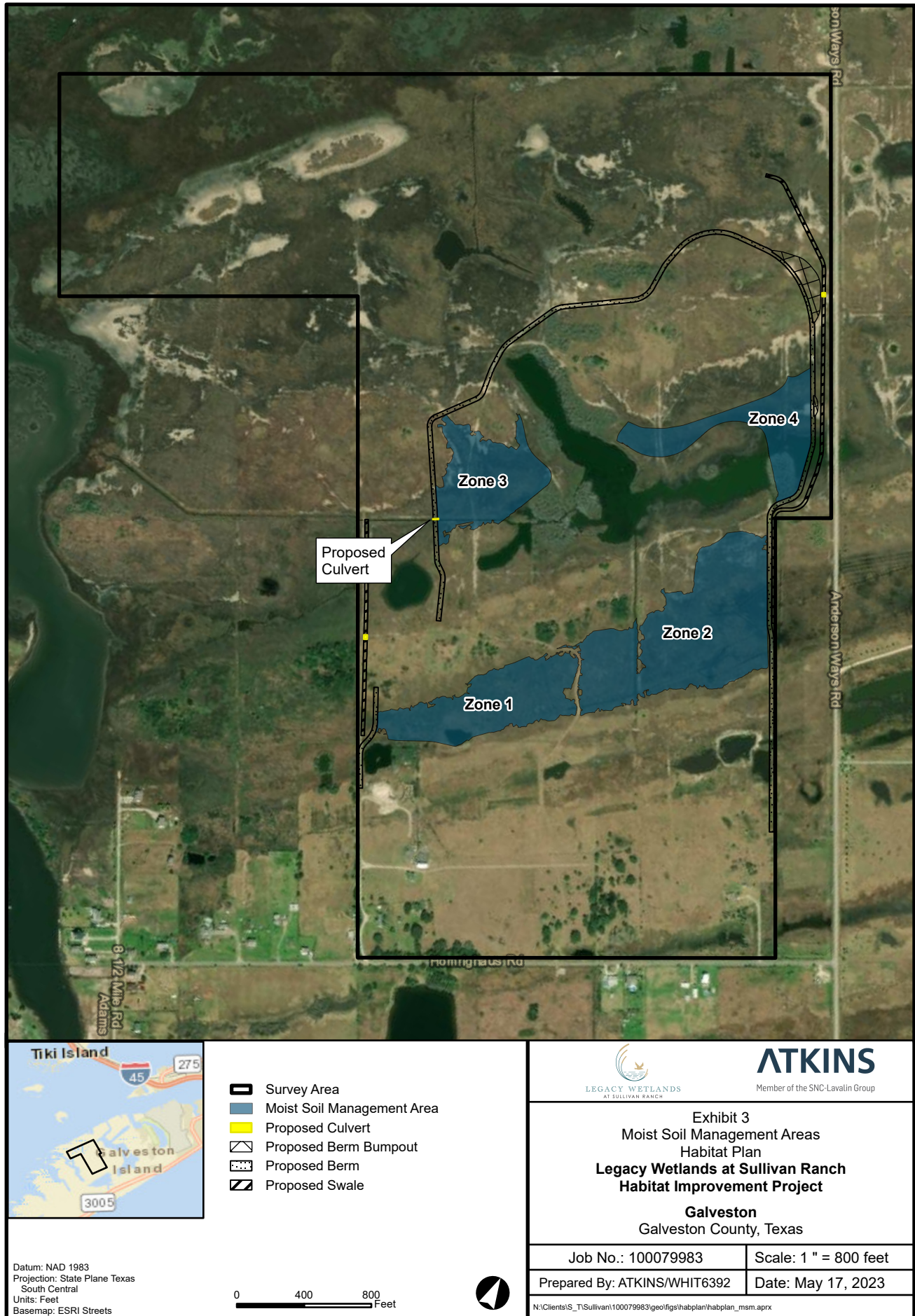
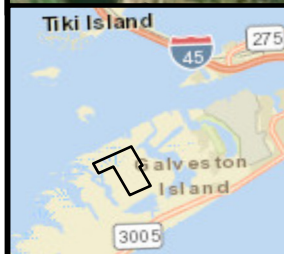


Exhibit 4 – Shorebird Nesting Protection Areas and Thin Layer Placement



- Survey Area
- Avoided Shorebird Habitat
- Proposed Thin Layer Placement Area

Datum: NAD 1983
Projection: State Plane Texas
South Central
Units: Feet
Basemap: ESRI Streets

0 400 800 Feet



ATKINS
Member of the SNC-Lavalin Group

Exhibit 4
Shorebird Nesting Protection Areas
with Thin Layer Placement
Habitat Plan
Legacy Wetlands at Sullivan Ranch
Habitat Improvement Project
Galveston
Galveston County, Texas

Job No.: 100079983

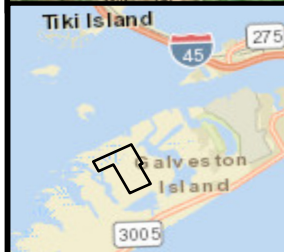
Scale: 1" = 800 feet

Prepared By: ATKINS/WHIT6392

Date: May 17, 2023

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Exhibit 5 – Livestock Grazing and Exclusion Areas



- Survey Area
- Livestock Grazing Allowed
- Livestock Exclusion Fencing

Datum: NAD 1983
Projection: State Plane Texas
South Central
Units: Feet
Basemap: ESRI Streets

0 475 950 Feet



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Exhibit 5
Livestock Grazing Areas
Habitat Plan
**Legacy Wetlands at Sullivan Ranch
Habitat Improvement Project**

Galveston
Galveston County, Texas

Job No.: 100079983

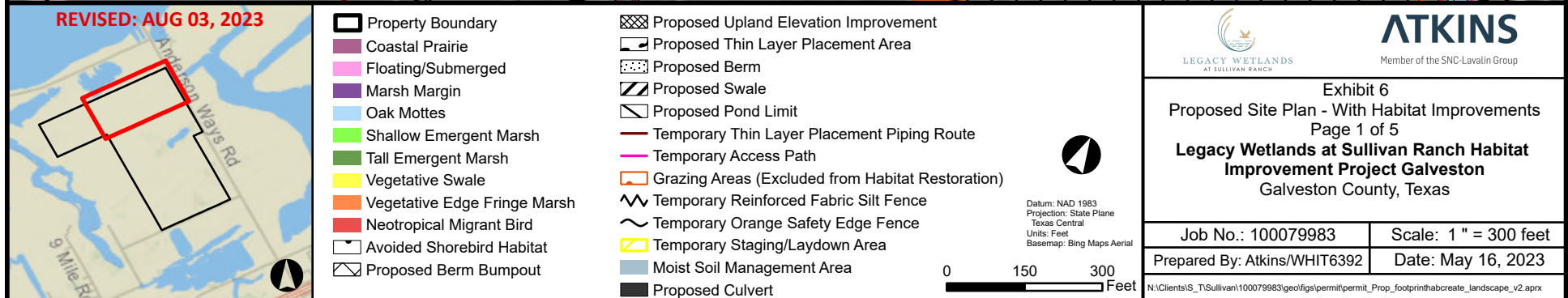
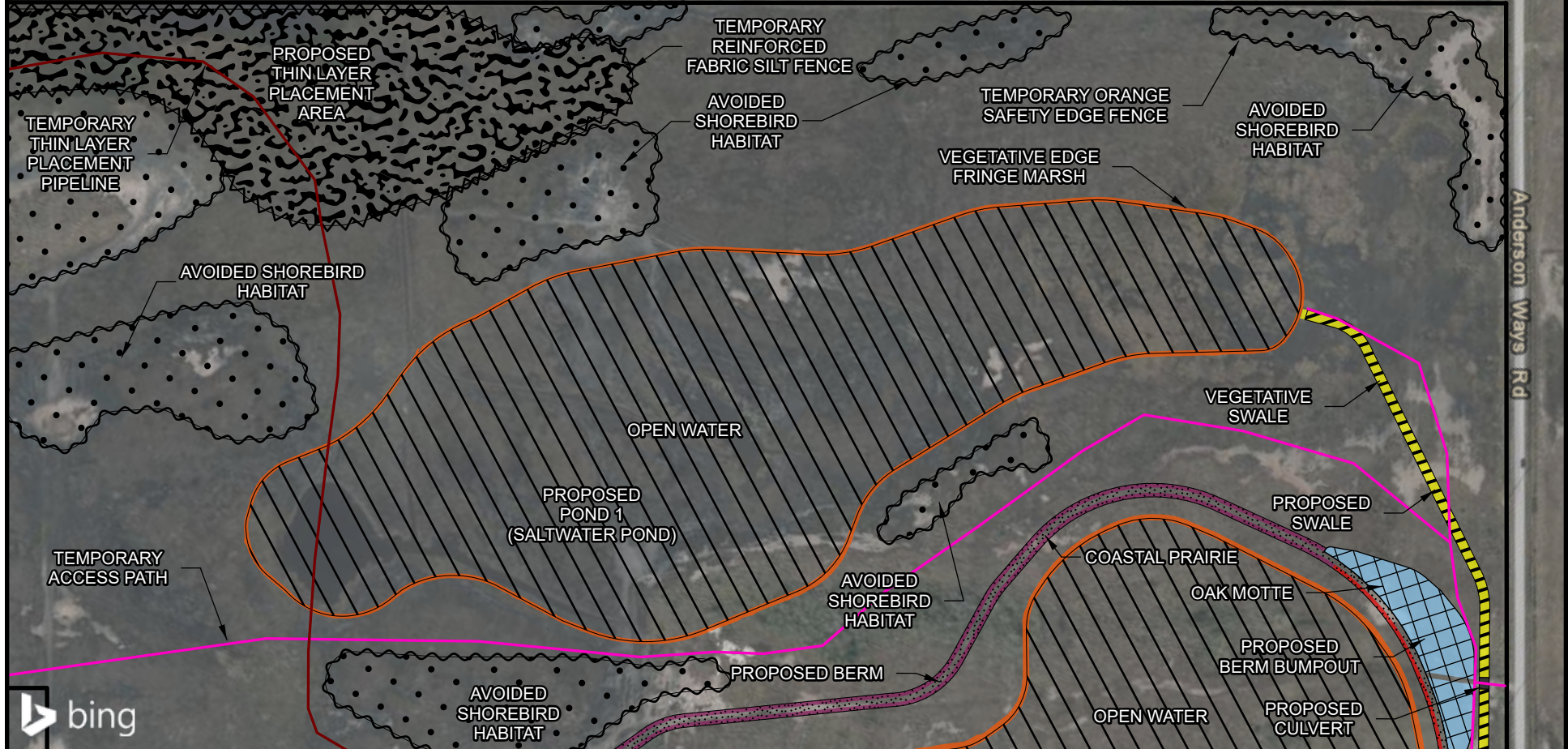
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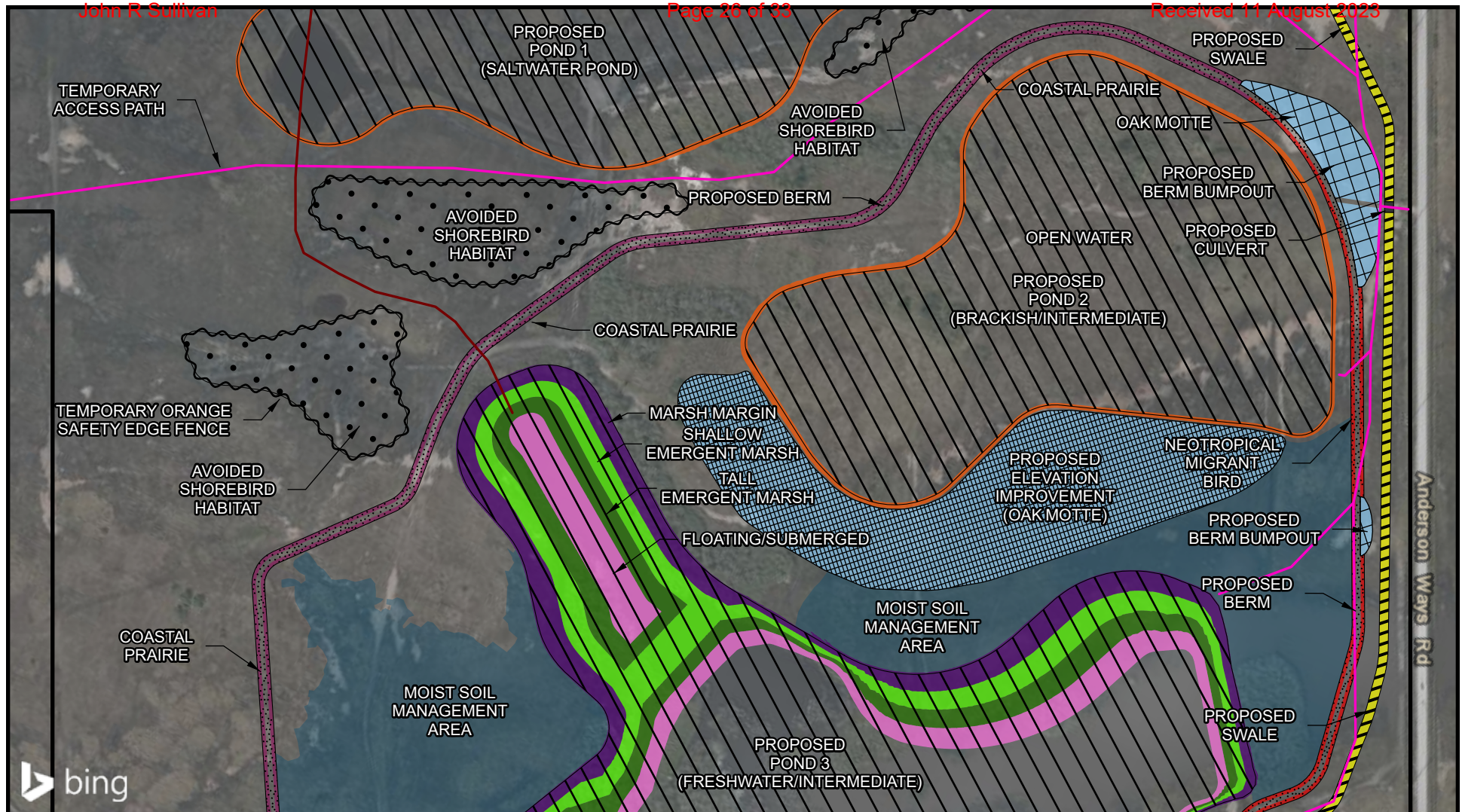
Prepared By: ATKINS/WHIT6392

Date: Aug 02, 2023

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Exhibit 6 – Habitat Planting Plan





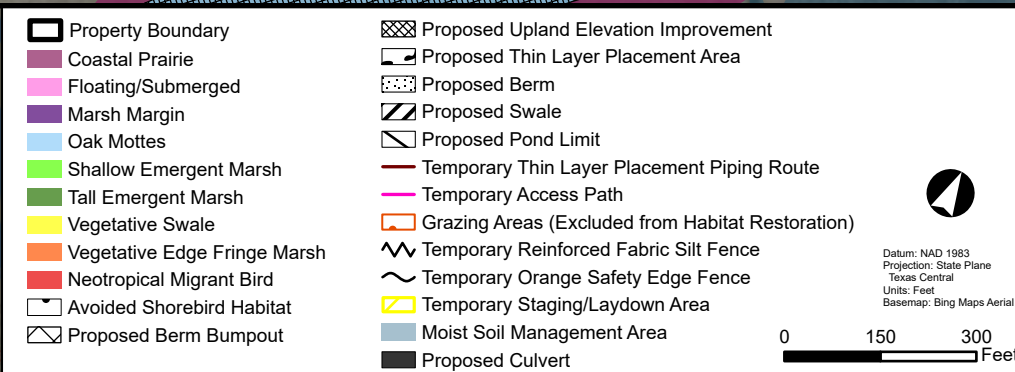
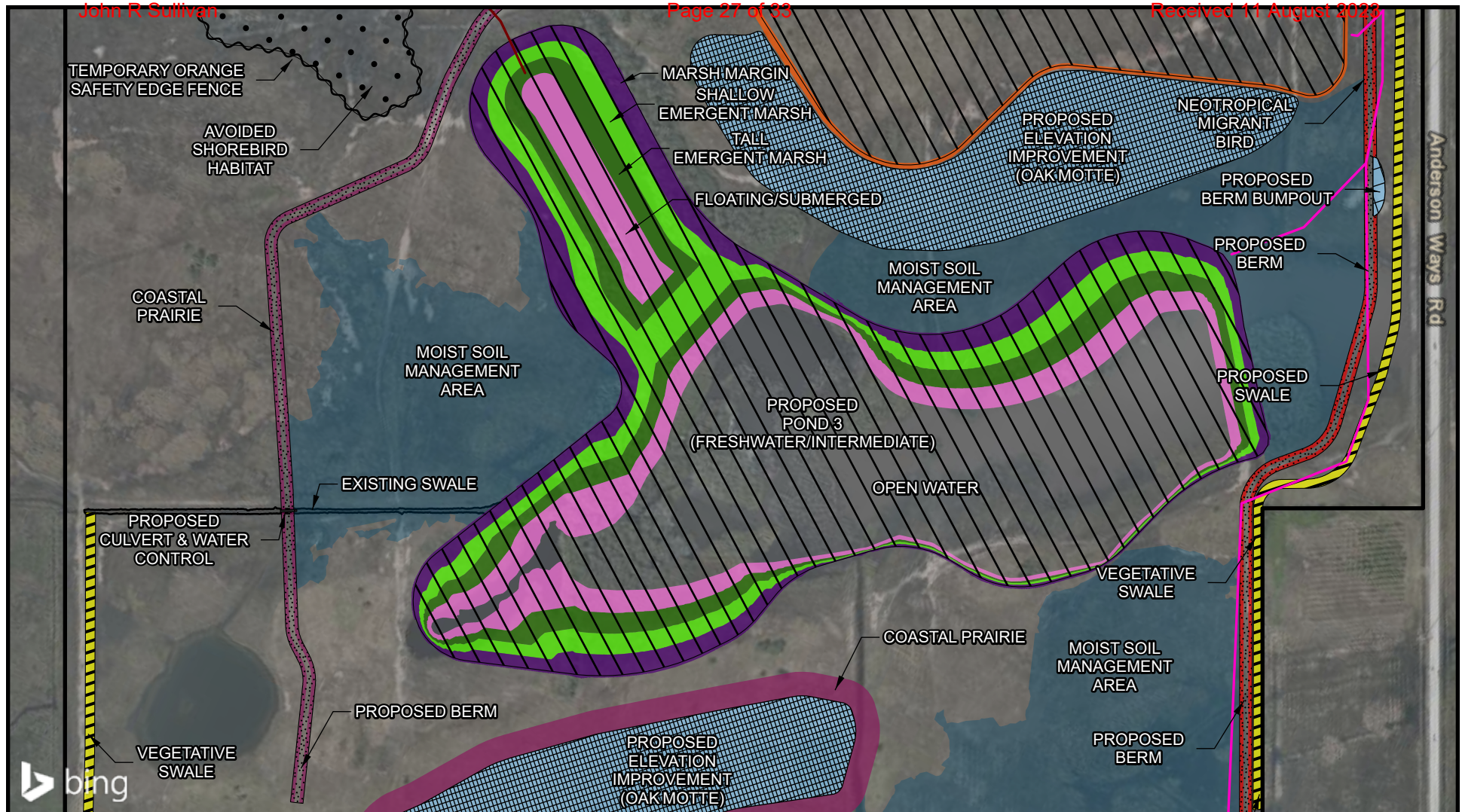
REVISED: AUG 03, 2023

- | | |
|------------------------------|---|
| Property Boundary | Proposed Upland Elevation Improvement |
| Coastal Prairie | Proposed Thin Layer Placement Area |
| Floating/Submerged | Proposed Berm |
| Marsh Margin | Proposed Swale |
| Oak Mottes | Proposed Pond Limit |
| Shallow Emergent Marsh | Temporary Thin Layer Placement Piping Route |
| Tall Emergent Marsh | Temporary Access Path |
| Vegetative Swale | Grazing Areas (Excluded from Habitat Restoration) |
| Vegetative Edge Fringe Marsh | Temporary Reinforced Fabric Silt Fence |
| Neotropical Migrant Bird | Temporary Orange Safety Edge Fence |
| Avoided Shorebird Habitat | Temporary Staging/Laydown Area |
| Proposed Berm Bumpout | Moist Soil Management Area |
| | Proposed Culvert |

Datum: NAD 1983
Projection: State Plane
Texas Central
Units: Feet
Basemap: Bing Maps Aerial

0 150 300
Feet

 LEGACY WETLANDS AT SULLIVAN RANCH	
ATKINS Member of the SNC-Lavalin Group	
Exhibit 6 Proposed Site Plan - With Habitat Improvements Page 2 of 5 Legacy Wetlands at Sullivan Ranch Habitat Improvement Project Galveston Galveston County, Texas	
Job No.: 100079983	Scale: 1" = 300 feet
Prepared By: Atkins/WHIT6392	Date: May 16, 2023
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Exhibit 6

Proposed Site Plan - With Habitat Improvements

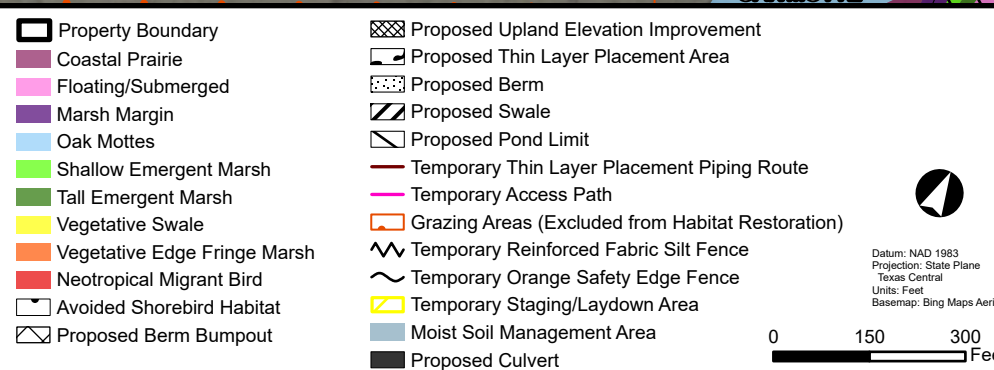
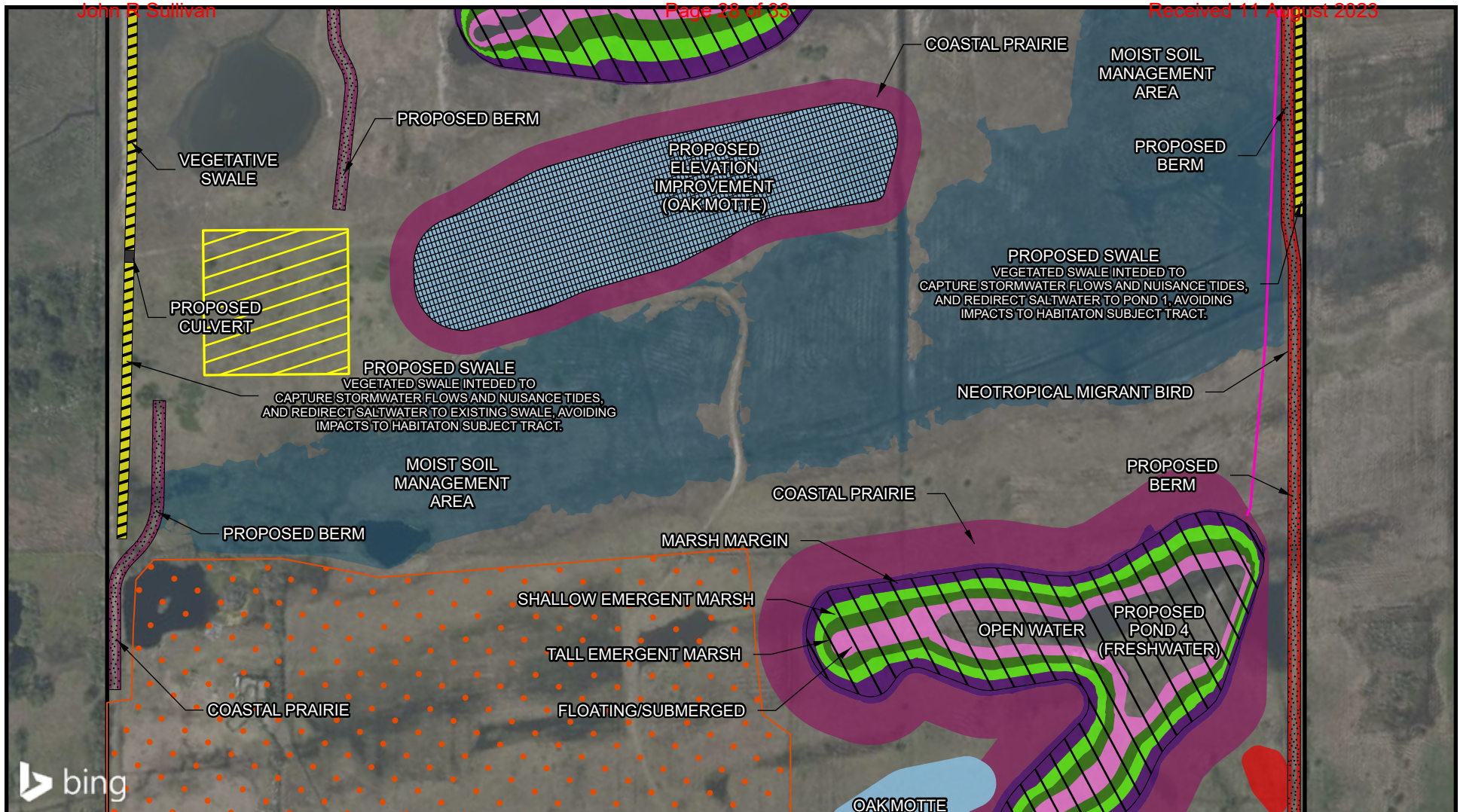
Page 3 of 5


Legacy Wetlands at Sullivan Ranch Habitat Improvement Project Galveston

Galveston County, Texas

Job No.: 100079983	Scale: 1" = 300 feet
Prepared By: Atkins/WHIT6392	Date: May 16, 2023

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Exhibit 6
Proposed Site Plan - With Habitat Improvements
Page 4 of 5
Legacy Wetlands at Sullivan Ranch Habitat Improvement Project Galveston
Galveston County, Texas

Job No.: 100079983	Scale: 1" = 300 feet
Prepared By: Atkins/WHIT6392	Date: May 16, 2023

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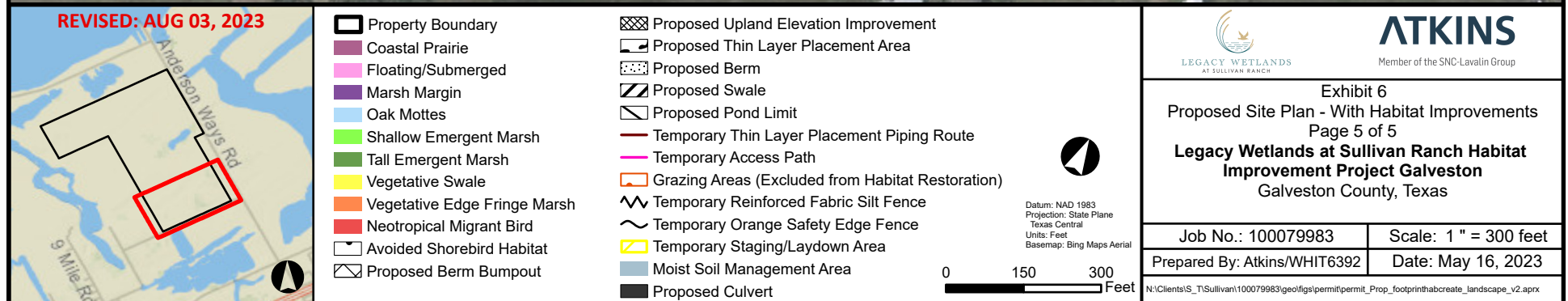
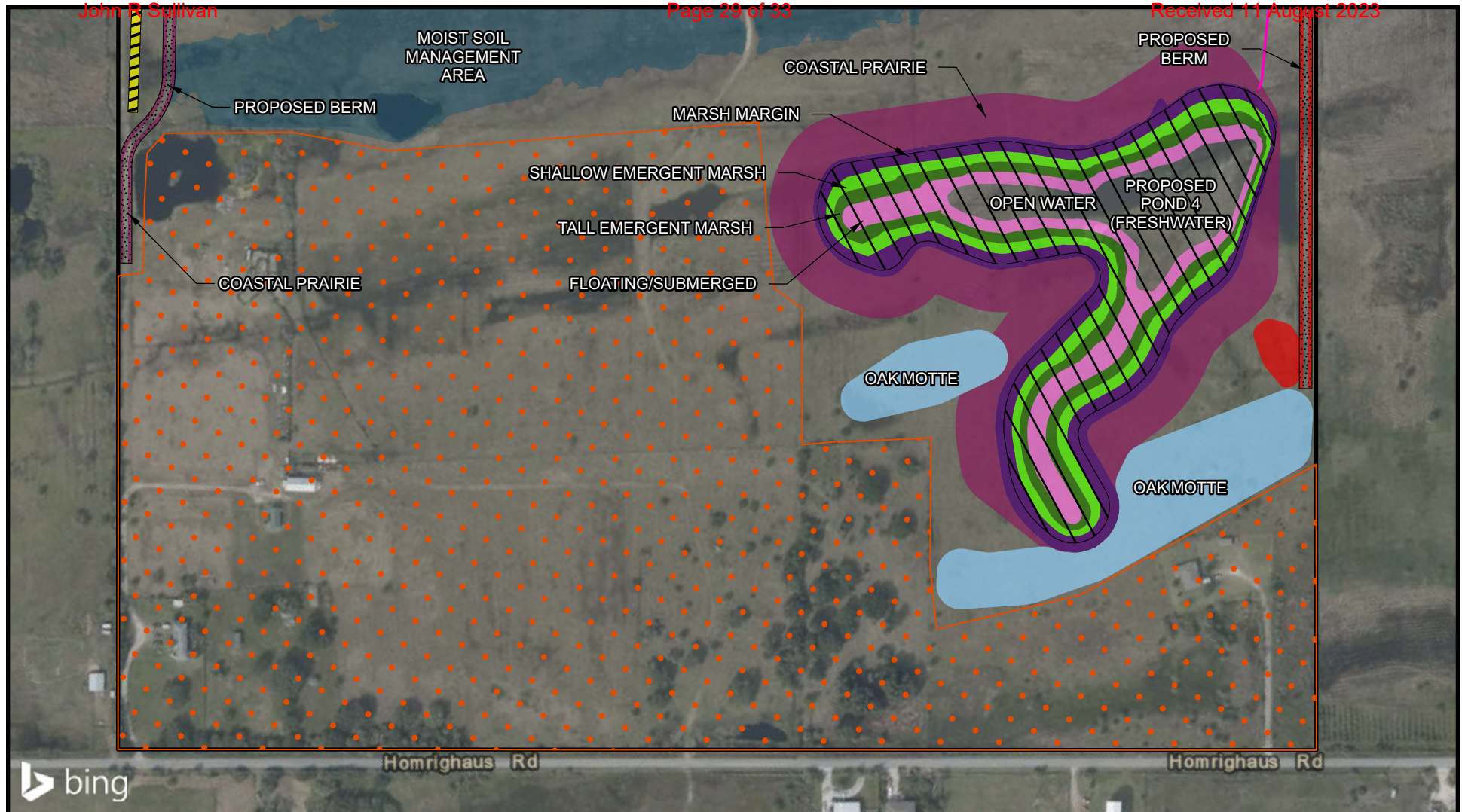
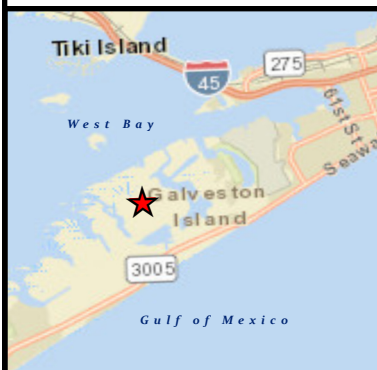


Exhibit 7 – Plant Species by Planting Zone

Planting Zone	Common Name	Genus/Species	Lower Elevation	Upper Elevation	Approximate Area Planted (acres)
Marsh Margin	Water Hyssop	Bacopa spp.	0.5	1	6.52
	Sedges	Carex spp.	0.5	1	
	Sand Spike Rush	Eleocharis montevidensis	0.5	1	
	Swamp Rose Mallow	Hibiscus moscheutos	0.5	1	
	Blue flag Iris	Iris virginicus	0.5	1	
	Soft Rush	Juncus effusus	0.5	1	
	Smartweed	Polygonum hydropiperoides	0.5	1	
	Prairie Cordgrass	Spartina pectinate	0.5	1	
	Maidencane	Panicum hemitomon	0.5	1	
	White Topped sedge	Rhynchospora colorata	0.5	1	
Shallow Emergent Marsh	Mountain Spike Rush	Eleocharis Montana	0	0.5	5.36
	Squarestem Spike Rush	Eleocharis quadrangulate	0	0.5	
	Duck Potato	Sagittaria lancifolia	0	0.5	
	Grassy Arrowhead	Sagittaria graminea	0	0.5	
	Delta Arrowhead	Sagittaria platyphylla	0	0.5	
	Pickernelweed	Pontederia cordata	0	0.5	
	Fire Flag	Thalia dealbata	0	0.5	
	Olney Bulrush	Scirpus americanus	0	0.5	
	Giant Bulrush	Scirpus californicus	-0.5	0	
	Softstem Bulrush	Scirpus Validus	-0.5	0	
Tall Emergent Marsh	Hardstem Bulrush	Scirpus Acutus	-0.5	0	5.03
	Giant Cutgrass	Zizaniopsis milacea	-0.5	0	
Moist Soil Management			1	3	37.10
Floating/Submerged	Pondweed	Potamogeton spp.	-2	-0.5	5.64
	Widgeon Grass	Ruppia maritima	-2	-0.5	
	Water Shield	Brasenia schreberi	-2	-0.5	
	Coontail	Ceratophyllum demersum	-2	-0.5	
	White Water Lily	Nymphaea odorata	-2	-0.5	
	Floating Hearts	Nymphoides aquatica	-2	-0.5	

REVISED: AUG 03, 2023



NOTES:

1. Majority of marsh plantings will be installed as bare root plugs with a root mass approximately 3" x 3" with multiple stems, depending on individual species.
2. Tree and shrub species will be provided as contained grown, to add to diversity they will be either 1, 6, or 16 gallon size. 1-gallon will have a trunk caliper of less than .6 inch. 6-gallon will have a trunk caliper of .75-1.0 inch. 15-gallon will have a trunk caliper of 1.25-1.75 inch.
3. Oak Mottes will have tree sizes of 5, 15, 30 and 45 gallon size. Caliper size will range from .5 inch to 3.5 inch.
4. Actual plant species used will be based on availability at time of planting.



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Exhibit 7
Planting Summary

**Legacy Wetlands at Sullivan Ranch
Habitat Improvement Project**

Galveston
Galveston County, Texas

Job No.: 100079983

Scale: Not to Scale

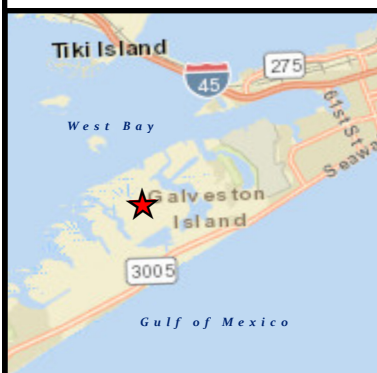
Prepared By: Atkins/WHIT6392

Date: May 16, 2023

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Planting Zone	Common Name	Genus/Species	Lower Elevation	Upper Elevation	Approximate Area Planted (acres)
Vegetative Edge Fringe Marsh	Saltwort	Batis maritima	1	3	2.02
	Saltgrass	Distichlis spicata	1	3	
	American Glasswort	Salicornia virginica	1	3	
	Gulf Cordgrass	Spartina spartinae	1	3	
	Seashore Paspalum	Paspalum vaginatum	1	3	
	Sea Ox Eye Daisy	Borrchia frutescens	1	3	
	Marsh Hay Cordgrass	Spartina patens	1	3	
	Black Needle Rush	Juncus roemarianus	1	3	
	Seaside Heliotrope	Heliotropium curassavicum	1	3	
	Eastern Baccharis	Baccharis halimifolia	1	3	
	Carolina Wolfberry	Lycium carolinianum	1	3	
Vegetative Swale	Marsh Hay Cordgrass	Spartina patens	1	2	1.85
	Alkali Bulrush	Schoenoplectus robustus	1	2	
	Smooth Cordgrass	Spartina alterniflora	1	2	
Coastal Prairie	Gulf Cordgrass	Spartina spartinea	3	5	10.38
	Marsh Hay Cordgrass	Spartina patens	1	5	
	Prairie Cordgrass	Spartina pectinate	3	5	
	Eastern Gama Grass	Tripsacum dactyloides	3	5	
	Big Bluestem	Andropogon gerardii	3	5	
	Little Bluegrass	Schizachyrium scoparium	3	5	
	Switchgrass	Panicum virgatum	3	5	
	Sugar Cane Plumegrass	Erianthus giganteus	3	5	
	Buttonbush	Cephalanthus occidentalis	3.5	5	
	Swamp Privet	Foresteria accuminata	3.5	5	
Neotropical Migrant Bird	Possum Haw	Ilex decidua	3.5	5	1.45
	Native Yaupon	Ilex decidua	4	N/A	
	Wax Myrtle	Myrica cerifera	4	N/A	
	Eastern Baccharis	Baccharis halimifolia	3.5	5	
	Swamp Dogwood	Cornus drummondii	3.5	5	
	Willow Oak	Quercus phellos	3.5	5	
	Swamp Laurel Oak	Quercus laurifolia	3.5	5	
	Live Oak	Quercus fusiformis	4	N/A	
	Cedar Elm	Ulmus crassifolia	3.5	5	
	Texas Ebony	Ebenopsis ebano	3.5	5	
	Hackberry	Celtis occidentalis	3.5	5	
	Black Willow	Salix nigra	3.5	5	
Oak Mottes	Live Oak	Quercus fusiformis	4	N/A	16.31
	Native Yaupon	Ilex decidua	4	N/A	
	Wax Myrtle	Myrica cerifera	4	N/A	

REVISED: AUG 03, 2023



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Planting SummaryLegacy Wetlands at Sullivan Ranch
Habitat Improvement ProjectGalveston
Galveston County, Texas

Job No.: 100079983

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