Appendix F

Cultural Resources

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in Federal documents be accessible to individuals with disabilities. The USACE has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the USACE at (409) 766-3108 or at SWG201900067@usace.army.mil if they would like access to the information.

Appendix F1

Cultural Resources Baseline Investigation Summary

Job No. PCA20166

APPENDIX F

CULTURAL RESOURCES BASELINE INVESTIGATION SUMMARY FOR THE PROPOSED CORPUS CHRISTI SHIP CHANNEL DEEPENING PROJECT

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Acronyms and Abbreviations

APE	Area of Potential Effects
AWOIS	Automated Wreck and Obstruction Information System
CDP	Channel Deepening Project
ENC	Electronic Navigation Chart
GIWW	Gulf Intracoastal Waterway
NAS	naval air station
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
PCCA	Port of Corpus Christi Authority
SAL	State Antiquities Landmarks
SHPO	State Historic Preservation Offices
THC	Texas Historical Commission
TPWD	Texas Parks and Wildlife Department
USACE	U.S. Army Corps of Engineers
USS	United States Ship

1.0 CULTURAL RESOURCES

The proposed Port of Corpus Christi Authority (PCCA) Channel Deepening Project (CDP) is subject to various Federal and State cultural resource regulations. At the Federal level, the proposed project is subject to Section 106 of the National Historic Preservation Act of 1966, as amended (Section 106). Under this law, any Federal agency must consider how its actions might affect significant cultural resources. In the eyes of this law, "significant" resources are those that are determined to be eligible for or are listed on the National Register of Historic Places (NRHP). In simpler terms, Section 106 requires that Federal agencies ask themselves, "What could happen to important cultural resources if I issue this permit (or provide these funds, or allow construction on lands that I control)?" Section 106 is not a prohibition on impacting important cultural resources; it only requires that an agency know the potential effects of their action and take those effects into account as part of their decision-making process.

Cultural resources are often divided into archaeological and non-archaeological (buildings, objects, districts, cultural landscapes) resources at least 50 years of age. In addition, Traditional Cultural Properties are included among Federally managed cultural resources. Traditional Cultural Properties are places of cultural, ceremonial, or religious significance, most often associated with Native American Tribes, that may or may not include archaeological or non-archaeological components. The U.S. Army Corps of Engineers (USACE) issued PCCA CDP Record of Decision under the National Environmental Policy Act would be one such Section 106-triggering Federal action. The USACE takes significant cultural resource impacts into account by consulting with local interested parties, including State Historic Preservation Offices (SHPOs, in the case of Texas, the Texas Historical Commission [THC]) and Tribal Historic Preservation Officers to determine how best to identify cultural resources that may be affected by a proposed action, what resources can be considered "significant," and how best to manage those resources in relation to the proposed action. Federal agencies consult with Tribes directly for Section 106 projects on a nation-to-nation basis.

The State of Texas also manages terrestrial and underwater archaeological resources through the Antiquities Code of Texas. Under the Antiquities Code of Texas, archaeological resources located on lands owned or managed by the State of Texas or a political subdivision thereof must be identified and managed by that controlling agency in consultation with the THC. Significant archaeological sites, called State Antiquities Landmarks (SAL) must be found and assessed prior to allowing ground-disturbing activities within these public lands. The proposed PCCA CDP is located within lands that the Texas General Land Office manages, making the project subject to State-level archaeological resource regulatory oversight.

While both the Federal and State cultural resource laws have significant overlap, one important distinction is that the Antiquities Code of Texas is limited to projects' direct physical impact footprint. Federal agencies must take direct *and* indirect effects into account to comply with Section 106. As a result, Federal cultural resource review and documentation often incorporates archaeological, historical, and cultural properties that are farther away from the proposed project footprint.

The following summary details a general overview of the cultural setting and history of the study area that will form the basis of assessing the PCCA CDP-related effects.

2.0 CULTURAL HISTORY OVERVIEW

2.1 PALEOINDIAN PERIOD

Humans arrived in North and South America (collectively called "the New World") between 16,000 and 14,500 years before present (BP) (Gilbert et al., 2008; Pitblado, 2011). Until recently, archaeologists and historians thought that the Paleoindian Period in Texas did not begin until around 12,000 BP (Perttula, 2004). However, new evidence from the Debra Friedkin and Gault sites in Central Texas have pushed the date of earliest occupation back to around 15,000 BP (Swaminathan, 2014; Gault School, 2016). The Paleoindian Period in Texas is currently estimated to range from approximately 15,000 to 8,500 BP.

As the Pleistocene ended, diagnostic Paleoindian materials in the form of Clovis, Folsom, and Plainview projectile points began to enter the archaeological record. These points were lanceolate-shaped and fluted for hafting to wooden spears. Paleoindian-period hunters then used atlatls (a wooden instrument with a handle at one end and a hook at the other used to throw the "spears" – because these "spears" were thrown and not thrust, they are called "darts") to increase their throwing force and range. This allowed them to hunt large game such as mammoth, mastodons, bison, camel, and horse (Black, 1989; Hofman et al., 1989). In addition to large game, Paleoindian groups also harvested smaller prey, including antelope, turtle, frogs, and other small to medium-sized game. Stylistic changes in projectile point technology occurred during this later portion of the period. Environmental studies suggest that Late Pleistocene climates were wetter and cooler (Mauldin and Nickels, 2001; Toomey et al., 1993), gradually shifting to drier and warmer conditions during the Early Holocene (Bousman, 1998). The end of the Pleistocene was arid to semiarid, and prickly pear and agave populations were high (Bousman et al., 1990).

2.1.1 Offshore Pre-European-Contact (Pre-Contact/Prehistoric) Cultural Resources

The Gulf of today is 200 to 300 feet higher than it was when the first humans arrived on the North American continent during the closing centuries of the last Ice Age more than 14,000 years ago when much of the Earth's water was locked up in ice sheets and glaciers. At the height of the Ice Age, the Texas Coast was roughly 100 miles farther out than it is today and the modern-day Corpus Christi Bay Estuary was not coastal at all; it was composed of inland prairie terraces and river valleys that were probably like the environment surrounding Kenedy or Poteet, Texas of today. The plant and animal communities native to these inland prairies would have had a much larger range that would have extended into what is now the Outer Continental Shelf. Early humans in the region would have occupied this same, extended landform during this time as well (Joy, 2018). Over time, global temperatures rose which, in turn, melted the ice sheets and lifted sea levels across the planet. Geological data indicate that these rising waters first flooded the study area around 9,000 years ago, creating the Corpus Christi Bay estuary (Ricklis, 2021). As the Gulf Coast receded, so did prehistoric peoples of Texas, creating a band of previously exposed upland landforms that have the potential to hold submerged, intact cultural deposits (Joy, 2018; 2020).

This phenomenon of rising sea levels over a period of thousands of years has distinct implications for the archaeological and cultural record of the study area. Paleoindian occupants in the study area would not have been coastal peoples; sites of this age submerged in the study area would be prairie Paleoindian occupation sites of inland peoples. These inland sites would have been clustered along paleochannels that are now inundated by Gulf waters. Coastal communities from the Paleoindian period are far offshore on the Outer Continental Shelf, and these types of sites have only just begun to receive intensive archaeological attention (Joy, 2020).

Cultural resource management laws do not make management distinctions between historic and prehistoric resources; identifying and assessing the significance of *all* cultural resources is central to Section 106's objective. Despite this, finding the remnants of these earliest communities in offshore environments has been opportunistic and passive. This is largely because most of the remnants of ancient human occupation sites – primarily stone tools and tool-making-byproducts, flakes that archaeologists call "lithic debitage" – are difficult for archaeologists to detect using traditional underwater remote sensing tools like magnetometers and side-scan sonar. Despite the high concentrations of Pre-Clovis, Clovis, and Folsom sites along the Gulf Coast, not a single unequivocal coastal Paleoindian site has ever been identified on the Gulf or Atlantic Ocean Outer Continental Shelf (Joy, 2018; Lowery, 2012; Stanford and Bradley, 2012). Archaeologists are learning that lithic debitage scatters, indicative of pre-contact occupation sites of this period, can be detected on the sea floor using sub-bottom profiler data (Grøn et al., 2018; 2021). By coupling these new methods with ongoing marine paleo-landscape modeling and sediment coring, researchers are conducting more offshore studies dedicated to exploring these first human occupations in the region (Evans, 2016).

2.2 ARCHAIC PERIOD

Archaeological sites attributed to the Archaic Period in the Central Coast region exhibit a shift from more mobile hunting strategies to a heavier reliance on a diverse spectrum of local plants and animals, centered at seasonal campsites associated with springs and/or drainages (Hofman et al., 1989). The Archaic broadly dates from 8500 to 1250 BP (Hofman et al., 1989; Perttula, 2004). Increased numbers of ground and pecked stones, roasting pits, and stone-lined hearths at archaeological sites of this periot suggest that populations relied more heavily on specialized processing of plants for food (Hofman et al., 1989).

Early Archaic sites in this region primarily consist of dense oyster shell piles, called middens, with few stone artifacts. A notable lack of land animal or fish bones shows that these were not yet important food sources during this period. The massive glaciers of the last Ice Age melted during the Early and Middle Archaic, and the Texas region transitioned to a period of intense heat and aridity, called the altithermal. Archaeologists note that site densities were lower than earlier prehistoric occupations. This indicates that fewer people lived in the region, presumably because of the hotter, drier conditions along the coast. By the Late Archaic, sea levels stabilized, and the present-day bays, lagoons, and barrier islands began to take form (Ricklis, 1995). Some Late Archaic sites tend to have thicker deposits and greater densities of artifacts than Early Archaic sites which suggests a larger population and more intensive resource use. Although few cemeteries from the Early Archaic period have been recorded (Ricklis et al., 2012), the number of archaeologically recorded cemeteries appears to have increased dramatically during the Late Archaic period. This indicates a transition in settlement patterns from more nomadic bands of hunter-gatherers, to more permanent settlements based around productive fishing and hunting grounds (Ricklis et al., 2012).

2.3 LATE PREHISTORIC PERIOD

The Late Prehistoric period in the study area corresponds with the introduction of the bow and arrow. Despite this technological advancement, hunting and foraging activities were similar between the Late Archaic and the beginning of the Late Prehistoric. Beginning around 1000 to 300 BP, the Toyah culture came to prominence in Central and Southern Texas. This corresponds with the time when bison herds returned to the Southern Plains, and bison bones are common at Toyah sites. Toyah material culture includes a distinctive “toolkit” of Perdiz arrow points, beveled knives, end scrapers, and drills, all of which were useful in processing bison and deer hides (Kenmotsu and Boyd, 2012).

2.4 HISTORIC/POST-EUROPEAN-CONTACT PERIOD

The Texas Coast’s Post-Contact, Historic Period begins in the early 16th century with the first European explorers visiting the region and documenting their observations. The Historic Period then continues to the modern day. The Texas Gulf Coast consists of several barrier islands, bays, ports, and channels whose history is closely tied to early maritime exploration, 18th and 19th century settlement, and 20th century trade and development. By the mid-19th century, most development in the region stayed closest to the coast (Long, 2020a).

2.4.1 Early European Maritime Exploration

In 1519, Governor of Jamaica, Francisco de Garay, authorized an expedition to explore the Gulf Coast between Florida and the Río Pánuco of Mexico (at modern-day Tampico, Veracruz, Mexico) in the hopes of finding a waterway that would lead to Asia. Lieutenant Alonso Álvarez de Piñeda was chosen to lead four ships and a contingent of 270 men on the voyage. Between the early spring and late fall of 1519, Piñeda’s team documented many prominent features along their voyage, such as the mouth of the Mississippi River, and produced the first known chart of the Gulf Coast that includes the study area region (Weddle, 2021; Lowery, 2020). Piñeda is credited with naming the Corpus Christi Bay system, claiming it for the Spanish King on the Feast of Corpus Christi Day, in June of 1519 (Leatherwood, 2021a).

Nearly a decade later, in 1528, Álvar Núñez Cabeza de Vaca and his crew were among a large expedition party that wrecked along the Texas Coast while documenting the Coast between the Rio Grande and the Cape of Florida. Cabeza de Vaca’s group was among the few who survived when they wrecked on Galveston Island (Long, 2020a). Over the next six years, Cabeza de Vaca and his companions walked west to the Pacific Coast then headed south, eventually to Mexico City. Along their journey they visited the study area. His account is regarded as Texas’ first ethnological study of the region’s Indigenous populations and is an often-cited resource for Texas archaeologists interpreting prehistoric lifeways from sites and features (Chipman, 2021; Thoms et al., 2021).

The French explorer Robert Cavelier, Sieur de La Salle was the next prominent European explorer to visit the area. La Salle and 300 crew and settlers sailed from France in 1684 with four ships – *La Belle*, *l'Aimable*, *Le Joly*, and *Le Saint-Francois* – to find the mouth of the Mississippi River and set up a permanent settlement (Bruseth and Turner, 2005). La Salle's flagship, *La Belle*, sank in Matagorda Bay during a storm in 1686 and was the subject of an extensive archaeological excavation in the 1990s (41GM86; Bruseth and Turner, 2005). The earliest known map thought to depict the Copano Bay region from LaSalle's voyage provides possible evidence La Salle reached Aransas and Corpus Christi bays (Dowling et al., 2010).

In 1746, Colonel José de Escandón built the fort Aranzazu at Live Oak Point to defend the bay from the French. On the opposite side of the bay, the Spanish founded the port of El Cópano, the first seaport in Texas. El Cópano, found at the northern end of Copano Bay, remained unpopulated until the 19th century. With little Spanish activity occurring along the Texas Coast, the area fell victim to piracy, smuggling, and illegal trading (Dowling et al., 2010).

Twenty years later, Escandón, then governor of Nuevo Santander, authorized Captain Blas María de la Garza Falcón to explore the coast between the Rio Grande and Garza Falcón's ranch outpost, Estancia de Santa Petronila south of present Corpus Christi. Garza Falcón settled the area, as well as provided a report of Padre Island in 1766. The report included descriptions of the landscape: small clumps of stunted laurels and willows, red grass, and ships' timbers littering the beach. While waiting for Garza Falcón's report, Escandón received information from fisherman and settler, José Antonio de Garabito, describing the Texas Coast between the Rio Grande and the Nueces River as "large pastureland surrounded by lagoons." He noted sandbanks, which became fully submerged during a storm surge, and therefore, the area could not be identified as an island (Weddle, 2020).

In September of that year, 25 soldiers, led by Garza Falcón, supported Ortiz Parilla's expedition, as tensions rose between the French and Spanish. He and the soldiers set camp along the Laguna Madre, located between Padre Island and the mainland, referring to it as Playa de la Bahía de Corpus Christi, or Playa de Corpus Christi. Ortiz Parilla's expedition produced a map, including an accurate depiction of Padre Island and Corpus Christi Bay, Mustang Island, Copano Bay (referred to as Bahía de Santo Domingo), and San José Island. However, the Nueces River is missing from the sketches (Weddle, 2020).

2.4.2 Post-Contact Native American Tribal history in the Region

The Karankawa people were the primary occupants of the Texas Gulf Coast when European explorers first arrived in the region. Their name means "dog lovers" in their native language (Calhoun County Museum, 2020; Bruseth and Turner 2005). These early Texas inhabitants were nomadic; they seasonally occupied the barrier islands in the Gulf Coast and retreated to the Texas inlands in the off season. They lived in small huts, made of a ring of poles drawn together at the center and covered with hides or mats (Bruseth and Turner 2005). The Karankawas navigated between the islands and the Texas interior maritime pathways on large dugout canoes. Fishing, hunting, and foraging were their main form of subsistence (Lipscomb, 2020). Early written accounts depicted the Karankawas as tall, with body piercings and linear or animal-shaped tattoos (Calhoun County Museum, 2020; Bruseth and Turner 2005).

The Karankawa people were familiar with Spanish and French interests in the region and were known to have clashed with both groups in the early years of European exploration. Following La Salle's tepid claim to the region in the early 18th century, Spain bolstered its efforts to colonize the region and convert the local inhabitants to loyal Spanish citizens. The Karankawas resisted the conversion to Catholicism and more violence ensued. The Spaniards used the Karankawa-Spanish War as justification for their eradication and as an opportunity to gain control of the Texas Coast. Conflicts continued for more than a decade (Lipscomb, 2020; Seiter, 2020).

When Texas fell under Mexican control in 1821, the Mexican government encouraged white settlers to immigrate to the underpopulated region that the Karankawa had called home. Anglo-American Texans flooded in, straining the region's natural resources. The settlers waged constant war against the Karankawa to drive them off. During the Texas Republic era, the Karankawas were politically demonized and pushed into Mexico, then back into Texas. To survive, many of them took Mexican last names or allied themselves with white ranchers and assimilated into those communities. The last band of Karankawas was eradicated in 1858 in Rio Grande City along the Texas/Mexico border (Lipscomb, 2020; Seiter, 2020).

Modern Karankawas call themselves "the Karankawa Kadla," meaning mixed or partial Karankawa, and they have made considerable efforts to revitalize their language and cultural traditions in the region (Lipscomb, 2020). They are not a Federally recognized Tribe.

2.4.3 Merchant Vessels and Harbors of the 18th and 19th Centuries

Ports developed along the lower Texas Coast supported various industries, including fishing, cattle and sheep ranching, and ship building. Local leaders saw the economic advantages the bay area could bring if further developed. Families settled into the area, businesses and schools opened, and a system of channels and harbors supported maritime shipments. In the 1780s, Governor Bernardo de Gálvez established a port of entry and customhouse in what is now Refugio County, named El Cópano. The port served Refugio and neighboring towns, and its formidable reputation encouraged settlement in the area. (Long, 2020a; Leffler, 2020).

White settlers were not permanently established in the Corpus Christi Bay area until September 1839 when entrepreneurs Henry Lawrence Kinney and his partner, William P. Aubrey, established a trading post on the west shore of Corpus Christi Bay (Long, 2020a; 2020b). The town was small with no more than 20 reported residences.

When the United States acquired the Texas Republic, the nation feared that Mexican forces would try to reclaim portions of their former territory. The U.S. government sent Army General Zachary Taylor to the beach at Corpus Christi in July of 1845 to stand ready to enforce its claim on the southern border. More than half of the U.S. Army camped at Fort Marcy – as Taylor called it – along a mile-long site near the site where United States Ship (USS) *Lexington* is moored today until the following March of 1846 (Payne, 1970). The seven-month encampment spurred the growth of Corpus Christi. Various traders, entrepreneurs, and Federal resources poured into the area to service the almost 4,000 men stationed on a desolate stretch of sand. Larger trade routes were set up to connect the camp by land to the other military forts and by sea to the greater Gulf Coast for provisions, mail, and general trade. The summer months were favorable, but the winter made the area's shortcomings clear. Inadequate housing and a lack of wood for heat and cooking left scores of men ill and bedridden. Future U.S. Presidents Zachary Taylor and Ulysses S. Grant, in addition to a host of future high-ranking military leaders of the Civil War, lived at the camp before moving south during the Mexican American War (Payne, 1970).

Corpus Christi's shortcomings compared to other Texas coastal communities became increasingly clear as populations rose during the second half of the 19th century. Corpus Christi lacked access to fresh water and a deep-water port, making it somewhat of a lawless frontier town. In addition, there was no effective city government until the 1850s. However, by the 1860s, the population had grown to 1,200 and new schools and businesses were built (Long, 2020b).

2.4.4 The Study Area During the Civil War

The Civil War reached the study area in the summer of 1862, during the Battle of Corpus Christi. A part of the Texas Coast from Pass Cavallo to Corpus Christi was under blockade by United States Ship (USS) *Arthur.* Commerce, however, continued through the port at Corpus Christi because USS *Arthur* had too deep of a draft to pass through the barrier islands. Lieutenant John W. Kittredge, commander of *Arthur,* later received two vessels from New Orleans, *Corypheus,* a yacht, and *Sachem,* a steamer, both of which could pass through the shallow waters and into the interior waterways of Corpus Christi. Once inside, his shallow-drafted Union vessels captured Confederate Ship *Reindeer* and Confederate Ship *Belle Italia* and converted them into Union gunboats. On August 12, 1862, Kittredge commanded a fleet made up of *Corypheus*, *Sachem*, *Reindeer*, and *Belle Italia* into Corpus Christi Bay, and captured Confederate Ship *Breaker* (Delaney, 2020).

A conflict between the Union naval fleet and Confederate ground forces at Corpus Christi ensued after civilians fled the area. Confederate forces managed to drive back the Union fleet despite being outgunned and outmanned but keeping the city under Confederate control was hardly a celebratory victory. The years after the Battle of Corpus Christi left many of the city's residents unprotected from encroaching United States' forces and cut off from supplies. Residents were faced with starvation and constant turmoil until the war ended three years later (Delaney, 2020).

2.4.5 Post-Civil War Era

Following the Civil War, Corpus Christi, and the surrounding areas, including Port Aransas and Refugio, supported sheep and cattle ranching. Port Aransas, formerly known as Ropesville and Tarpon, is located on Mustang Island. The port town, St. Mary's of Aransas, found on Copano Bay, was the largest lumber and building-materials center in western Texas. Merchants also shipped much-needed supplies out of the port during the Civil War. The war devastated Aransas County's economy, and many towns were destroyed. However, towns such as Fulton and Rockport were founded in 1866 and 1867, respectively. Both towns supported the cattle industry, with Rockport home to several packeries. Rockport was eventually developed into a deep-water harbor, as was Aransas Pass in 1920 after several failed attempts (Long, 2020a).

Corpus Christi was used as a shipping center during a cattle boom in the 1870s, revitalizing the post-war economy. But it was not until the September 14, 1919 hurricane, which devastated the Gulf Coast, that Corpus Christi leaders implemented a plan for a deep-water port. To support its growing cattle trade, Corpus Christi dredged its main sea channel to allow access to larger steamers. Construction was completed on the port in 1926 (Long, 2020b). Its construction reduced the importance of Rockport's deep-water port (Long, 2020a).

The economy improved following the construction of the deep-water ports after being impacted by the damaging effects of the 1919 hurricane. In the years to follow, the construction of the Port of Corpus Christi, as well as the discovery of oil in Nueces County in 1930, offset the economic impact of the Great Depression (Long, 2020b). In addition, the late 19th century introduced shipbuilding and fishing into the market. The shrimping industry, introduced to the economy of Rockport by the 1930s, was prosperous, producing 51 million pounds of shrimp by the 1950s. Rockport's shipbuilding industry boomed during World War I and World War II (Long, 2020a). In 1965, the Port of Corpus Christi began dredging the navigational channels that are being upgraded as part of the current undertaking (Long, 2020b).

2.4.6 The Gulf Intracoastal Waterway

The proposed CDP crosses the Gulf Intracoastal Waterway (GIWW), a significant inland navigational and commercial waterway that parallels the Gulf coast, as it passes through the barrier Mustang and San José islands into Nueces Bay. The GIWW is a 1,100-mile-long, shallow-draft (~12 feet deep) canal system and interior waterway that runs continuously from the Port of Brownsville, Texas to Saint Marks, Florida. More than 30 percent of the entire GIWW (379 miles) follows Texas' coast (Texas Department of Transportation, 2020). Engineers and government leaders formulated the first concepts for the GIWW as an internal commercial system of interconnecting canals and roads as early as 1808, but, beyond occasional survey approvals, little physical progress was made throughout most of the 19th century. The first plans for the Texas portion of the GIWW were developed in 1875, but the dominant railroad industry successfully hindered most efforts to build it well into the 20th century (Leatherwood, 2021b). Prospectors' discovery of oil at the Spindletop field near Beaumont ushered in an oil boom that pushed canal development further, but the GIWW did not reach the study area until 1941 (Leatherwood, 2021b). Construction began in earnest when the United States entered World War II when the Gulf of Mexico became a primary hunting ground for German U-Boats (submarines). The US needed a safe transport corridor to carry supplies out of the gulf and into the open Atlantic Ocean. The GIWW was expanded and extended to its current dimensions during the War (Texas Department of Transportation, 2020; Leatherwood, 2021b).

2.4.7 Naval Aviation and Naval Air Station Corpus Christi

During the 1920s and 1930s, the U.S. Navy explored the fledgling tactic of employing aircraft in naval combat roles. These various wargaming exercises were called "Fleet Problems." By 1938, the U.S. Navy had 1,000 planes in service; however, that year, Congress authorized funds to triple naval air strength and construct new naval air stations (NAS). The Navy chose a location in Flour Bluff, fifteen miles southeast of Corpus Christi as one such NAS. The site was selected due to its favorable weather year-round and flat, undeveloped land. Corpus Christi Bay would also allow space for seaplanes to land. Construction on NAS Corpus Christi began quickly, and the station was commissioned on March 12, 1941. In early April, the first group of cadets reported for training (Coletta, 1985).

Following the Japanese attack on Pearl Harbor on December 7, 1941, NAS Corpus Christi was flooded with recruits. With its access to the ocean and port facilities, the station soon became a supply base for vessels involved in coastal patrol. In addition, the PBY *Catalinas,* used in advanced pilot training, conducted long-range patrols of the Texas Coast. In 1944, a torpedo bombing training squadron was also added to the facility. Pilots trained at NAS Corpus Christi typically joined carrier air wings or went on to fly multi-engine patrol bombers, as several types of aircraft were used to train cadets, including F6-F *Hellcats*, F8-F *Bearcats*, P2V *Neptunes*, and PBM *Mariners*.

During the 1950s, the Navy constructed more runways and navigation systems at NAS Corpus Christi. Training aircraft for primary recruits were upgraded to the T-28 *Trojan* planes while helicopters were being used at the base regularly. In 1954, the first F9F-2 *Panther* jet propelled aircraft began flying from NAS Corpus Christi; however, jet flight training quickly switched to NAS Kingsville in 1957. In 1956, USS *Antietam*, CV-36, arrived off NAS Corpus Christi, allowing pilots to become carrier qualified. By the mid-1960s, the Navy discontinued seaplane operations (Coletta, 1985), including landings in Corpus Christi Bay.

3.0 OVERVIEW OF KNOWN CULTURAL RESOURCES IN THE STUDY AREA

The following section is a summary of previously-recorded terrestrial and offshore archaeological sites, surveys, cemeteries, NRHP properties or districts, and other cultural resources within the study area that have been recorded in various databases. These include:

- THC's Online Archeological Sites Atlas (THC Atlas, 2021)
    - NRHP-listed Districts and Properties
    - Historic-age cemeteries
    - Previously conducted terrestrial and underwater archaeological investigations (locations, reports of findings)*
    - Previously recorded archaeological sites*
    - Previously recorded historic shipwrecks*
- Texas State Marine Archeologist (at the THC)
    - Various records and past investigation reports not available on the Atlas.
- National Oceanic and Atmospheric Administration (NOAA) Automated Wreck and Obstruction Information System (AWOIS) and Electronic Navigation Chart (ENC) Datasets (NOAA, 2021)
    - Recorded historic and recent shipwreck general locations and descriptions.

** Denotes datasets that contain sensitive archaeological site location information. These data are restricted from public presentation or distribution.*

3.1 TERRESTRIAL CULTURAL RESOURCES

3.1.1 National Register of Historic Places Properties and Districts in the Study Area

According to the THC's Atlas (2021), six NRHP listed Districts (Table 1) and 14 NRHP listed properties are located within the study area (Table 2). Most of these resources are individual residences, commercial buildings, and other structures that are far away from the CDP project's Area of Potential Effects (APE). Previous CDP cultural resource coordination resulted in a determination that none of these resources is likely to be affected by the proposed action. The Aransas Pass Light Station is the closest National Register-listed resource to any of the proposed project components.

Table 1
Historic Districts within the Study Area

National Register Reference #	Year Listed	Historic District	County
77001423	1977	Aransas Pass Light Station	Aransas
88001829	1988	Broadway Bluff Improvement	Nueces
6000121	2016	600 Building	Nueces
15000336	2015	Galvan Ballroom	Nueces
66000820	1966	King Ranch	Kleberg, Kenedy
96000065	1996	Seale, Wynn, Junior High School	Nueces

Source: THC Atlas (2021).

Table 2
National Register Listed Properties within the Study Area

National Register Reference #	Year Listed	County	NRHP Property Name
83003155	1983	Nueces	Guggenheim, Simon, House
75001945	1975	Aransas	Fulton, George W., Mansion
79003002	1979	Nueces	Tarpon Inn
79003003	1979	Nueces	Old St. Anthony's Catholic Church
93000129	1993	Nueces	King, Richard, House
94001016	1994	Aransas	Hoopes--Smith House
71000918	1971	Aransas	Mathis, T.H., House
76002054	1976	Nueces	Britton-Evans House
83003156	1983	Nueces	Lichtenstein, S. Julius, House
83003157	1983	Nueces	Sidbury, Charlotte, House
76002055	1976	Nueces	Nueces County Courthouse
03001043	2003	Nueces	USS *Lexington*
83003811	1983	Refugio	Wood, John Howland, House
10000863	2010	Nueces	Sherman Building

Source: THC Atlas (2021).

3.1.2 Recorded Historic-Age Cemeteries within the Study Area

According to the THC Atlas (2021), 39 previously recorded historic-age cemeteries are mapped within the study area (Table 3). San Ignacio Cemetery, near the community of Ingleside, is the closest of any of these historic-age cemeteries to the CDP project vicinity, but it is still roughly 1.6 miles away. This cemetery is briefly discussed in the Impacts chapter.

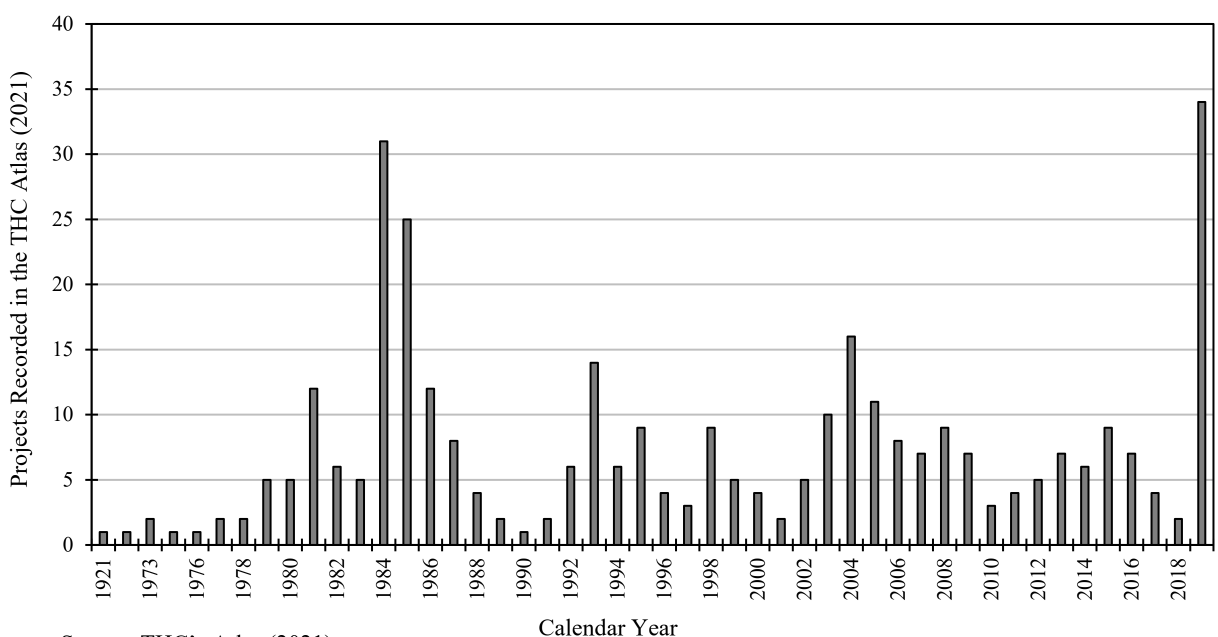
Table 3
Previously Recorded Cemeteries within the Study Area

THC Cemetery #	Cemetery Name	County
NU-C003	Memory Gardens	Nueces
RF-C004	St Bernard	Refugio
RF-C005	La Rosa	Refugio
RF-C006	Oakwood	Refugio
NU-C013	Seaside Memorial	Nueces
NU-C014	Aberdeen	Nueces
NU-C033	Rose Hill	Nueces
NU-C018	Holy Cross	Nueces
NU-C002	Old Bayview	Nueces
NU-C009	Nueces County	Nueces
NU-C031	Mercer	Nueces
NU-C022	Royal Palms	Nueces
NU-C011	Robstown	Nueces
NU-C025	Hebrew Rest	Nueces
NU-C008	St. Anthony's	Nueces
AS-C005	McLester Family	Aransas
AS-C008	Barber	Aransas
NU-C016	Sunshine	Nueces
NU-C001	Duncan	Nueces
AS-C001	Cementerio San Antonio de Padua	Aransas
AS-C002	Fulton	Aransas
AS-C003	Rockport	Aransas
AS-C004	Lamar	Aransas
AS-C006	Powell-Young	Aransas
AS-C007	Aransas Memorial Park	Aransas
SP-C001	Sinton	San Patricio
SP-C008	San Pedro	San Patricio
SP-C010	Bethel	San Patricio
SP-C012	Bellevue	San Patricio
SP-C013	San Patricio Memorial Park	San Patricio
SP-C014	Portland	San Patricio
SP-C015	Prairie View	San Patricio
SP-C016	San Ignacio	San Patricio
SP-C022	Eternal Rest	San Patricio
SP-C025	Meansville	San Patricio
RF-C003	Saint Mary's	Refugio
SP-C011	Rosita	San Patricio
SP-C020	Welder Grave	San Patricio
NU-C019	New Bayview	Nueces

Source: THC Atlas (2021).

3.1.3 Previously Conducted Terrestrial Archaeological Investigations in the Study Area

The THC's Atlas includes information regarding all recorded terrestrial archaeological field projects (that the state is informed of) conducted within the state. These projects include reconnaissance and intensive field surveys, NRHP and/or SAL-eligibility testing, and data recovery excavations. Information thoroughness and accuracy varies between the records but one can make some general interpretations from the dataset. The THC Atlas (2021) records indicate that 344 terrestrial field investigations have been conducted within the study area with the earliest dating back to 1921 (Figure 1). The USACE oversees a range of public and private development projects such as navigation improvements, oil and gas pipelines, and general infrastructure. The 109 recorded terrestrial projects in the study area attributed to the USACE – nearly five times its nearest neighbor – reflects the agency's broad oversight (Table 4). Archaeological surveys and intensive site investigations associated with road and other transportation improvement projects, sponsored by the Texas Department of Transportation (n=23; and its earlier iteration as the Texas Department of Highways and Public Transportation: n=7) or the Federal Highway Administration (n=15), make up another significant component of recorded field investigations. None of the previously conducted terrestrial projects directly overlaps the CDP APE; however approximately 33 – roughly 10 percent of the total number of recorded terrestrial field investigations – are within 3,000 feet of it. Findings from the remaining 311 recorded investigations are unlikely to contribute significant insights relevant to the CDP's potential to impact significant terrestrial archaeological resources.



Source: THC's Atlas (2021).

Figure 1. Recorded Archaeological Field Investigations Conducted within the Study Area

Table 4
Summary of Previously Conducted Terrestrial Archaeological Projects in the Study Area

Project Sponsor/Agency	Number of Projects
U.S. Army Corps of Engineers-Galveston District	109
Texas Department of Transportation	23
City of Corpus Christi	20
Environmental Protection Agency	17
Federal Highway Administration	15
U.S. Air Force	11
Texas Water Development Board	10
Texas Parks and Wildlife Department	9
Texas Department of Highways and Public Transportation	7
Port of Corpus Christi Authority	6
U.S. Navy	6
Housing and Urban Development	6
Federal Energy Regulatory Commission	5
Texas A&M University - Corpus Christi	4
Lower Colorado River Authority	4
Federal Housing Administration	3
City of Rockport	3
Nueces County	3
City of Portland	2
San Patricio Municipal Water District	2
General Services Administration	2
Aransas County	2
Veterans Administration	2
Other*	22
Null/Unknown	*51*
Total	344

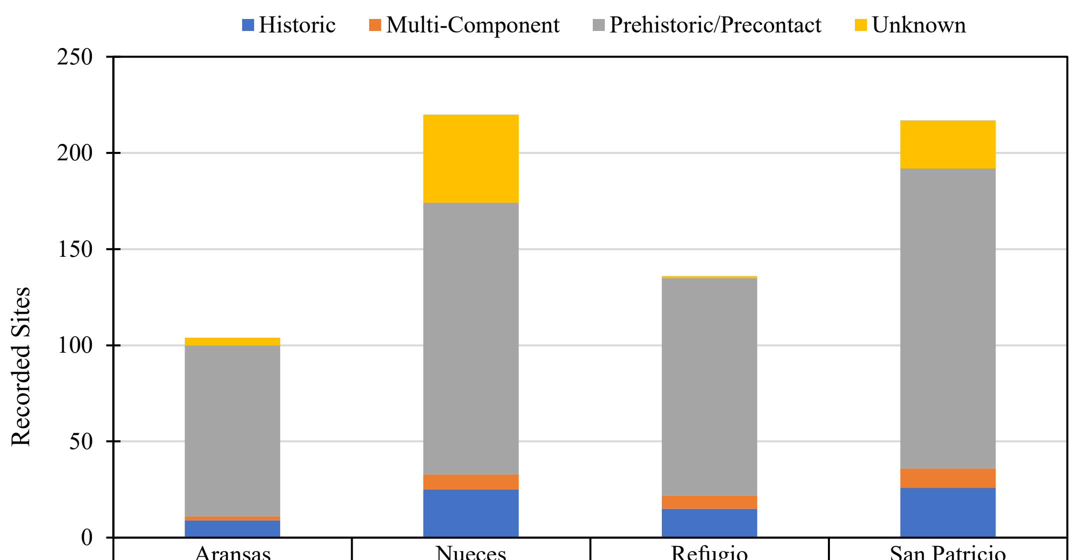
*Other: Gregory-Portland Independent School District, Bureau of Reclamation, City of Fulton, Port of Corpus Christi Authority, U.S. Fish and Wildlife Service, Private, US Fish and Wildlife, Refugio County, Texas General Land Office, San Patricio County Drainage District, Naismith Engineering, Inc., Naval Facilities Engineering Command Southeast, City of Woodsboro, U.S. Army, Voestalpine Texas LLC, Environmental Protection Agency, Bureau of Land Management, Federal Communications Commission, Witte Museum, Texas Commission on Environmental Quality, City of Port Aransas, and Nueces County Coastal Parks System (1 recorded survey each).

Source: THC Atlas (2021).

3.1.4 Previously Recorded Terrestrial Archaeological Sites in the Study Area

The THC's Atlas (2021) records indicate that there are 677 previously recorded terrestrial archaeological sites within the overall study area (Figure 2). These sites are remnants of a range of occupations from humans' earliest millennia in the region to the early-to-mid-20th century. Most of these sites dot the shorelines of the study area's major water bodies while many have been recorded farther inland. Across each of the study area counties, site age distributions are similar: most recorded sites are attributed to pre-contact/prehistoric periods while historic-age sites make up roughly 10 percent of a given county's site tally. The overwhelming majority of recorded prehistoric/precontact site components are of an unspecified age (Table 5). In some part, the unattributed components could be an indication of incomplete or inaccurate site records in the THC's database. With that said, many archaeological sites are small, isolated lithic flake or shell scatters with no specific types of artifacts that archaeologists know date to a certain historical period, called "diagnostics." As a result, a substantial number of these sites' ages remain unspecified.

Most of the recorded prehistoric sites date to the Late Prehistoric or Late Archaic/Late Prehistoric periods (from 3,000 to 300 years ago). Also of note, only one recorded site (41SP157 in San Patricio County) in the study area has an identified Paleoindian component. This matches the regional cultural chronology patterns discussed above. Most of the recorded prehistoric archaeological sites/site components within the study area are small, isolated lithic scatter sites like those described above (Table 6). When one includes the even more sparse scatters, these non-descript sites make up more than 60 percent of the total tally. A third of the prehistoric sites are defined as occupation sites, most often with shell middens. This is indicative of the bay systems' influence on ancient people's lives. In addition, nine site records include references to containing human remains: 41AS80, 41NU60, 41NU66, 41NU276, 41RF20, 41SP1, 41SP45, 41SP64, and 41SP203. Many of these sites were recorded decades ago in poor condition, eroded on shorelines and none are mapped in the CDP's project vicinity.



	Aransas	Nueces	Refugio	San Patricio
Unknown	4	46	1	25
Prehistoric/Precontact	89	141	113	156
Multi-Component	2	8	7	10
Historic	9	25	15	26

Source: THC Atlas (2021).

County

Figure 2. Distribution of the Ages of Terrestrial Archaeological Sites within the Study Area (Divided by Bounty and Primary Site Component Age)

Table 5
Summary of Recorded Terrestrial Archaeological Site Components in the Study Area

Prehistoric/ Precontact Period	Number of Components	Percentage of Total
Late Paleoindian/Archaic	1	10.2
Archaic	36	6.8
Early Archaic	1	0.2
Early/Middle Archaic	1	0.2
Middle/Late Archaic	1	0.2
Late Archaic	16	3.0
Late Archaic/Late Prehistoric	17	3.2
Late Prehistoric	73	13.9
Unspecified	*380*	*72.2*
Total	526	100.0

*Divided by specific component age

Source: THC Atlas (2021).

Table 6
Summary of Recorded Terrestrial Prehistoric Archaeological Sites/Site Components in the Study Area*

Recorded Prehistoric Site/ Site Component Type	Number of Recorded Sites	Percentage of Total
Scatter/campsite	244	46.4
Occupation/midden/shell midden	165	31.4
Unknown Prehistoric	95	18.1
Scatter/campsite; shell midden	13	2.5
Prehistoric burial/cemetery	8	1.5
Scatter/campsite; prehistoric burial/cemetery	1	0.2
Total	526	100.0

* Divided by Site type

Source: THC Atlas (2021).

Pre-contact archaeological sites that now lie underwater but were originally on dry land would follow similar distributional patterns of terrestrial pre-contact archaeological sites farther inland. Typically, terrestrial archaeological sites of this period are denser on terraces overlooking waterways. Periodic floods along these waterways carry mud that can bury remnants of ancient campsites, homes, and other features, preserving them in place (Davis, 2017). This preservation gives archaeologists more data from which to learn about the people who used and created the site and therefore makes them more scientifically valuable. Even though they are now underwater, many of these relict river and stream channels – and their corresponding terraces – are detectable within the study area. Bathymetric data indicates that most of the modern Corpus Christi Bay complexes were terrestrial terraces overlooking the confluence of the Nueces and Mission rivers during this period (Evans, 2016). The ancient Nueces River channel continued southward, through Redfish Bay and what is now Mustang Island State Park, where it eventually emptied into the Gulf at the Outer Continental Shelf. Because of natural siltation processes within the Gulf, prehistoric cultural deposits could be preserved under more recent Holocene deposits (Evans, 2016; Davis Jr., 2017).

As stated above, historic-age archaeological sites make up roughly 10 percent of the total study area assemblage. This is likely the result of two factors: 1) archaeologists did not typically study and formally record historic-age sites as intensively before cultural resource regulatory laws were put in place; and 2) the "historic" period lasts for only 300-400 years, roughly five percent of the full span of human occupation in the region. Not enough time has passed in the historic period to generate as many sites as the 8,000-year prehistoric period. Accordingly, when viewed in relation to their prehistoric counterparts, the density of historic-age sites is high (Table 7). Domestic and farmstead sites make up nearly half of all the historic-age sites, most dating to the late 1800s and early 1900s. Nondescript trash scatters make up another quarter of the total historic-age site tally. Other notable sites relate to military (41NU253, Zachary Taylor's Army Camp site; 41AS82, Shellbank Island Civil War Fort; and 41NU361, military housing remnants at Corpus Christi NAS), commercial (41SP35, La Quinta Mansion; 41SA95, a mid-19th-century salt production facility), and transportation (41NU289 and 41NU290, remnants of the Aransas Railroad and Ransom Island causeways) activities. Four cemeteries/burial sites are among the THC Atlas (2021) site records for the study area as well: 41NU254, 41RF143 (the Plummer's Graves Cemetery), 41SP122 (Hatch Preemption Cemetery), and 41SP276 (Portland/Georgia Cemetery). All are attributed to the late 19th century.

Table 7
Summary of Recorded Historic-Age Terrestrial Archaeological Sites/Site Components in the Study Area*

Recorded Historic-Age Site Type/Primary Age	Sites/Site Components	Percentage of Total
Agriculture	2	2
1901-1950	1	50
Unspecified	1	50
Burial/cemetery	4	3.9
1851-1900	4	100
Commerce/Transportation	5	4.9
1851-1900	2	40
1901-1950	3	60
Commercial	7	6.9
1801-1850	1	14.3
1901-1950	6	85.7
Domestic/Farmstead	44	43.1
1801-1850	1	2.3
1851-1900	15	34.1
1901-1950	17	38.6
Unspecified	11	25

Recorded Historic-Age Site Type/Primary Age	Sites/Site Components	Percentage of Total
Education	2	2
1851-1900	2	100
Engineering/Industrial	3	2.9
1901-1950	3	100
Military	6	5.9
1801-1850	1	16.7
1851-1900	3	50
1901-1950	1	16.7
Unspecified	1	16.7
Nondescript scatter/trash dump	29	28.4
1851-1900	1	3.4
1901-1950	14	48.3
Unspecified	14	48.3
Grand Total	102	100

* Divided by site type and primary age.

Source: THC Atlas (2021).

Previously recorded sites 41NU92, 41NU153, and 41NU210 are located within the proposed CDP's APE. They will be discussed in more detail in the Impacts chapter. Below is a summary of some of the other previously recorded sites within the study area but are farther away. Though they are not likely to be impacted by the undertaking, they are indicative of the types of terrestrial archaeological resources in the project vicinity.

Site 41SP28 is part of a series of shell middens that were recorded on a shoreline dune ridge on the northern shore of Corpus Christi Bay. Shell middens along the dune ridge typically hold the remains of lithic tools and fire-hardened clay in addition to the shell artifacts. Many of these sites are dateable only by projectile points; in the case of 41SP28, two dart points were recovered: one Tortugas point and the other a Plainview type, dating the site to sometime in the Middle to Late Archaic (41SP28 Site Record in THC Atlas, 2021). Evidence for long-term occupation in the study area is prevalent.

Site 41SP11 is the location of a substantial prehistoric occupation; artifacts at the site included several types of lithic dart points (Darl, Catan, Perdiz, Eddy, Starr, and Young), shell tools, stone pipe fragments, decorated and undecorated ceramics, and a glass bead. Artifacts seen at Site 41SP108 indicate a camp site and associated shell midden. In addition to the midden, artifacts included lithics, burned bone, and ceramics. Site 41SP78 was the location of a prehistoric burial that includes five to seven individuals and associated burial goods like a necklace, Ensor lithic point, and bone objects (41SP11 Site Record in THC Atlas, 2021).

While shell middens such as 41SP28 demonstrate that humans occupied the area during the Archaic Period, the ceramics at 41SP108 and 41SP11 and burials at 41SP78 indicate temporally longer occupations and possibly permanent settlements by the Late Prehistoric period (Rutherford et al., 2018).

Sites 41NU253 and 41NU351 have been identified as the locations of General Zachary Taylor's Camp during the Mexican American War. Artifacts recovered from 41NU253 included clay pipes, bottles, ammunition, and military accoutrements including buttons and belt buckles (41NU253 site record in Atlas, 2021). Site 41NU351 is also part of General Taylor's encampment at Corpus Christi, and it is located within modern-day Artesian Park. The park was named after a well that was drilled at the site to supply fresh water for the army during Taylor's encampment. The archaeological site has a subsurface layer of coal and iron slag left over from the seven-month encampment. After the Civil War, the area was presumably used as a leisure area; archaeologists encountered bottles dating from 1878 to 1882 (41NU351 site record in THC Atlas, 2021).

Finally, Site 41AS91 was initially recorded in 1995 as a potential army supply depot and camp dating to the Mexican American War and potentially re-used during the Civil War. Though informants visited the site, the high sand dunes obscured what historical records suggested might be buried features such as the quartermaster's headquarters, ordinance stores, general hospital, and more. Archaeologists did not observe any such features and based their interpretations primarily on archival records. In 2001, archaeologists returned to the site area. This time, investigators successfully interpreted that the landform on which the original 41AS91 boundary had been recorded had not developed until the 1870s, after the Aransas Lighthouse was constructed. The site recorders in 2001 did find structural features, including brick fragments and wooden posts that they attributed to a factory built in 1934. The site's original boundary is adjacent to the proposed SJI project component, but the revised site boundary is farther to the west, away from the APE. Archaeologists recommended that the site's NRHP and SAL eligibility was undetermined, pending additional investigation (41AS91 site records in THC Atlas, 2021).

Other sites associated with leisure along the bay shore include the site of the Harbor Inn (41SP199), a resort dating to the early 20th century. Structural elements and steps are located on site along with caliche-lined walkways. Artifacts recovered from the site included colorless glass, cow bone, and refrigerator and stove parts (41SP199 site record in Atlas, 2021). Historic causeways leading to the barrier islands include sites 41NU289 and 41NU290. Site 41NU289 is the remains of a 1912 railroad causeway leading to docking facilities on Harbor Island, and 41NU290 is of the remains of a causeway leading to 1930s and 1940s resorts on Ransom Island (THC Atlas, 2021).

3.2 UNDERWATER/MARITIME CULTURAL RESOURCES WITHIN THE STUDY AREA

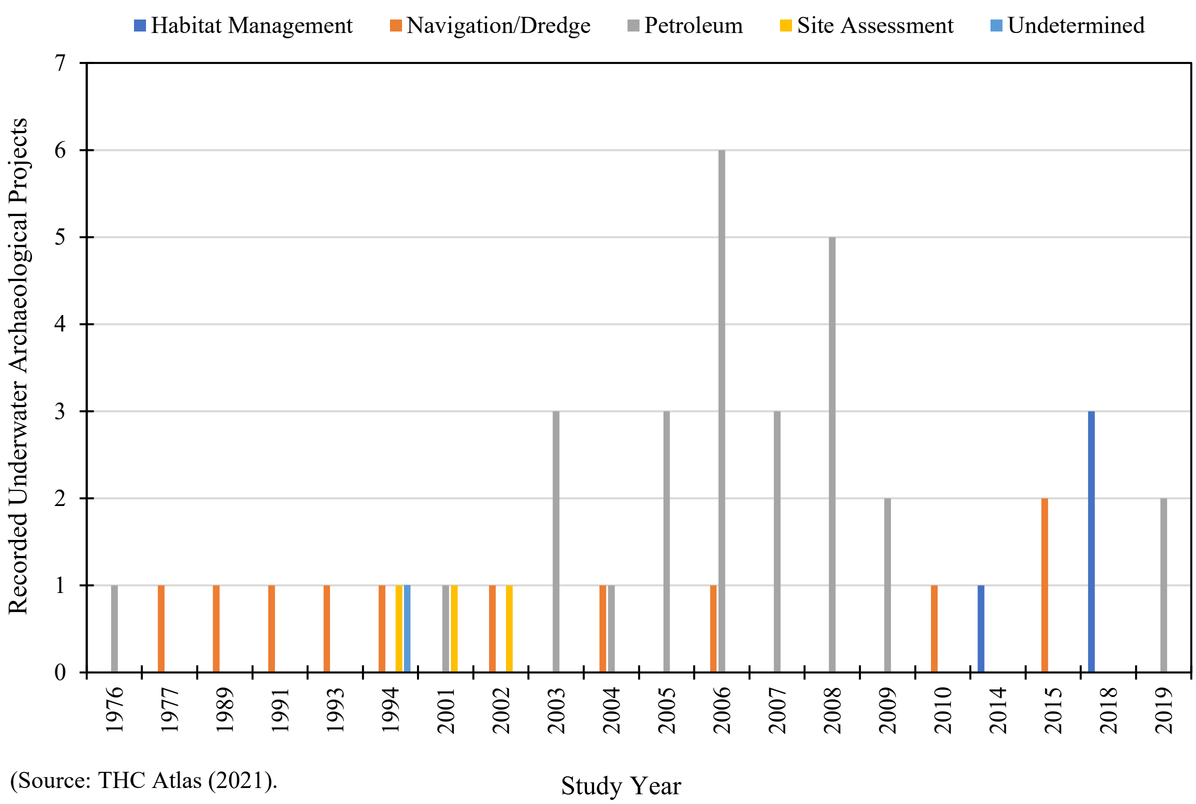
3.2.1 Previously Conducted Underwater Archaeological Surveys

According to the THC Atlas (2021), underwater archaeologists have conducted 46 surveys within the study area. These surveys cover nearly 31,000 acres of submerged lands in the study area and span more than 40 years, beginning in 1976 and extending to 2019. Investigations supporting the petroleum industry (n=27) make up nearly 60 percent of the total number of projects, while navigational, dredging, and other infrastructure improvements account for another quarter (n=11). Other surveys correspond with reef and habitat improvement projects (n=4), and specific site assessments (n=3; Table 8). Most of these projects were conducted regularly throughout the 43 years of recorded investigations, but a distinct increase in petroleum-industry-related surveys corresponds with the recent fracking boom of the mid-to-late 2000s (Figure 3). Ten of the 46 recorded investigations overlap or are located adjacent to CDP project components. Those surveys will be discussed in more detail in the Impacts chapter.

Table 8
Summary of Recorded Underwater Archaeological
Surveys Conducted in the Study Area

Proponent Industry	Number of Surveys	Percentage of Total Surveys
Petroleum	27	59.0
Navigation/Dredge	11	24.0
Habitat Management	4	9.0
Site Assessment	3	7.0
Undetermined	1	2.0
Total	46	100.0

Source: THC Atlas (2021).



(Source: THC Atlas (2021).

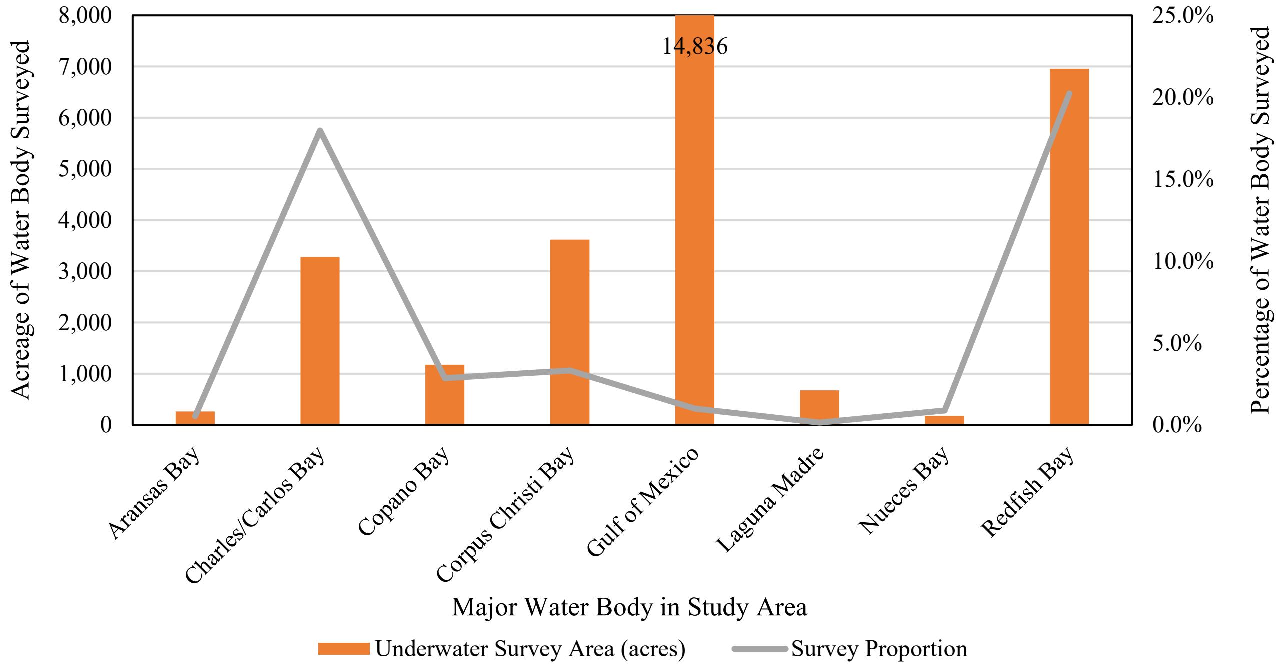
Figure 3. Recorded Archaeological Field Investigations Conducted within the Study Area

Intensive archaeological survey is necessary to determine with certainty how a proposed action (e.g., a construction project like the proposed CDP) might impact – directly or indirectly – archaeological cultural resources. Bulk geographic data from Texas Parks and Wildlife's Coastal Fisheries Division (2018) and aggregated information from underwater archaeological investigations within the PCCA CDP study area (THC Atlas, 2021) offer a preliminary glimpse of what might be affected once the project begins construction. Table 9 and Figure 4 provide breakdowns of these datasets. At the most basic level, little of the study area has been physically investigated. Collectively, more than two million acres of the study area's underwater footprint (more than 98 percent; larger than the state of Delaware) has never been subject to formal archaeological investigations. Most of the individual water bodies, though higher than the overall average, have three percent or less survey coverage. A significantly greater proportion of Charles/Carlos Bay, near the study area's eastern edge, and Redfish Bay, just inside the breakwater, have been previously surveyed. For the former, this is likely a reflection of the bay's small size, while the latter corresponds with a particularly busy part of the study area with numerous previous development projects.

Table 9
Summary of Geographic and Cultural Resource Distribution Data within the Study Area

Water Body	Total Area (acres)	Underwater Survey Area (acres)	Survey Proportion (Percent)	Recorded THC Shipwrecks	Underwater Surveys	Shipwrecks Per Surveyed Acre	Surveyed Acres Per Shipwreck
Aransas Bay	50,970	266	0.5	10	9	0.0376	26.6
Charles/Carlos Bay	18,252	3,280	18.0	0	1	0.0000	N/A
Copano Bay	41,190	1,173	2.8	3	5	0.0026	391.1
Corpus Christi Bay	108,968	3,617	3.3	18	11	0.0050	200.9
Gulf of Mexico	1,490,390	14,836	1.0	89	6	0.0060	166.7
Laguna Madre	472,615	674	0.1	1	1	0.0015	674.1
Nueces Bay	19,842	175	0.9	0	2	0.0000	N/A
Redfish Bay	34,385	6,958	20.2	28	11	0.0040	248.5
Total	2,236,610	30,980	1.4	149	46	0.0048	207.9

Source: THC Atlas (2021); Texas Parks and Wildlife Department (TPWD, 2018).



Source: THC Atlas (2021); TPWD (2018).

Figure 4. Previous Underwater Survey Coverage of the Study Area by Water Body/Bay System

Researchers can expect greater interpretive accuracy from a combination of the total survey acreage *and* the proportion of that coverage compared to the overall study area. From that perspective, data projections generated from earlier surveys in Corpus Christi and Redfish bays are likely more correct than those from, for instance, Nueces Bay or Laguna Madre. While the previous investigations do tell us a lot about the types of archaeological resources that the CDP may impact, it is essential to remember that we are basing that understanding on a tiny portion of the overall picture.

3.2.2 Previously Recorded Shipwrecks within the Study Area

THC records list 149 recorded shipwrecks within the study area (THC Atlas, 2021). Fifty-four (n=54) of those are nearest to the proposed segments of the CDP APE. Twenty-seven (n=27) of these recorded shipwrecks correspond with entries in NOAA's AWOIS/ENC databases. An additional 31 AWOIS shipwreck records are mapped in the study area but do not correspond with THC shipwrecks. This brings the total number of recorded shipwrecks in the study area to 180. Table 10 includes the list of known shipwrecks inside the study area, as well as their THC Shipwreck Number and/or AWOIS Record Number, the year each was lost, a trinomial (if the shipwreck is also an archaeological site), each shipwreck's SAL status, what type of vessel (if known), and its estimated position accuracy (THC Atlas, 2021; NOAA, 2021).

Table 10
Reported Shipwrecks within the Study Area

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
5	–	*Henrietta*	1888	–	yes	sailing ship, merchant	1.0 mile	–
31	182	*Empress*	1955	–	no	trawler	1.0 mile	THC, AWOIS, ENC
41	–	Unknown	pre–1943	–	no	barge	"excellent"	–
51	4175	*Mary*	1876	41NU252	yes	sail–steam, merchant	"exact"	THC, AWOIS
113	–	Unknown	1834	–	yes	sailing ship	15.0 miles	–
114	–	*Wildcat*	1834	–	yes	sail	5.0 miles	–
115	–	*Cardena*	1834	–	yes	sailing ship, merchant	3.0 miles	THC
137	191	*Atlanta*	1957	–	no	unknown	1.0 mile	THC, AWOIS, ENC
141	–	*Baddacock*	1920	41NU282	no	sail tug	–	–
153	–	*Bertha*	1917	–	no	unknown	5.0 miles	–
156	–	*Betty Sca*	1966	–	no	oil screw	–	–
165	–	*Captiva II*	1942	–	no	yacht	3.0 miles	–
175	–	*Chuckadee*	1963	–	no	shrimp boat	1.0 mile	–
192	–	*Colonel Yell*	1847	–	yes	sail–steam, merchant	2.0 miles	THC
197	–	*Coral Sands*	1955	–	no	unknown	–	THC
208	–	*Dayton*	1845	–	yes	sail–steam, merchant	–	–
214	–	*Desco*	1966	–	no	oil screw	–	–
215	–	*Dixie Dandy*	1957	–	no	oil screw	–	–
235	–	*Electra*	1955	–	no	unknown	5.0 miles	–
256	–	*40 Fathom No. 12*	1955	–	no	unknown	0.5 miles	THC
260	–	*Florette*	1938	–	no	unknown	20.0 miles	–
286	–	*Guyton No. 1*	1916	–	no	barge	1.0 mile	THC
287	–	*Guyton No. 10*	1911	–	no	barge	5.0 miles	THC, ENC
307	–	Unknown	1865	41NU153	yes	anti–torpedo raft; naval vessel	0.10 miles	–
315	–	*Japonica*	1941	–	no	oil screw	5.0 miles	–
316	–	*Jesse C. Barbour*	1922	–	no	sailing ship, merchant	20 miles	–

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
343	–	*Libbie Shearn*	1911	–	no	sailing ship, merchant	3.0 miles	–
423	–	*Philidelphia*	1868	–	yes	sail–steam, merchant	1.0 mile	–
469	–	*San Jacinto*	1960	–	no	oil screw	5.0 miles	–
512	–	*Umpire*	1852	–	yes	sail–steam, merchant	0.5 miles	THC
513	11022(?)	Unknown (*Utina*?)	–	41NU264	no	–	–	THC, AWOIS
609	–	*Mary E. Lynch*	1902	–	no	sailing ship, merchant	1.5 miles	–
623	–	*Mystery*	1899	–	yes	sailing ship, merchant	–	–
637	–	*Hannah*	1862	–	yes	sailing ship, merchant	–	–
653	–	*Mattie*	1873	–	yes	sailing ship, merchant	0.5 miles	THC
655	–	*Mary Agnes*	1862	–	yes	sailing ship, merchant	5.0 miles	THC
658	–	*Lottie Mayo*	1886	–	yes	sailing ship, merchant	3.0 miles	–
659	–	*Louisa*	1865	–	yes	sailing ship, merchant	5.0 miles	–
853	176(?)	Unknown	1954	–	no	unknown	–	THC, AWOIS, ENC
854	–	*Tarambana*	1967	–	no	unknown	–	–
855	185(?)	Unknown	1960	–	no	trawler	0.5 miles	THC, AWOIS, ENC
858	4162	*Hill Tide*	1967	–	no	–	1.0–3.0 miles	THC, AWOIS, ENC
860	–	*Liboria C.*	1954	–	no	trawler	1.0 mile	–
861	201	*Blue Bonnet*	1967	–	no	trawler	–	THC, AWOIS
992	–	*Lake Austin*	1903	–	yes	trading scow	3.0 miles	THC
1019	–	Unknown	pre–1928	–	no	unknown	0.25 miles	THC
1024	4190	Unknown	–	–	no	unknown	–	THC, AWOIS, ENC
1025	4193	*Lisa Gail*	1972	–	no	unknown	–	THC, AWOIS, ENC
1027	–	Unknown	pre–1968	–	no	unknown	0.25 miles	THC
1028	195	*De Rail*	1972	–	no	cabin cruiser	0.25 miles	THC, AWOIS

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
1030	–	Unknown	pre–1950	–	no	unknown	0.25 miles	THC
1031	4175	*Jimbo*	1965	–	no	fishing boat	0.35 miles	THC, AWOIS
1032	5020	*John Worthington*	1944	41AS88	no	oil tanker	"exact"	THC, AWOIS, ENC
1045	–	*William Bagley*	1863	–	yes	sail–steam, merchant	3.0 miles	THC
1047	–	Unknown	pre–1935	–	no	unknown	0.25 miles	THC
1049	–	*Ramyrez*	1882	–	yes	unknown	0.25 miles	THC
1056	–	Unknown	pre–1853	–	yes	schooner	0.5 miles	THC
1086	–	Unknown	pre–1971	–	no	unknown	–	THC
1087	–	Unknown	pre–1973	–	no	unknown	0.25 miles	THC
1088	–	Unknown	pre–1975	–	no	unknown	0.5 miles	THC
1089	–	Unknown	pre–1966	–	no	unknown	0.5 miles	THC
1090	–	Unknown	1977	–	no	unknown	–	THC, ENC
1091	–	Unknown	pre–1977	–	–	unknown	–	THC
1092	–	Unknown	pre–1967	–	no	fishing vessel	0.5 miles	THC
1180	–	Unknown	pre–1971	–	no	unknown	0.25 miles	THC
1181	–	Unknown	pre–1971	–	no	unknown	0.25 miles	THC
1218	5166(?)	Unknown	pre–1975	–	no	unknown	0.25 miles	THC, AWOIS
1219	–	Unknown	pre–1975	–	no	unknown	0.25 miles	THC
1220	–	Unknown	pre–1970	–	no	unknown	0.25 miles	THC
1221	5101(?)	Unknown	pre–1972	–	no	unknown	0.25 miles	THC, AWOIS
1222	–	Unknown	pre–1959	–	no	unknown	0.25 miles	THC
1223	10439(?)	Unknown	pre–1959	–	no	unknown	0.25 miles	THC, AWOIS, ENC
1224	5047(?)	Unknown	pre–1959	–	no	unknown	0.25 miles	THC, AWOIS, ENC
1225	5051(?)	Unknown	pre–1970	–	no	unknown	0.25 miles	THC, AWOIS, ENC
1226	–	Unknown	pre–1975	–	no	unknown	0.25 miles	THC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
1227	–	Unknown	pre–1968	–	no	unknown	0.25 miles	THC
1228	5967	Unknown	pre–1972	–	no	unknown	0.25 miles	THC, AWOIS
1229	–	Unknown	pre–1971	–	no	unknown	1.0 mile	THC
1230	–	Unknown	pre–1971	–	no	unknown	–	THC
1231	–	Unknown	pre–1975	–	no	unknown	–	THC
1232	4998	*Bahia Honda*	pre–1968	–	no	shrimp boat	0.25 miles	THC, AWOIS, ENC
1233	–	Unknown	pre–1970	–	no	unknown	–	THC, ENC
1234	10436	Unknown	pre–1959	–	no	unknown	0.25 miles	THC, ENC
1272	–	*L'éclair*	1866	–	yes	sailing ship, merchant	5.0 miles	THC
1289	–	Unknown	pre–1971	–	no	unknown	0.5 miles	THC
1411	–	*Two Marys*	1882	–	yes	sailing ship, merchant	0.5 miles	THC
1412	–	*Tex Mex*	1882	–	yes	sailing ship, merchant	0.5 miles	THC
1417	–	*Silas*	1902	–	no	sailing ship, merchant	2.0 miles	THC
1420	–	*Ellen*	1901	–	no	sailing ship, merchant	0.25 miles	THC
1422	–	*Mary Lorena*	1900	–	yes	sailing ship, merchant	1.0 mile	THC
1449	–	*Reindeer*	1870	–	yes	sailing ship, merchant	0.5 miles	THC
1450	–	*Sea Bird*	1870	–	yes	sailing ship, merchant	3.0 miles	THC
1457	–	*Surprise*	1871	–	yes	sailing ship, merchant	1.0 mile	THC
1459	–	*Mary Hanson*	1870	–	yes	sailing ship, merchant	3.0 miles	THC
1476	–	*Nonesuch*	1880	–	yes	sailing ship, merchant	5.0 miles	THC
1528	–	Unknown	pre–1900	–	yes	unknown	0.25 miles	THC
1532	4817	Unknown	pre–1971	–	no	unknown	–	THC, AWOIS, ENC
1533	–	Unknown	1970	–	no	unknown	–	THC
1534	–	Unknown	pre–1966	–	no	unknown	0.1.0 miles	THC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
1535	–	Unknown	pre–1950	–	no	unknown	0.25 miles	THC
1536	–	Unknown	pre–1971	–	no	unknown	0.25 miles	THC
1537	–	Unknown	pre–1950	–	no	unknown	0.25 miles	THC
1538	4816(?)	Unknown, *Donna Marie* (AWOIS)	pre–1976	–	no	unknown	–	THC
1539	–	Unknown	1976	–	no	unknown	–	THC
1690	–	*Leeway II*	1975	–	no	fishing vessel	"poor"	THC
1727	–	*Pilot Boy*	1916	–	no	steamship	20 miles	THC
1938	4183	*Eagle's Cliff*	1981	–	no	freighter	10.0 miles	THC, AWOIS
1939	–	*Jane and Julie*	1981	–	no	trawler	5.0 miles	THC
1940	–	*De Rail*	1972	–	no	yacht	3.0 miles	THC
1941	–	*Liberia C*	1964	–	no	–	5.0 miles	THC
1942	–	*Cabezon*	1959	–	no	–	5.0 miles	THC
1943	–	*Princess Pat*	1958	–	no	–	2.0 miles	THC
1944	–	*Jiffie*	1955	–	no	–	5.0 miles	THC
2186	–	*Tramp*	1919	–	no	–	5.0 miles	THC
2187	–	*Ring Dove*	1919	–	no	–	5.0 miles	THC
2190	–	*Texas No. 2*	1960	–	no	–	–	THC
2209	–	*American Star*	1970	–	no	–	5.0 miles	THC
2215	–	*Baetty Sca*	1966	–	no	–	5.0 miles	THC
2218	–	*Bill Hollis*	1970	–	no	–	3.0 miles	THC
2224	–	*Buckroy*	1959	–	no	–	–	THC
2231	–	*Captain Jimmie*	1962	–	no	–	–	THC
2236	–	*Claudia Eliza G.*	1976	–	no	–	–	THC
2240	–	*Corpus Lady*	1969	–	no	–	–	THC
2260	–	*Georgiana*	1951	–	no	–	5.0 miles	THC
2271	–	*Irvin*	1948	–	no	–	–	THC
2281	4191	*Lionel Hodgson*	1977	–	no	–	–	THC, AWOIS, ENC
2282	–	*Little Saran*	1959	–	no	–	–	THC
2287	–	*Mert*	1970	–	no	–	–	THC
2289	–	*Coral Chipper*	1961	–	no	–	–	THC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
2291	–	*Miss Anita Bryant*	1971	–	no	–	–	THC
2292	–	*Miss Aransas*	1974	–	no	–	–	THC
2302	–	*Mr. Murphy*	1968	–	–	–	–	THC
2306	–	*Ocean Bride*	1958	–	no	–	–	THC
2311	–	*Powhatton*	1969	–	no	–	–	THC
2323	–	*Scorpion*	1984	–	no	–	–	THC
2334	–	*Taasinge*	1970	–	no	–	–	THC
2369	–	Unknown	–	41NU291	no	–	"exact"	THC
2373	186(?)	Unknown	pre–1973	–	no	–	0.25 miles	THC, AWOIS, ENC
2374	–	Unknown	pre–1991	–	no	–	"high"	THC
2408	5016	"Fire Brick" Wreck	post–1915	41AS117	no	steamship	"exact"	THC, AWOIS, ENC
2414	–	*Waco*	–	–	–	–	"exact"	THC
2430	–	*Utina* (Hull 1)	–	41NU292	no	–	"exact"	THC, ENC
2459	–	"Bob Hall Pier Wreck"	1800s?	41KL108	no	unknown	1.0 mile	THC
2473	–	*Breaker*	1862	–	–	schooner	5.0 miles	THC
2479	–	*Lizzie Baron*	–	–	–	steamer	5.0 miles	THC
2488	–	*America*	1863	–	–	schooner	5.0 miles	THC
2545	–	Unknown	pre–1900	41AS119	–	steamship	"exact"	THC
2561	–	Unknown	pre–1908	–	–	–	0.25 miles	THC
2562	–	Unknown	–	TBA	–	–	"exact"	THC
–	190	Unknown	–	–	–	–	–	AWOIS, ENC
–	279	Unknown	–	–	–	–	–	AWOIS, ENC
–	4159	*Gypsy Girl*	–	–	–	–	–	AWOIS, ENC
–	4172	"Blue Hull Airboat"	1984	–	–	airboat	–	AWOIS
–	4186	*Margie B*	–	–	–	–	–	AWOIS, ENC
–	4807	Unknown	–	–	–	–	–	AWOIS, ENC
–	4838	Unknown	–	–	–	–	–	AWOIS, ENC
–	4839	*Sir John*	–	–	–	–	–	AWOIS, ENC
–	4846	Unknown	–	–	–	–	–	AWOIS, ENC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
–	5014	*Moon Glow*	–	–	–	–	–	AWOIS, ENC
–	5087	Unknown	–	–	–	–	–	AWOIS, ENC
–	5110	Unknown	–	–	–	–	–	AWOIS, ENC
–	5117	Unknown	–	–	–	–	–	AWOIS, ENC
–	5155	Unknown	–	–	–	–	–	AWOIS, ENC
–	5190	Unknown	–	–	–	–	–	AWOIS, ENC
–	7856	Unknown	–	–	–	–	–	AWOIS, ENC
–	7857	*First Boy*	–	–	–	–	–	AWOIS, ENC
–	8209	Unknown	–	–	–	–	–	AWOIS, ENC
–	8877	*Vilco 22*	–	–	–	–	–	AWOIS, ENC
–	10427	Unknown	–	–	–	–	–	AWOIS, ENC
–	10428	Unknown	–	–	–	–	–	AWOIS, ENC
–	10429	Unknown	–	–	–	–	–	AWOIS, ENC
–	10431	Unknown	–	–	–	–	–	AWOIS, ENC
–	10432	Unknown	–	–	–	–	–	AWOIS, ENC
–	10434	Unknown	–	–	–	–	–	AWOIS, ENC
–	10435	*Rose Mist*	–	–	–	–	–	AWOIS, ENC
–	10961	*Teachers Pet*	–	–	–	–	–	AWOIS, ENC
–	11022	Unknown	–	–	–	shipwreck	–	AWOIS
–	13346	Unknown	–	–	–	fishing vessel	–	AWOIS, ENC
–	13347	*Bertram*	1992	–	–	fishing vessel	–	AWOIS, ENC
–	13348	Unknown	–	–	–	–	–	AWOIS, ENC

Figure 5 presents the overall number of shipwrecks in the THC's shipwreck database within each of the study area's major water bodies/bay systems while Figure 6 depicts the general density of recorded shipwrecks within each of the study area's major water bodies in surveyed acres per recorded shipwreck (THC Atlas, 2021; TPWD, 2018). On this chart, higher bars correspond with less frequent recorded wrecks and lower site density. (Charles/Carlos and Nueces bays had no recorded shipwrecks, so their corresponding wreck densities cannot be calculated). Overall, shipwrecks are distributed across the Corpus Christi Bay system at an average of one every 203.8 surveyed acres (see Table 7). Recorded shipwrecks are more frequent within Aransas and Corpus Christi bays and within the Gulf study area portions. The greatest density of recorded shipwrecks in the study area are in the vicinity of the bay entrance at Aransas Pass. This is due to the intense vessel traffic through the pass as well as the navigational hazards that endangered those ships prior to more permanent jetties being constructed (USACE, 2003). They are less common in Copano and Redfish bays. Shipwrecks are least common within Laguna Madre. This should not be interpreted as a direct representation of actual shipwreck density. The survey coverage is much lower there than in other water bodies. It is likely that more investigations within the Laguna Madre could significantly change this projection. The CDP components correspond with higher-shipwreck-density major water bodies (the Gulf and Corpus Christ Bay), suggesting a higher likelihood that construction could affect previously unrecorded shipwrecks and cultural resources.

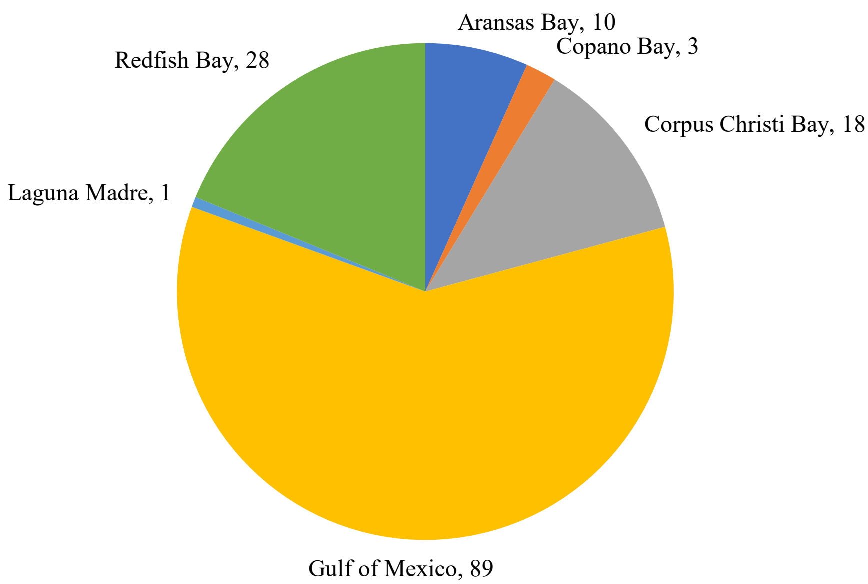
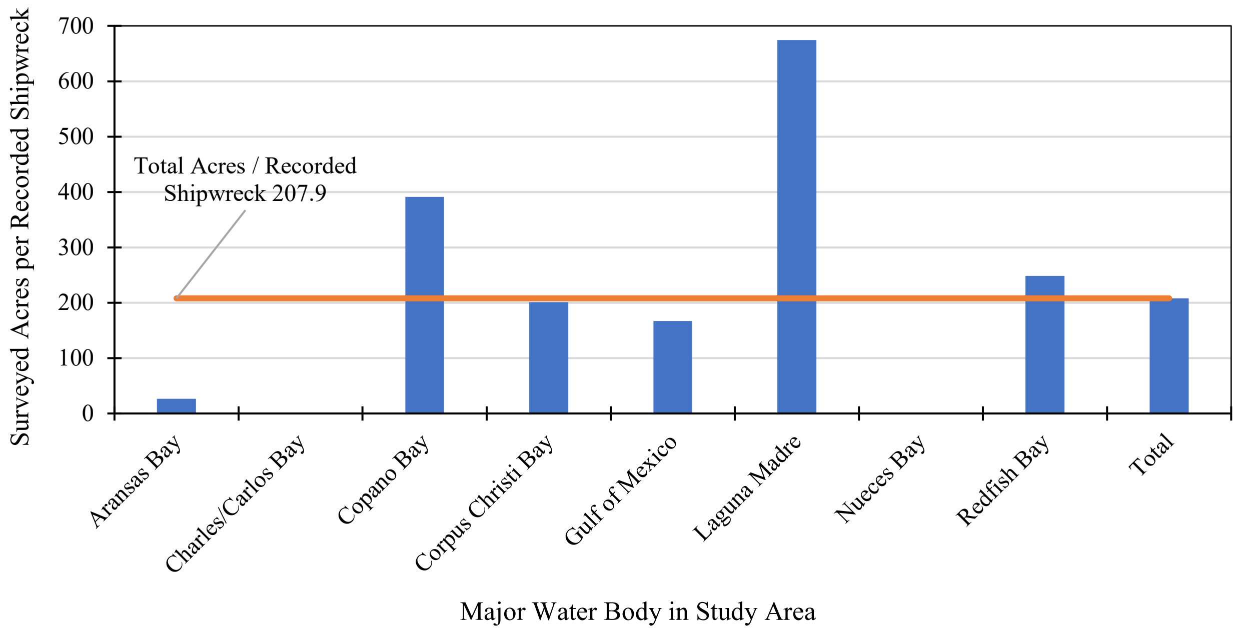


Figure 5. Number of Recorded Shipwrecks within the Study Area

Estimated shipwreck age information included with previously recorded shipwreck datasets supplies another opportunity for basic analysis and interpretation. Most previously recorded shipwrecks within the study area wrecked sometime after 1950 (n=84, 55; Figure 7). Only six recorded shipwrecks (four percent) date to 1850 or earlier (THC Atlas, 2021). In general, this data suggests that previously unknown and unrecorded shipwrecks within the study area are more likely going to have wrecked in the last 70 years. Figures 8 and 9 show a consistent distribution of the different shipwreck age groups across each of the major water bodies. With that said, Redfish Bay shipwrecks are more often older than those in Corpus Christi Bay or the Gulf. Unrecorded shipwrecks within Redfish Bay could more likely be older as well.

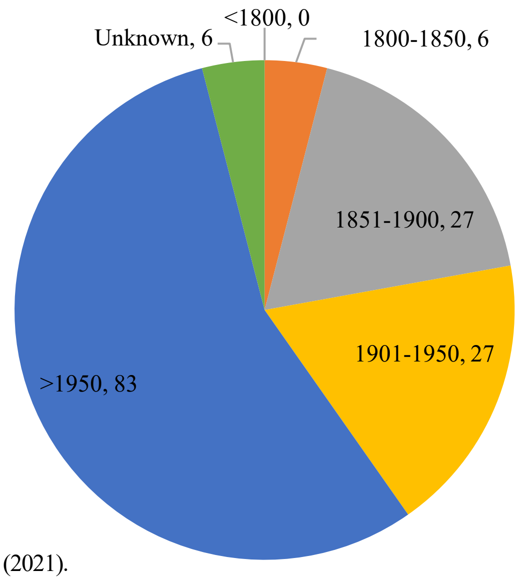


Source: THC Atlas (2021); TPWD (2018).

Figure 6. Density of Recorded Shipwrecks within the Major Water Bodies of the Study Area

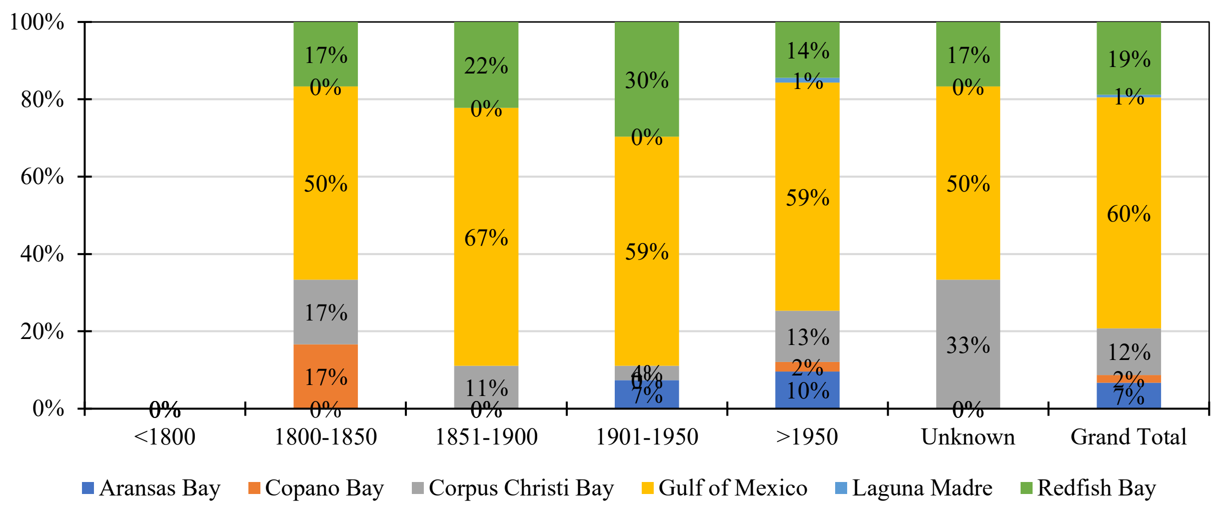
3.2.3 Potential for Submerged Aircraft

It is important to highlight the history of NAS Corpus Christi when evaluating submerged cultural resources within the study area. Following numerous reports of salvage events, the United States Navy Naval History and Heritage Command's Underwater Archaeology Branch, expanded their purpose to the protection of submerged naval aircraft in addition to naval shipwrecks during the late 1990s (Neyland and Grant, 1999; Coble, 2001). At domestic NAS locations, the greatest potential for losses comes from operational flights (such as ferry flights) or training flights. This has been demonstrated at coastal NAS locations throughout the country (Schwarz et al., 2017; Bleichner et al., 2018). It is currently unknown where dive bombing ranges for NAS Corpus Christi were located, but it can be assumed that at least some were in the surrounding bays, as pilots would have needed to be proficient at bombing targets on the water's surface. Additionally, the introduction of the torpedo bombing training schedule for pilots in 1944 suggested another bombing range in the bays specifically for torpedo bombing practice. Following the arrival of USS *Antietam* in 1956, potential for training accidents grew larger as pilots could gain carrier qualifications. It is currently unknown if any training losses occurred; however, as demonstrated by similar accidents aboard USS *Wolverine* (IX-64) and USS *Sable* (IX-81) off Chicago during World War II, potential for losses cannot be ruled out (Naval History and Heritage Command, 2020).



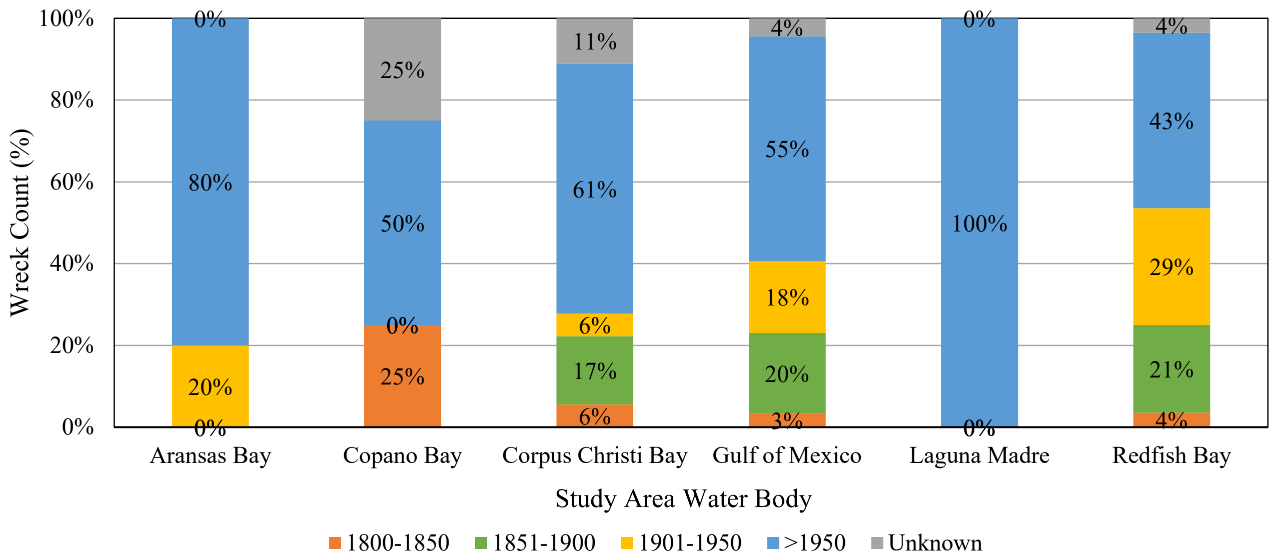
Source: THC Atlas (2021).

Figure 7. General Age Distribution of Recorded Shipwrecks within the Study Area



Source: THC Atlas (2021); TPWD (2018).

Figure 8. Percentage of Age Distribution of Recorded Shipwrecks within the Study Area



Source: THC Atlas (2021); TPWD (2018).

Figure 9. Percentage of Water Body Distribution of Recorded Shipwrecks within the Study Area, By Age Group

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Appendix F2

Cultural Resources Terrestrial Survey Report

REVISED DRAFT

Cultural Resources Survey Report

INTENSIVE PEDESTRIAN SURVEY OF APPROXIMATELY 955-ACRES ALONG MUSTANG AND SAN JOSE ISLANDS

NUECES AND ARANSAS COUNTIES, TEXAS

March 2022

Terracon Project No. 90217183

Texas Antiquities Permit # 30312

Prepared for:

Port of Corpus Christi Authority
Corpus Christi, Texas

Prepared by:

Victoria C. Pagano
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San Antonio, Texas

Some of the information contained in this report is confidential and not intended for public release or display. This information has been redacted from this report.

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Environmental ▪ Facilities ▪ Geotechnical ▪ Materials

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NUECES AND ARANSAS COUNTIES, TEXAS

Port Aransas, TX and Allyns Blight, TX USGS 7.5-Minute Maps (2019)

Prepared for:
Port of Corpus Christi Authority

In association with:
U.S. Army Corps of Engineers
Permit # SWG-2019-00067

Texas Antiquities Permit # 30312

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ABSTRACT

On behalf of the Port of Corpus Christi Authority (PCCA), Terracon carried out pedestrian archeological survey of approximately 955 acres of shoreline located along Mustang and San Jose Islands in Nueces and Aransas Counties, Texas. Investigations took place in support of a larger overall effort related to the development of the Draft Environmental Impact Statement (DEIS) for the Port of Corpus Christi Authority's (PCCA) 75' Channel Deepening Project (Corps Permit #SWG-2019-00067). The project will impact Waters of the US, privately held land (San Jose Island), and land owned by subdivisions of the State (Nueces County and Texas General Land Office). As such, compliance with federal and state regulations is required under Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas.

Terracon staff completed the pedestrian survey in two mobilizations: September 27-30 and October 27-29, 2021. Field investigations were completed by Principal Investigator Victoria C. Pagano, RPA, Juan Morlock, and Ruben Castillo, Jr. Approximately 726 acres of the total 955 acres were able to be surveyed by pedestrian transects within the terrestrial APE; the remaining acreage was inaccessible due to standing water greater than 1 foot in depth. No shovel tests were excavated during the survey due to the 100-percent ground surface visibility of the majority of the APE, the irregular topography and active migration activity of the dunes, sensitive wildlife habitat within the San Jose Island APE, and minimal ground disturbance planned by the beach reinvigoration (i.e., hydrologic placement of sand).

The APE along Mustang Island has seen major historical impacts (both natural and artificial), urbanization, and continuing modern changes (i.e., occasional mechanical grading and beach recreation) that have altered the landscape and ecology. These mechanical alterations to the shoreline have altered both the beach and the dune line which borders the northwest part of the APE. Our inspection of the APE yielded no observations of previously identified archaeological sites (41NU92 or 41NU153), shipwrecks, or other previously unidentified resources. San Jose Island has mostly retained its natural state, with historical and modern impacts to the island on interior and southern fringes.

Due to the absence of observed materials, documented historical and contemporary ground disturbance, and minimal planned ground disturbance, Terracon recommends that the project be allowed to proceed, pending concurrence by regulating agencies. Should any cultural deposits or materials be observed during the beach nourishment, work should stop, and the THC should be notified.

All field records generated during field investigations will be prepared for permanent curation at a Center for Archaeological Research at the University of Texas at San Antonio.

1.0 INTRODUCTION

Terracon carried out intensive pedestrian survey of approximately 955 acres of select beneficial use sites along Mustang (MI) and San Jose Islands (SJI) in Nueces and Aransas counties, Texas. This survey was part of a larger overall effort related to the development of the Draft Environmental Impact Statement (DEIS) for the Port of Corpus Christi Authority's (PCCA) 75' Channel Deepening Project (Corps Permit # SWG-2019-00067). The project will impact Waters of the US, privately held land (San Jose Island), and land owned by subdivisions of the State (Nueces County and Texas General Land Office). As such, compliance with federal and state regulations is required under Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas.

Terracon staff completed the survey in two mobilizations: September 27-30 and October 27-29, 2021. Field investigations were completed by Principal Investigator Victoria C. Pagano, RPA, Juan Morlock, and Ruben Castillo, Jr. Reporting was completed following guidelines published by the State Historic Preservation Office (SHPO) and the Council of Texas Archeologists (CTA). The appendices which follow the report include additional photos, historical topographic maps, planned impacts, and other relevant documentation.

1.1 Area of Potential Effects Description

The APE is located on the United States Geological Survey (USGS) Allyns Bight, TX (2019), Estes, TX (2019), and Port Aransas, TX (2019) 7.5-minute topographic quadrangle maps (NGMDB and NGP 2021). Terrestrial impacts will take place along the select Beneficial Use Sites along of Mustang Island (MI; 362-acres) and San José Island (SJI; 563-acres) (Figure 1). As such, the total of 955-acres (areas MI and SJI) is considered the area of potential effects (APE) for survey. Beach nourishment will be accomplished through dune and beach restoration along MI and SJI, with impacts that include the placement and distribution of dredged sediment through mechanical and/or hydrologic means.

The Mustang Island shoreline is understood to be controlled by Nueces County (5.7 acres) and the Texas General Land Office (TX GLO; 356.3 acres). Therefore, this portion of the project area is under the purview of the Antiquities Code of Texas (ACT). San Jose Island consists of privately held land (271.2 acres) and TX GLO shoreline (321.8 acres). As such, only GLO-owned portions of SJI are subject to provisions of the ACT.

Figure 1. Overview of the APE on The National Map (TNM) topographic base map.

2.0 ENVIRONMENTAL AND CULTURAL CONTEXTS

Environments are composed of such interconnected elements as underlying bedrock geology, soil, biology (i.e., plants and animals), and climate. Environmental conditions are also connected to the initial patterning and subsequent preservation of materials left behind by humans, the culmination of which is referred to as site formation processes. Understanding site formation processes aids in assessing the presence and preservation of cultural resources. It is, therefore, important to consider environmental conditions of the past and present when assessing cultural resources of all ages. Coastal Texas is a dynamic place geologically and environmentally with major climatological shifts that continually shape and re-shape the coast, resulting in a unique and shifting landscape that is reflected in the present archeologic record. The following sections broadly summarize the current and past environmental and cultural contexts of the APE.

2.1 Ecology and Vegetation

The APE is situated within the Mid-Coast Barrier Islands and Coastal Marshes Level 4 Ecoregion (34h) (Figure 2). The Mid-Coast Barrier Islands and Coastal Marshes ecoregion is characterized by mostly Holocene age deposits; saline, brackish, and freshwater marshes; barrier islands with minor washover fans, and tidal flat sands and clays (Griffith et al. 2007). The natural vegetation of the ecoregion can be characterized by a variety of cordgrass, saltgrass, blue stem, seaoats, and reeds. Black Mangroves occur along the coast from Port O'Connor south. This part of the coast is home to commercially important shrimp, crab and oyster fisheries.

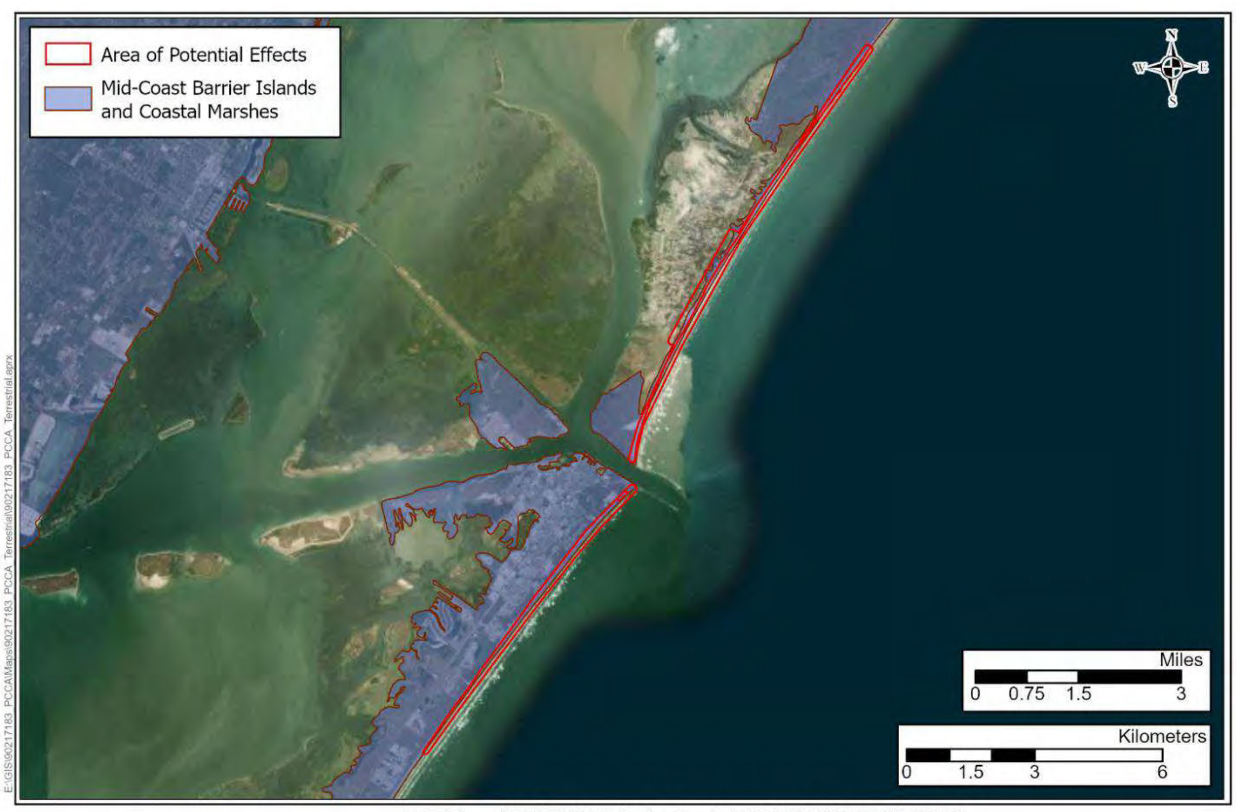

Figure 2. APE within Level 4 Ecoregion Mid-Coast Barrier Islands and Coastal Marshes (Griffith et. al. 2007).

Griffith et. al. (2007) describe the climate of the region as sub humid as compared to the humid Ecoregion 34g to the northeast and the semiarid Ecoregion 34i to the south. Rainfall in the region follows a similar pattern, as amounts increase from the southwest (average of 34 inches) to the northeast (average of 46 inches).

2.2 Geology and Soils

The surficial geology is characterized as Holocene age sands, silts, and clays (Griffith et. al. 2007), while the underlying bedrock geology of the APE (Figure) 3 is mapped entirely as Pleistocene age Barrier Island Deposits (Qbi) (USGS BEG & TNRIS 2021). The Barrier Island Deposits (Qbi) are best described as sand, silt, and clay; mostly sand that is well sorted, fine grained, with abundant shells and shell fragments that interfingers with silt and clay in a landward direction; it includes beach ridge, spit, tidal channel, tidal delta, washover fans, and sand dune deposits.

Figure 3. Mapped geology and soils within the APE.

Soil formation is a function of local climate, biology, parent material, topography, and time, and so it is clearly tied to environment as defined above. Accordingly, soil can serve as a proxy for environmental conditions of the present and past. Defining soils as they are relevant to investigations of cultural resources, however, is useful because of how they are characterized and mapped by the Natural Resources Conservation Service (NRCS), formerly Soil Conservation

Service. Though agricultural in nature, county soil surveys provide a description of soil characteristics, including depth, color, inclusions, etc., which can be used to elucidate site formation processes.

The soils mapped across the proposed APE (see Figure 3) include: Beaches (By), Coastal Beach (Co), and Psamments (Ps) (USDA NRCS 2021); brief descriptions of these soils can be found in Table 1.

Table 1. Soils mapped within the APE. (USDA NRCS 2021)

Soil Name	Description	Depth to Subsoil
Beaches (By)	Sand and gravel beaches on barrier islands	--
Coastal Beach (Co)	Sand and gravel beaches on barrier islands	--
Psamments (Ps)	Dredge spoil banks on mounds on lagoons on bays	Approximately 20-46 centimeters

2.3 Cultural Context

Broadly speaking, the cultural chronology of Texas can be divided into the Prehistoric and Historic periods. The Prehistoric period is further subdivided into the Paleoindian, Archaic, and Late Prehistoric, together encompassing over 10,000 years of hunter-gatherer occupation in Coastal Texas, the archeological region in which the project is located. The beginning of the Historic period is defined by the introduction of the written record, which in coastal Texas began in AD 1528 with the accounts of Cabeza de Vaca and three companions who shipwrecked on the shores of Galveston Island (Hester 2004). What follows is a summary of the lengthy and complex human history of Coastal Texas.

2.3.1 Prehistoric Period

The Paleoindian period (ca. >13,500-10,000 BP) is broadly characterized as a time when highly mobile hunter-gatherer people moved across the North American continent, exploiting megafauna as well as a diversity of small game and plant resources (Ricklis 1995, 2021a). Archeological evidence of Paleoindian occupation is usually restricted to distinctive stone tools. The Paleoindian period occurred at the end of the last major ice age, the Pleistocene epoch, during which much of earth's water was captured in ice sheets, resulting in much lower sea levels and a Texas coastline which extended much further east than it does now (Bever and Meltzer 2007:72-74). Today, many formerly coastal areas habitable during the Paleoindian period are submerged. Such sites have not yet been pinpointed, though Paleoindian artifacts from submerged sites have washed up on Texas shores, most famously at McFaddin Beach on the upper Texas Coast (the project area is located in the central coast). Additionally, several Paleoindian sites have been found in the modern Coastal Texas environment, though these sites would not have been near the coast line 10,000 years ago and do not bear evidence of the exploitation of coastal resources. Nonetheless, the potential to discover submerged Paleoindian sites in Coastal Texas waters remains, as does the potential to discover sites on the modern coastline that were once not gulf-front (Aiuvalasit 2007; Bever and Meltzer 2007:72-74).

Following the Paleoindian period was the Archaic period (ca. 10,000-1200 BP). The start of the Archaic period began with the onset of the Holocene epoch, which is characterized by an overall warmer and wetter environment than the Pleistocene (Ricklis et al. 2012). By the Early Archaic, sea levels had started rising, and by about 6000-4000 BP had inundated river mouths including that of the Aransas and Nueces Rivers, forming coastal bays and estuaries (Ricklis 2021a). By around 3000 years ago, sea levels were approximately at modern levels, and the barrier islands we see today began to develop. Archaic period sites in Coastal Texas show evidence of mixed coastal and terrestrial resource use. As the Archaic period progressed, coastal populations increased, and sites were more intensively inhabited, as reflected in increasing density of artifacts and features at later period sites. An exception to this is a period of apparent coastal abandonment between 4000-3000 BP. Geological research suggests that this corresponds with a period of major sea level rise that likely reduced the availability of the shallow water dependent food resources that humans were exploiting on the coast. By the Late Archaic, 3000 to 1200 years ago, local environmental conditions on the coast had stabilized, leading to the formation of the modern coastal barrier islands. The formation of the barrier islands led to the restoration of the extensive shallow water dependent fish and shellfish, which in turn led to a resurgence of human activity on the coast. This intensive exploitation of resources occurred all over the coast, although with less of an emphasis on shellfish in the lower coast where hypersaline conditions were less conducive to them (Ricklis 1995, 2021a).

The Late Prehistoric period (ca. 1200-500 BP) is characterized by dramatic changes in the prehistoric toolkit, including the adoption of bow-and-arrow technology and pottery. Ceramic technology spread west from Louisiana and north from Mexico to the Texas coast, where Rockport pottery became a central coast phenomenon (Ricklis 2021a). During the Late Prehistoric, coastal populations increased, spurred by favorable environmental conditions and an abundance of coastal resources, as well as an expansion of coastal prairies which supported an expansion of bison. It is evident Late Prehistoric coastal dwelling peoples did not venture far inland due to other groups different ethnic and cultural identities, however archaeological evidence and ethnographic accounts support trade and interactions between coastal and non-coastal people (Ricklis 1995, 2021a). The Late Prehistoric people of central Coastal Texas were the ancestors of the Karankawa Indians encountered by Cabeza de Vaca and his companions in the 16th century.

2.3.2 Historic Period

As noted, the historic period begins with the introduction of the written record. The first written account of Texas was that of Álvar Núñez Cabeza de Vaca, a Spanish explorer whose ship wrecked on the coast of Galveston Island in AD 1528. Cabeza de Vaca and three other companions, two Spaniards and an enslaved African, went on to live almost seven years among the native people of Texas and Mexico. In AD 1685, an expedition to establish a French colony at the mouth of the Mississippi River was led by Robert Cavelier, Sieur de La Salle that ultimately led to the ill-fated establishment of Fort St. Louis (AD 1685-1688) near Matagorda Bay (Bruseth et al. 2017; Ricklis 2021b). In the early 18th century, the Spanish established the first coastal mission, Espiritu Santo, near the location of the failed French fort, with the hopes of converting the Karankawa Indians. Conflict ensued over the course of many decades, until peace between the Spanish and Karankawas was made in AD 1790. The aftermath of the Mexican Revolution brought unrest to the area again, when the new Mexican government began making land grants in Coastal Texas to cattle ranchers.

The first permanent non-native settlement near the APE was the town of Corpus Christi, which grew from a trading post established in 1839 on the west shore of Corpus Christi Bay (Long 2021). Corpus Christi slowly grew into a modest frontier port town. It was an important to Confederate commerce during the Civil War and was eventually occupied by Union forces. In the post-bellum period, Corpus Christi's economy benefited from the cattle and sheep (wool) ranching in the surrounding area. In 1874, the main ship channel was dredged, permitting larger ships than before to enter the port. In the last 100 years, Corpus Christi has continued to grow, despite setbacks including the devastating hurricane of 1919 and the Great Depression. Oil was discovered in the region in 1930, ushering in a new era of economic success.

Port Aransas was established in 1850 on St. Joseph's Island, a settlement focused on cattle and sheep grazing that was owned by Robert A. Mercer of Lancaster, England (Upchurch 2021). Over the next 46 years, the settlement was moved to Mustang Island and referred to as Ropesville, growing in size to include residences, stores, and a growing fishing industry, which led to settlement name of Tarpon in 1896. In 1911, the name was changed to Port Aransas and over time the town became a hub along the coast of Texas for tourism.

Aransas Pass is the water passage between Mustang Island and St. Joseph Islands, and has played a historically important role to the region (Leatherwood 2021). The natural channel is documented on maps as early as 1528 and provides a channel from the Gulf of Mexico into Corpus Christi Bay, Aransas Bay, and Redfish Bay. This pass played a critical economic role in the early 16th century and continues to provide crucial routes for trade along Coastal Texas. Aransas Pass was also a critical military port and passageway during the Civil War allowing trade between Mexico and the Confederacy. Infrastructure investment in creating and maintaining a shipping channel for Corpus Christi and the surrounding coastal towns has continued to be crucial to the economic development of the region.

The Aransas Pass Light Station District is adjacent to the APE. This district is comprised of a series of historically significant buildings that were from 1857 to 1938 (Holland 1977). This district was listed to the NRHP in 1977 and is comprised of a double-dwelling, single-dwelling, Principal Keeper's dwelling, radio room and radio beacon tower, oil house, light tower and lantern, wharfs, walks, privies, and cisterns. Included within this district is the State Historical marker for the Aransas Pass Light Station lighthouse which was constructed in 1855-1856. This light house was used as a tactical tool during the Civil War and decommissioned in 1952.

3.0 RESEARCH AND SURVEY METHODS

3.1 Archeological Literature Review

Terracon conducted a review of public and non-public databases, maps, and records. Sources included the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils data (USDA NRCS 2021); United States Geological Survey (USGS) topographic maps and other historical maps (USGS and ESRI 2021; NGMDB and NGP 2021); historical and contemporary imagery (NETR 2021); the Texas Historical Commission's (THC) Archaeological Sites Atlas (THC 2021); and shipwreck and site records provided by the THC. These sources provide information on factors that affect the likelihood of intact archeological deposits being present, previously recorded archeological investigations, recorded prehistoric or historic-period sites, and recorded historic properties listed in, or eligible for listing in the NRHP within and near the project area.

3.2 Pedestrian Survey

The objectives of the pedestrian survey included: 1) identifying and recording previously undocumented cultural resources within the APE, and 2) determine whether any additional studies (e.g., eligibility testing, monitoring, historic surveys, etc.) are warranted. Work conformed to the Council of Texas Archeologists (CTA) Standards and Guidelines, accepted by the THC, for the intensive terrestrial survey guidelines for non-linear projects. Archaeological investigations were conducted by Terracon cultural resources professionals meeting the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (Title 36, Code of Federal Regulations [CFR] Part 61), and professional qualification requirements for Principal Investigator (13 TAC 26.4).

The field approach consisted of pedestrian surface inspection whereby the exposed ground surfaces in the APE were examined for evidence of archaeological resources. Transects were spaced no more than 30 meters apart; surface staining and other anomalies were lightly troweled to investigate these as possible archeological features. This approach was possible because of the nearly 100 percent surface visibility of the bulk of the APE, irregular topography within the vegetated dunes, and the low potential for subsurface project related impacts. The survey limits and methodology were previously coordinated with the THC prior to contracting, and the agency authorized the proposed methodology for the Antiquities Permit research design for Permit 30312.

Activities (e.g., shovel tests, isolated finds, and transects) were documented with handheld GNSS/GPS units capable of <1-3m accuracy and loaded with ESRI software for field data collection. GIS data was produced in the State Plane coordinate system (NAD 1983 Texas South Central 4205 (feet)). No artifacts or features identified in the field were collected or excavated but were documented following the CTA guidelines for In-Field Recording. Artifacts or features identified at surface were recorded by a GNSS point, photographed with scale, and are discussed in the following Results section. These were documented when observed as points of interest due to their historical nature or if they were not identifiable from surface without major excavation.

4.0 RESULTS

Desktop review of previous literature, archaeological databases, and historical maps and imagery revealed several points of interest that would require field inspection within the APE and within a one-kilometer search radius. Over the course of six days of survey, natural and cultural disturbance to the majority APE was observed; noted disturbances included beach grading, recreational beach fire pits, dune alteration, and flood destruction/debris. Photos, maps, and other relevant documentation can be found as appendices following this report.

4.1 THC Archeological Sites Atlas and NRHP Database Review

Review of the Texas Archeological Sites Atlas (THC 2021a) and accompanying National Register of Historic Places (NRHP) database records, indicates that several terrestrial investigations and several historic-age archaeological sites are within a one-kilometer radius of the APE (Figure 4; Tables 2 and 3). One historic-age shipwreck is within the APE (Wreck No.992) and two archaeological sites (41NU92 and 41NU153) have potential to be within the APE.

The following section presents records and summations (where appropriate) of terrestrial investigations, sites, cemeteries, and shipwrecks, documented within the terrestrial APE and within the one-kilometer search radius of the terrestrial APE. There are no NRHP properties, SALs, districts, State Historical markers, or cemeteries located within the APE. However, there are two cemeteries within the one-kilometer search radius (Figure 4). Two cemeteries are located within the one-kilometer search radius, Mercer Cemetery (NU-C031) and Royal Palms Cemetery (NU-C022).

Table 2. Previous terrestrial investigations within the APE and/or with the 1-kilometer search buffer.

Year	TAC Permit #	Company	Sponsor	Survey Type	Within APE?	Total Survey Acres
1981	--	--	Environmental Protection Agency	Survey	No	9.67
1985	--	--	--	Survey	No	2.26
1995	--	TxDOT	--	Survey	No	1.52
1996	--	--	Army Corps of Engineers - Galveston	Survey	No	37.59
2001	--	Prewitt and Associates	Army Corps of Engineers - Galveston	Survey	No	6260.5
2004	--	TAS Inc.	Army Corps of Engineers - Galveston	Survey	No	773.2
2004	--	TAS Inc.	Army Corps of Engineers - Galveston	Survey	No	50.05
2004	3334	PBS&J	Lower Colorado River Authority (LCRA)	Survey	No	Linear
2005	3861	TAS Inc.	Army Corps of Engineers - Galveston	Survey	No	6.34
2014	6857	TxDOT	TxDOT	Survey	No	14.05

Year	TAC Permit #	Company	Sponsor	Survey Type	Within APE?	Total Survey Acres
2017	7982	Coastal Environments, Inc.	Nueces County Coastal Parks System	Survey	Yes	133.2
2018	8611	Perennial Environmental, LLC	City of Port Aransas	Survey	No	117.29

[redacted]

Figure 4. Previous investigations recorded archaeological sites, and cemeteries within the APE and a one-kilometer search radius.

Table 3. Summary of recorded archaeological sites within the APE and/or 1-kilometer search buffer.

Site Trinomial	Year Recorded/ Revisited	Site Type	NRHP Eligibility	Within APE?
41AS91	1995	Historic-age factory remains	Assessed **Ineligible** in 2005	No
41AS119	2019	Historic-age shipwreck	No record of assessment	No
41NU92	1980s	Burial	--	Potentially
41NU153	1974	Historic-age wreck	No record of assessment	Potentially

Site Trinomial	Year Recorded/ Revisited	Site Type	NRHP Eligibility	Within APE?
41NU187	1981	Historic-age gun emplacements	No record of assessment	No
41NU252	1987	Historic shipwreck	Assessed **Eligible** in 1994 and 2003	No
41NU264	1991	Historic-age shipwreck	Assessed **Eligible** 1992; assessed **Undetermined** in 2003	No
41NU282	1995	Historic-age shipwreck	No record of assessment	No
41NU292	2002	Historic-age shipwreck	Assessed **Undetermined** in 2003	No
Wreck No. 992	1966	Historic-Age shipwreck	Research/assessment by the THC is ongoing	Unknown

41AS91

Saint Joseph's Island Supply depot (41AS91) was originally recorded in 1995 by Frontera Archaeology (Perttula 1997). According to this initial site form, the Mexican War era (potentially even Civil War era) depot was not observed during the site investigation but was documented from historical records that place the depot on the southern interior tip of Saint Joseph's (today known as San Jose) Island. Perttula (1997) notes that Army and historical topographical maps would indicate that several structures, including quartermaster headquarters, ordinance stores, general hospital, troop encampments, and the small settlement of grog shops and houses. A 2001 archaeological site form update by Prewitt and Associates, Inc. documents observations of wooden pilings that protrude from the water and beach with a concentration of red bricks eroding from the bank line (Gadus 2001). Observations of the cut bank revealed approximately 75 to 100 centimeters of sterile sand above the eroding bricks which the recorder suggests would indicate other material may be buried and not observable at the surface.

Prewitt and Associates suggest that the interpretation of the supply depot location originally recorded as 41AS91 is inconsistent with the formation of land of San Jose Island:

> Based on the map references the features described here located in the north west corner of the previously mapped location of 41AS91 are the remains of a 1934 factory. The site was originally defined as the location of a Mexican War supply depot and camp dating to 1845-46 and also probably used during the Civil War. Unfortunately, this interpretation of the AS91location is not consistent with the fact that all the land on San Jose Island south west of the light house formed as the pass aggraded away from the Aransas light house ca. 1868-78 (Pearson and Simmons 1994:6-8). In effect the land indicated as the location of AS91 was not there until after the light house was built. Therefor the location of the supply depot on the island has to be north of the light house and remains undiscovered (Gadus 2001).

Gadus also states that the current site centroid does not mark the site center or any known cultural feature, as no cultural features were observed during that site visit. Therefore, those researchers recommended that the site trinomial be reassigned within the most current plotted location and as the 1934 factory.

41AS119

Site 41AS119 is described as a wreck that correlates with THC Wreck 1528; the site was identified during a 2019 marine remote sensing survey by BOB Hydrographics, LLC. (Gearhart 2019). The wreck is fully submerged and believed to be relatively intact according to sonar imagery, however, no direct observations of the wreck have been made. According to background conducted by Gearhart (2019) the wreck correlates with a wreck charted on the 1900 edition USCGS Chart 209 which would place the wreck some time between 1884 and 1900.

41NU92

Site 41NU92 is estimated to be within the current APE. Little detail is known about the site which included the burial of an adult male. The remains of this burial were recovered and analyzed by Claude Bramblett of the University of Texas Austin. This analysis concluded that the remains represented a male in his early twenties and of European or Amerindian descent. According to the Atlas, the site centroid is within the dunes of Mustang Island and not within the APE, however, the site was documented over two decades ago and location information is not complete.

41NU153

Site 41NU153 is a Civil War era "torpedo searcher" shipwreck that was originally documented in 1974 by Dan Scurlock and Tom Ray (1974); the wreck is thought to potentially be within the APE (Scurlock and Ray 1974). Materials observed when the site was recorded included rusty iron spikes, wood charcoal, and burned wood. An informant for the site, Peter Percival of the Institute Marine Science, U.T., Aransas Pass, stated that dunes cover and uncover the new sections of the wreck. According to Oertling (1991) the bolts of the raft were always visible, but it was not until Hurricane Allen in 1980 that the remains of the raft were exposed and identified as a Civil War era torpedo searcher. Excavation and documentation of the remains were undertaken in October 1985 by amateur archeological societies and professional archeologists sponsored by the Corpus Christi Museum. The raft is documented as consisting of crisscrossing wood timbers fastened with iron bolts (one-inch and greater in diameter) and wooden dowels. However, in November 1985, Hurricane Juan reburied the wreck, leaving only a few bolts visible from the surface (Smith et al. 1987).

The current plotted location on historical aerial imagery (ca. 1986) and historical topographic maps (ca. 1968 and 1975), indicate the site is located approximately 238-meters northeast from Access Road 1 along the dune-beach contact. Review of images (THC 2021b; Appendix C, NU697 and NU702) from the 1985 excavations show three buildings (Buildings 1-3) that may be able to be used to relocate the site.

According the Atlas, the site is not mapped within the APE but approximately 583 meters southeast of Highway 361 within undeveloped dunes. A 1974 sketch map of the site location and the 1974 site form states that the site is "In seaward edge of foredune on Mustang Island, 5 miles south of the Institute and 1.9 miles south (?) of county access road No. 2…" (Scurlock and Ray 1974).

Additionally, there is a second point marker (Wreck 307) within the Atlas Shipwrecks layer that is labelled and associated to the site but is located 3.43 kilometers (2.13 miles) southwest of the site centroid. Therefore, the location of the site is quite ambiguous.

41NU187

Site 41NU187 is a historic-age site that consists of two circular concrete and masonry gun emplacements located on two adjacent dunes on the Gulf beach side of Mustang Island. These structures were described as: "…concentric concrete foundations that support a steel track with outer parapets constructed as two concentric walls connected by radial reinforcing walls surrounds the track and pivot and is made of limestone block masonry. The parapet is plastered on its inner face" (Jurgens and Whitsett 1981). It was recommended by the site recorders that further archival study be conducted of the emplacements as their location put them in danger of both natural and cultural impacts and possible destruction.

41NU252 – The SS Mary Wreck

Site 41NU252 is the remnants of the side-paddle steamship, the SS Mary. The SS Mary was laid out in 1865 and completed in 1866. It carried people and cargo for ten years before bad weather caused it to become grounded on a sandbar as it tried to enter Aransas Pass in 1876 (Hoyt 1990). The SS Mary wreck was apparently designated a SAL, although no record of this can be found (Hoyt 1990). In 1989, the Army Corp of Engineers, Galveston District contracted Espey, Huston & Associates to conduct a remote sensing survey and NRHP Eligibility Assessment of the SS Mary. The study led to a recommendation of Eligibility for 41NU252. However, other than a copy of the report, no official documentation of this recommendation was available on the Atlas. Coastal Environments, Inc. (CEI) conducted a study of 41NU252 from 1991 to 1993 which led to another assessment of Eligibility for the NRHP (Pearson and Simmons 1995). PBS&J revisited the site as part of investigations required for ship channel improvements in 2000 and 2001. This led to yet another recommendation of Eligibility for the NRHP in 2003 (Enright et al 2003).

41NU264

Site 41NU264 is a shipwreck initially identified in 1991 during work by CEI on the wreck of the SS Mary (41NU252). CEI had identified the wreck as a World War I era cargo vessel the *Utina* and recommended it as Eligible for NRHP listing in 1992 (Pearson and Simmons 1995). However, later work conducted by PBS&J in 2003 suggested that the site 41NU292, very close to 41NU264, was actually the *Utina*. PBS&J concluded that 41NU264, while likely associated with 41NU292, was not the main body of the shipwreck. PBS&J concluded that 41NU292 was likely eligible for NRHP listing, but that the determination could not be made without further archaeological investigations (Enright et al. 2003).

41NU282

Site 41NU282 is the Baddacock shipwreck (THC Wreck No. 1048). According to the 1995 site form, the Baddacock was a steel hull ocean steam tug that was built and wrecked in 1920 (Arnold 1995). The site is located within the water, just south of the south jetty of Port Aransas and was identified by magnetometer survey.

41NU292

Site 41NU292 is believed to be associated to THC Shipwreck 2430, the cargo vessel *Utina* which was constructed during World War I as part of the United States Emergency Fleet Corporation (EFC) (Enright et.al. 2003: 20). The *Utina* was originally assigned to site trinomial 41NU264, however, following further field and archival work PBS&J archaeologists concluded that the location of 41NU292 is the main location of the *Utina* and 41NU264 is associated wreckage. The site currently has an undetermined eligibility status for inclusion to the NRHP.

Wreck 992 – Lake Austin

The Lake Austin scow schooner is known to have wrecked in November of 1903 near Port Aransas and was informally excavated in 1966 (Borgens 2011: 675). The exact location of the site is unknown, and it was not assigned a trinomial at the time of its excavation. Following its excavation, the ship was left exposed until it was declared a hazard to beachgoers and burned. Research into the location and details of the excavation is currently ongoing by the THC.

Additionally, several historical and contemporary shipwrecks are recorded within the APE and within the one-kilometer search radius (Figure 5). Most relevant to the terrestrial APE, are those mapped on land and/or the immediate shoreline, which are detailed in Table 4.

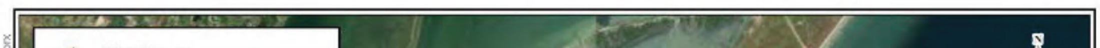
[redacted]

Figure 5. Shipwrecks available from THC Atlas records. Wrecks 609 and 1420 are plotted within the APE.

Table 4. Shipwrecks mapped on land and potentially accessible by terrestrial survey.

Wreck Number	Year Lost	Ship Name	Vessel Type
609	1902	Mary E. Lynch	Sailing ship; merchant
1420	1901	Ellen	Sailing ship; merchant

A review of historical maps (ca. 1925, 1950, 1951, 1968, and 1970) and aerial imagery (ca.1951, 1952, 1956, and 1967) indicate that no structures or developments within the APE have been present in recent history (NETR 2021; NGMDB/NGP 2021). However, the areas within the search radius has seen road infrastructure, military installations, residential, and commercial developments as early the mid-17th century up through modern day.

4.2 Pedestrian Survey

Due to the location of the APE along the shoreline, approximately 726 acres of the total 955 acres were able to be surveyed by pedestrian transects (Figures 6 and 7); the remaining acreage was inaccessible due to standing water greater than 1 foot in depth. No shovel tests were excavated during the survey due to the 100-percent ground surface visibility of the majority of the APE, the irregular modern topography of the dunes, sensitive wildlife habitat within the San Jose Island APE, and minimal ground disturbance planned by the beach reinvigoration (i.e., hydrologic placement of sand).

The APE is split between two barrier islands, Mustang Island and San Jose Island. The APE along Mustang Island has seen major historical impacts (both natural and artificial), urbanization, and continuing modern changes (i.e., mechanical grading and beach recreation) that have altered the landscape and ecology. These mechanical alterations to the shoreline are probably the most important when discussing the potential for intact prehistoric or historical resources within this portion of the APE.

San Jose Island, however, has mostly retained its natural state, with minor historical and modern impacts to the Island on interior and southern fringes. This is due to restrictive access to the privately-owned island (with exception for the beaches) and the fact that it is geographically isolated from the urbanized Mustang Island (no bridges or public boat ramps/ports). Both however, have been subject to intense historic and contemporary natural phenomenon (i.e., hurricanes) and less intense but equally as important natural processes (i.e., erosion by wind and water).

[redacted]

Figure 6. Overview of survey results along Mustang Island.

[redacted]

Figure 7. Overview of survey results observed along San Jose Island.

Overall, visual inspection of Mustang Island revealed 100-percent ground visibility across this portion of the APE and a shoreline that is actively being altered by natural processes, beachgoers, and county/city maintenance of beach roads and the shore. Observations of these alterations included: mechanical grading and spreading of sand within the APE, observations of modern dug-out fire pits, RV/camper and other beach infrastructure, and vehicular traffic. Visual inspection of the APE during intensive, systematic pedestrian coverage yielded no observations of previously identified archaeological sites (41NU92 or 41NU153), shipwrecks, or other previously unidentified resources. Materials observed during the survey included various plastics, wooden debris, organic material that has washed up on the beach, as well as trash from beachgoers.

Two points of interest (Features 01 and 02; Table 5) were documented along the beach of Mustang Island that were anomalous when compared to other materials observed during the survey. These two points were within a section of the beach that had a higher quantity of wooden debris washed on shore that was not clearly identifiable as firewood or other wood related to beach activities.

Overall, visual inspection of San Jose Island revealed 100-percent ground visibility along the beach and tidal flats with variable ground surface visibility within and behind the dunes. While ground surface visibility within and behind the dunes decreased, these areas were often characterized by irregular topography, modern and recent dune formation, and good ground visibility. Due to the remote nature of the island, the artificial alterations to the landscape within the APE were limited, with exception for two localities that are the site of barge removal projects from 2018 through present day (Figure 7). As the island is not maintained and cleaned like the beaches of Mustang Island, observed materials along the shoreline and within the dunes includes a wide assortment of contemporary and historical debris that ranged from plastic bottles, trash, building materials, plane siding, glass bottles, beached buoys, footwear, telephone poles, rail ties, and more. These materials were observed along the shoreline as well as within and behind the dunes in areas that would flood during intense weather events. Included are several modern boats that have been washed ashore during recent storms and that were observed during the survey of San Jose Island (see Appendix A for photos; Table 5). While not considered archaeological, these recreational boats were documented via GNSS point and photography and will be reported to the THC so that the THC can consider whether to include them in the shipwrecks database.

Table 5. Descriptions of isolated features observed during survey (photos can be found in Appendix A).

Feature	Association	Comments
01	MI	Wood with iron/steel bolts running through; curved; within woody debris line
02	MI	Large partially buried timber/wood; rail tie?
03	SJI	Partially exposed metal round post ~18cm diameter w/o cross beams
04	SJI	Partially exposed metal round post ~18cm diameter with cross beams; sticking ~42cm out of beach
05	SJI	Capsized buried fiberglass boat in dunes
06	SJI	Marooned boat; Lund Tyee 4.9
07	SJI	Two potentially historic-age glass bottles; one Renault Cognac liquor bottle with an “s in diamond” makers mark and one unidentified round base bottle with pyramid symbol makers mark

Feature	Association	Comments
08	SJI	Upside fiberglass bottom boat; front
09	SJI	Fiberglass and wood boat; back; Matamoros 1
10	SJI	T.C. Wheaton "Squibbs" bottle; ca. late 19th to mid-20th century (Lockhart et. al 2019)
11	SJI	Capsized boat; outside APE
12	SJI	Plane siding with other miscellaneous modern debris
13	SJI	Plane siding with other miscellaneous modern debris
14	SJI	Mako 1901
15	SJI	Boat hull, white, wood/fiberglass, no identifying marks visible

Features 03 and 04 consisted of partially exposed metal posts that were within one-meter of each other at the tidal line of the beach (Figure 7; Appendix A, Photos 40-46). According to the Atlas there are no reported shipwrecks within the vicinity of the features and neither piece was exposed enough to fully understand the nature of the features. Excavation or remote sensing of the area would likely be required to fully investigate the extent and purpose of the materials.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Terracon carried out pedestrian archeological survey of approximately 726 acres of the total 955 acres that were available to be surveyed by pedestrian transects within the terrestrial APE as part of a larger overall effort related to the development of the DEIS for the PCCA 75' Channel Deepening Project (Corps Permit # SWG-2019-00067). No shovel tests were excavated during the survey due to the 100-percent ground surface visibility of the majority of the APE, the irregular topography of the dunes, sensitive wildlife habitat within the San Jose Island APE, and minimal ground disturbance planned by the beach reinvigoration (i.e., hydrologic placement of sand).

The APE along Mustang Island has seen major historical impacts (both natural and artificial), urbanization, and continuing modern changes (i.e., mechanical grading and beach recreation) that have altered the landscape and ecology. These mechanical alterations to the shoreline have altered both the beach and the dune line which borders the APE along the northwest. Visual inspection of the APE yielded no observations of previously identified archaeological sites (41NU92 or 41NU153), shipwrecks, or other previously unidentified resources. San Jose Island has mostly retained its natural state, with historical and modern impacts to the Island on interior and southern fringes. Observed materials along the shoreline and within the dunes of SJI can be characterized as a wide assortment of contemporary and historical debris that ranged from small boats, plastic bottles, trash, building materials, plane siding, glass bottles, beached buoys, footwear, telephone poles, rail ties, and more. Overall, no materials, sites, or other deposits were observed in contexts that would suggest they were archaeological in nature.

As such, Terracon recommends that the project be allowed to proceed as planned, pending concurrence by the THC and USACE regulating agencies. Should the planned impacts change to include excavation, further investigations may be required by regulating agencies.

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APPENDIX A

Photolog with Photo Point Map

[redacted]

DATA SOURCES: ESRI WMS - World Aerial Imagery, OpenStreetMap

Project No.:	90217183
Date:	Mar 2022
Drawn By:	VCP
Reviewed By:	JCL

18001 W. 106th Street, Suite 300 Olathe, KS 66061
PH. (800) 593-7777 terracon.com

Port of Corpus Christi Authority
75' Channel Deepening Project
SWG-2019-00067
Nueces & Aransas Counties, Texas

Miles
0 0.2 0.4 0.8

Kilometers
0 0.4 0.8 1.6

[redacted]

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Project No.:	90217183
Date:	Mar 2022
Drawn By:	VCP
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Terracon

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Port of Corpus Christi Authority
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SWG-2019-00067
Nueces & Aransas Counties, Texas

Miles
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Kilometers
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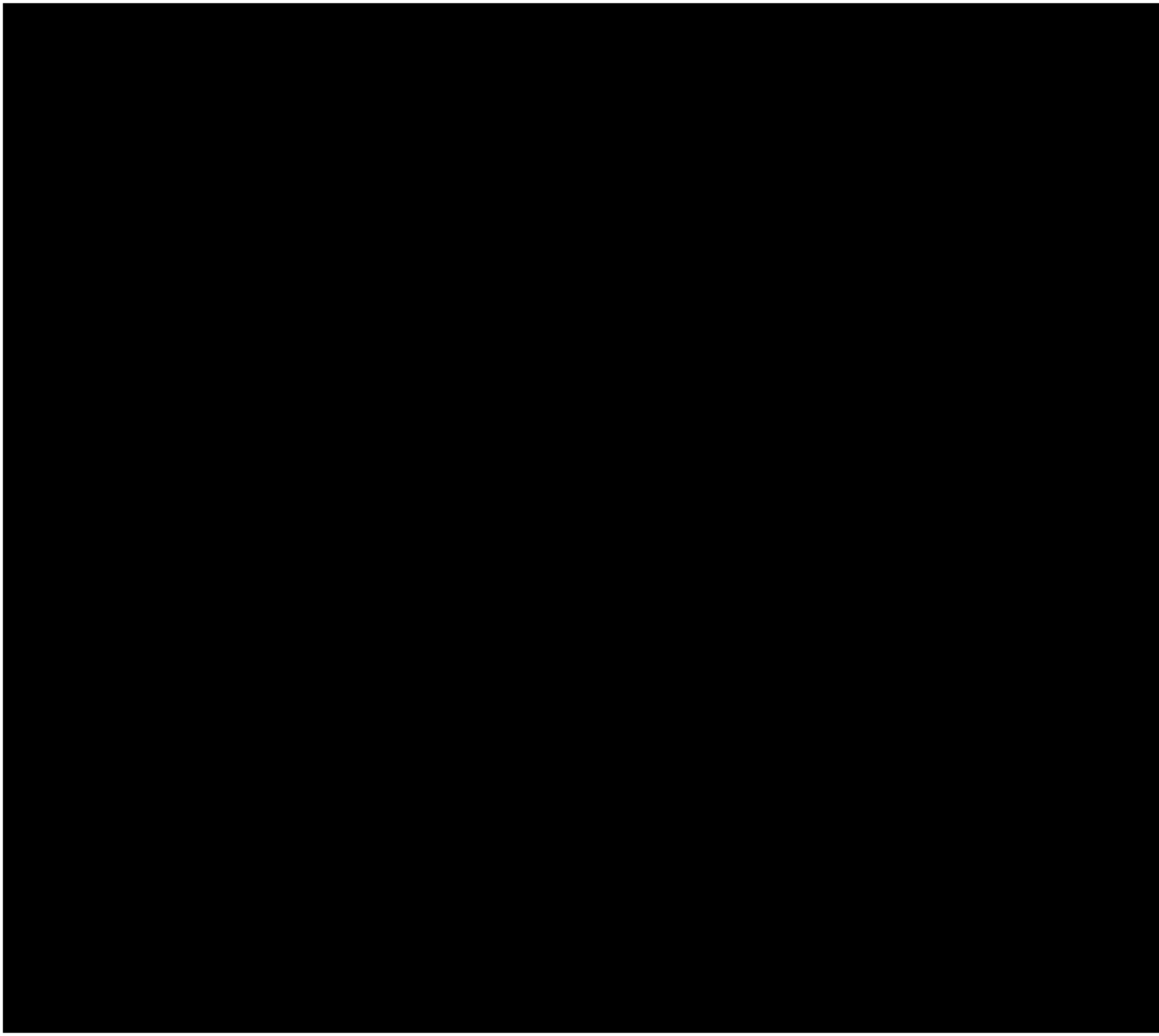

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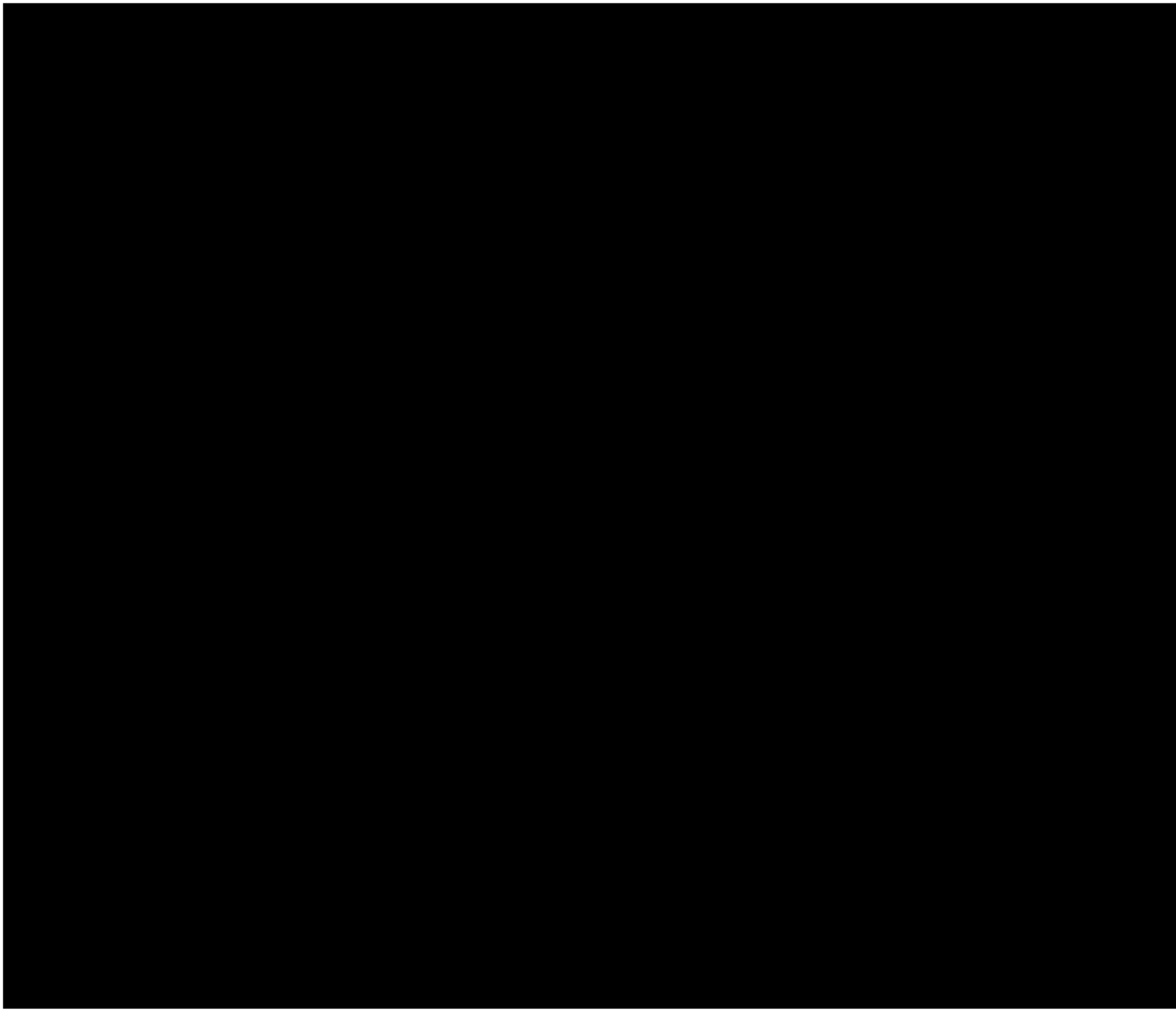

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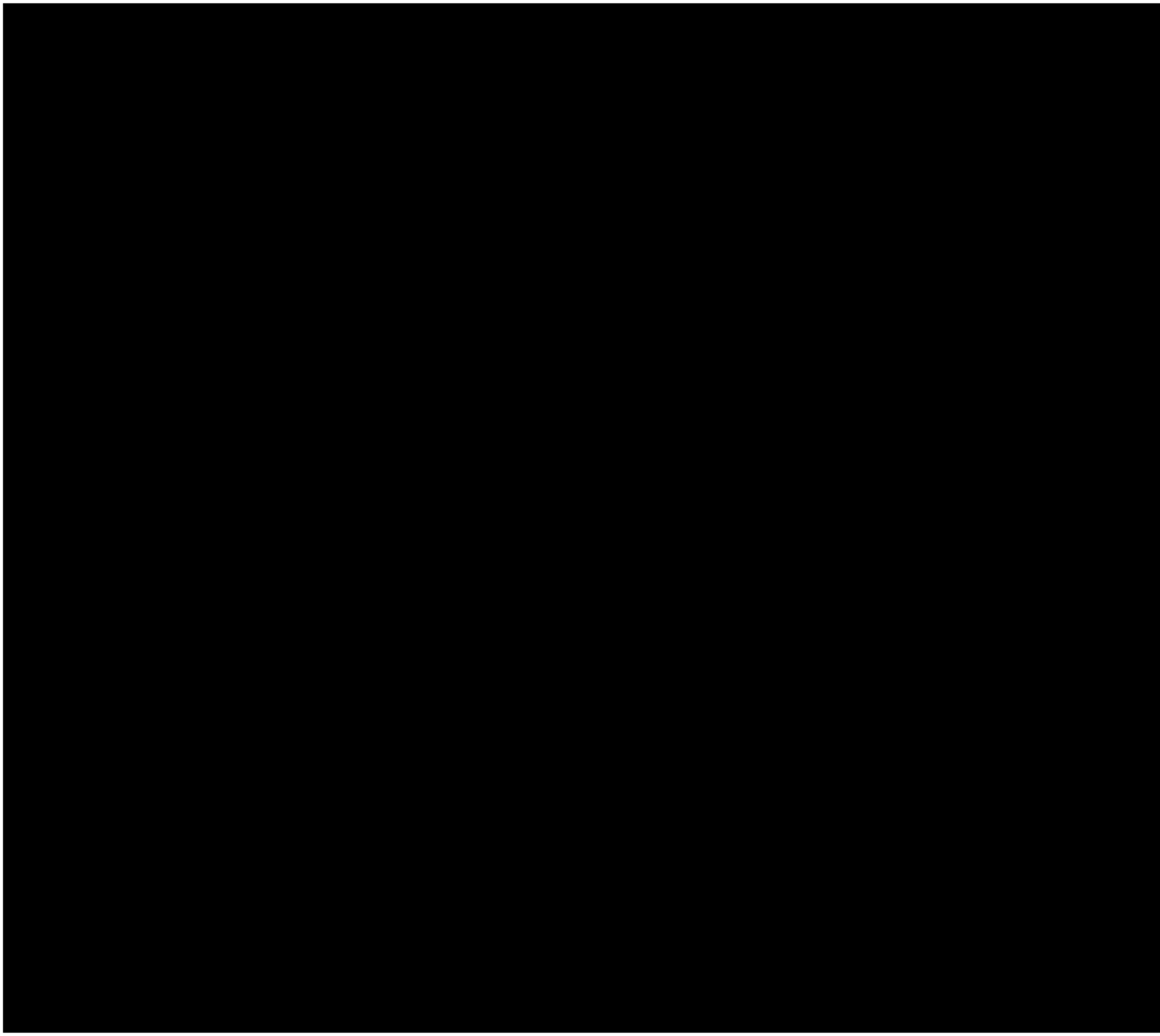

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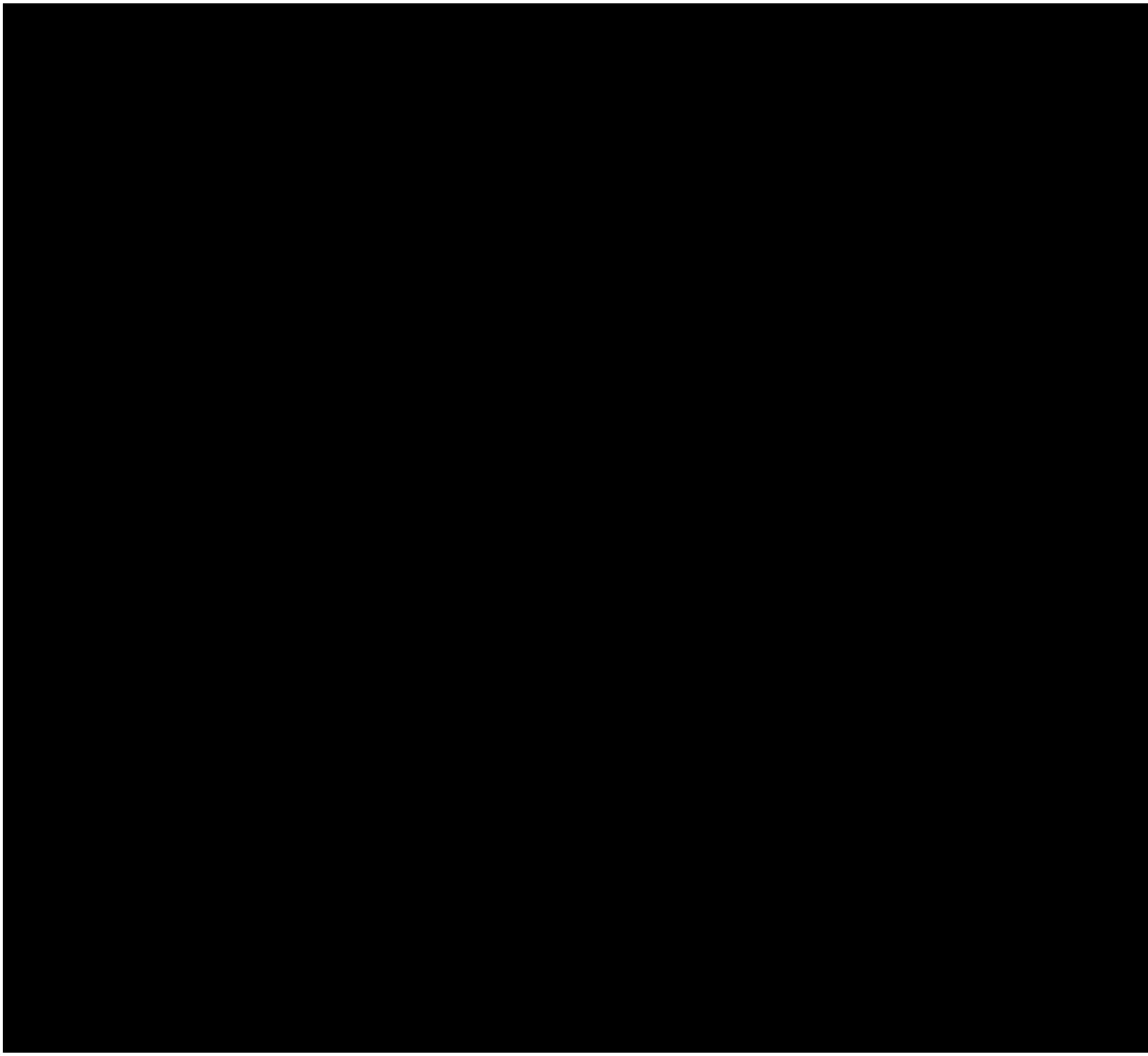

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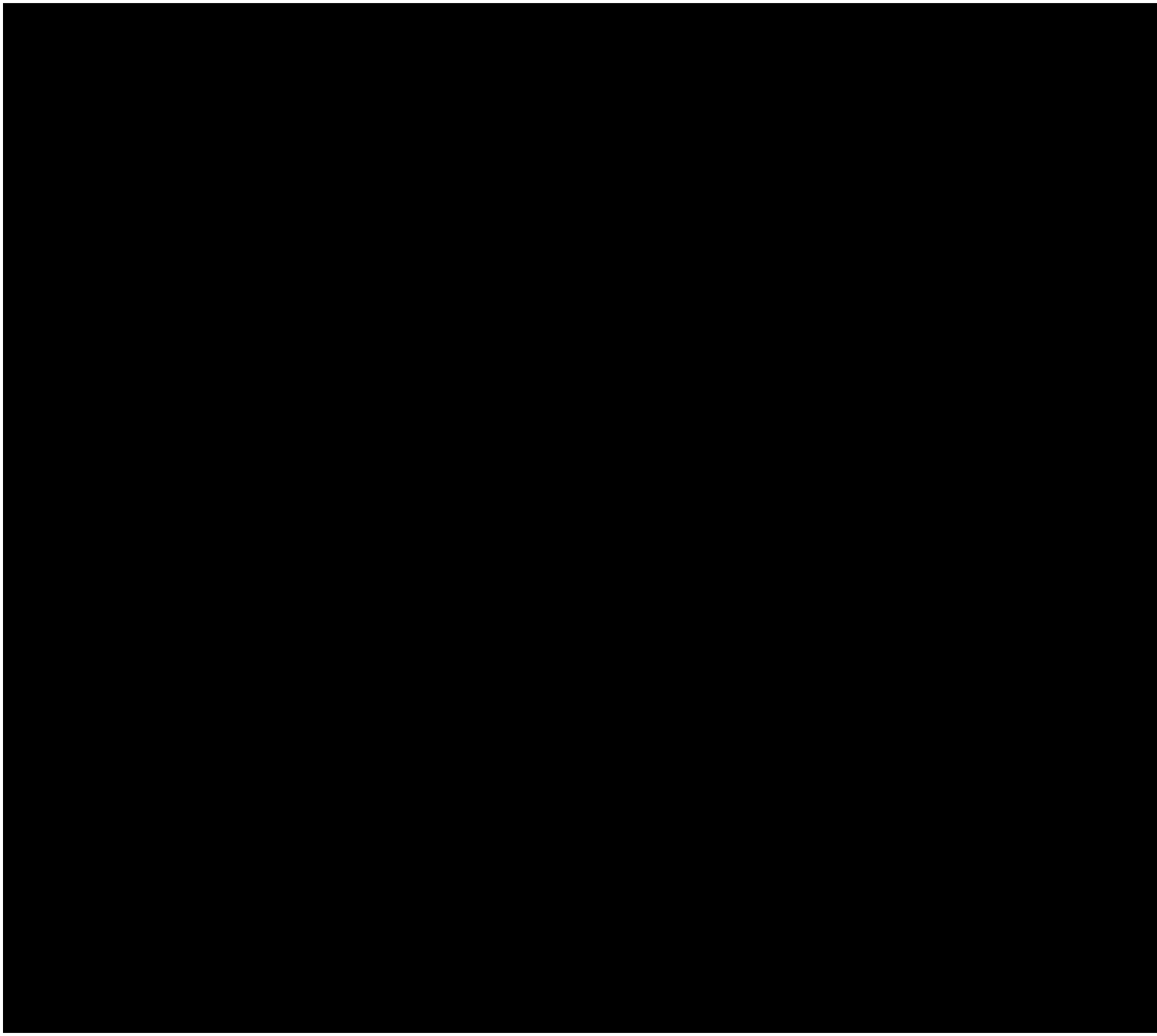

Responsive ■ Resourceful ■ Reliable

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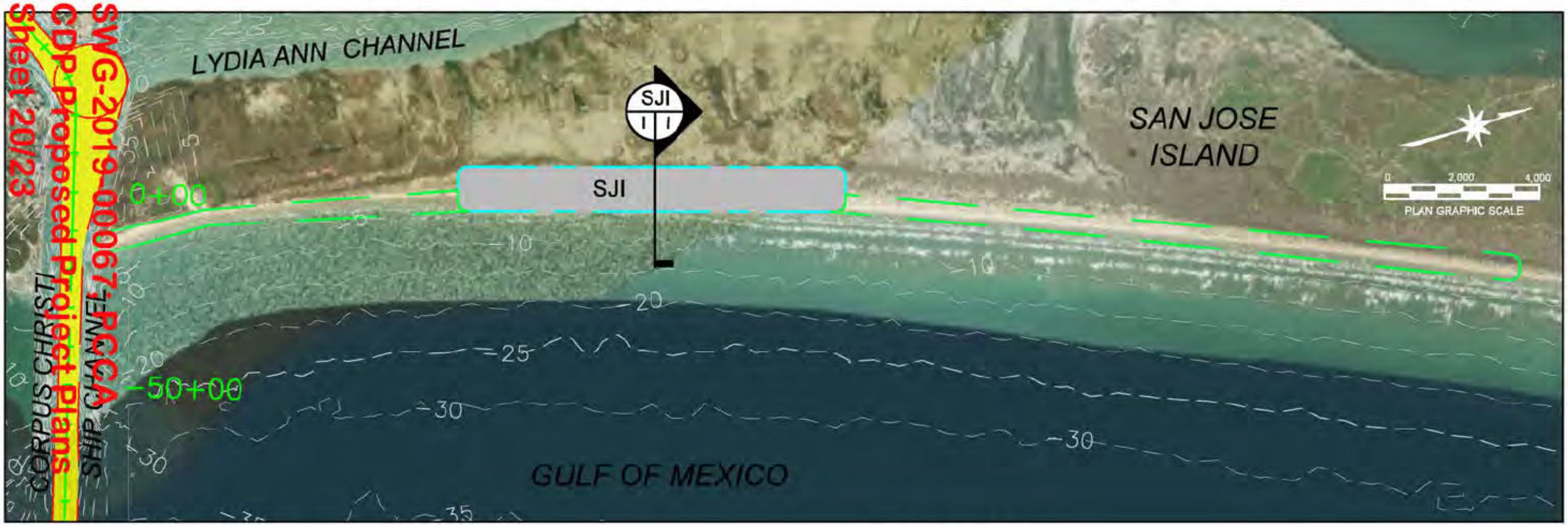
Responsive ■ Resourceful ■ Reliable

APPENDIX B

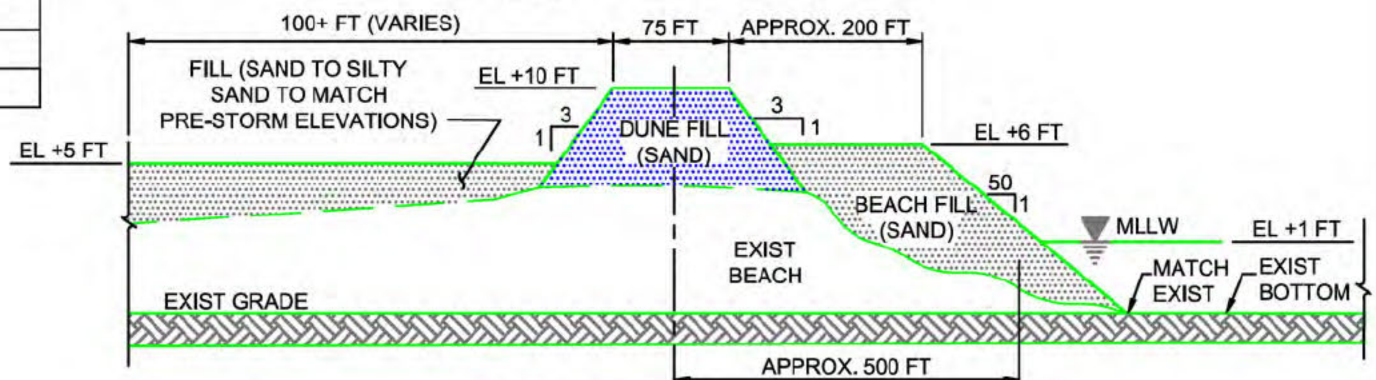
SWP-2019-00067-PCCA CDP PROPOSED PROJECT PLANS

Sheets 20-21 of 23



Placement Site Neatline Quantity – San Jose Island (SJI)	
Feature Description	**Construction Volume (CY)**
Dune Restoration	2,000,000
Beach Restoration	2,000,000
Total	**4,000,000**

SJI – PLAN
1" = 4,000'



SJI I | I SECTION
NOT TO SCALE

LEGEND

- PROPOSED SHIP CHANNEL DEEPENING
- -40- EXIST CONTOURS
- DUNE RESTORATION
- BEACH RESTORATION

GENERAL NOTES

1. BASE MAPPING SHOWN IS ESRI WORLD IMAGERY, RETRIEVED FROM ARCGIS TO AUTOCAD IN MAY 2019 - LAST UPDATED IN SEPT 2018.
2. HORIZONTAL COORDINATE SYSTEM IS NAD83 TEXAS STATE PLANE, SOUTH ZONE, US FOOT.
3. VERTICAL DATUM IS REFERENCED TO MEAN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. PIPELINE DATA FOR ARANSAS AND NUECES COUNTIES RETRIEVED FROM RAILROAD COMMISSION OF TEXAS ON NOVEMBER 19, 2018.

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

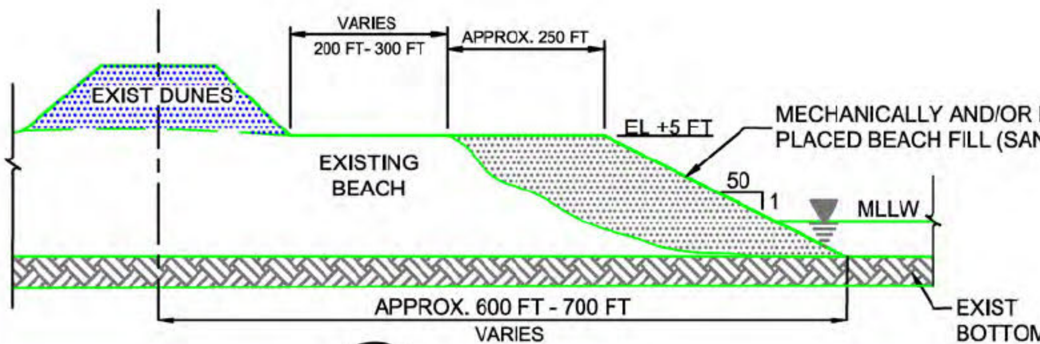
BENEFICIAL USE SITE AND SECTION VIEW - SJI
DUNE AND BEACH RESTORATION

County: Aransas and Nueces | State: Texas
Application By: Port of Corpus Christi Authority | Date: May 2019

SWG-2019-00067; PCCA
CDP Proposed Project Plans
Sheet 21/23

Placement Site Neatline Quantity – Mustang Island	
Feature Description	**Construction Volume (CY)**
Beach Nourishment	2,000,000
Total	**2,000,000**

MI
--
PLAN
1" = 4,000'



MI
P P
TYPICAL SECTION
NOT TO SCALE

GENERAL NOTES

1. BASE MAPPING SHOWN IS ESRI WORLD IMAGERY, RETRIEVED FROM ARCGIS TO AUTOCAD IN MAY 2019 - LAST UPDATED IN SEPT 2018.
2. HORIZONTAL COORDINATE SYSTEM IS NAD83 TEXAS STATE PLANE, SOUTH ZONE, US FOOT.
3. VERTICAL DATUM IS REFERENCED TO MEAN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. PIPELINE DATA FOR ARANSAS AND NUECES COUNTIES RETRIEVED FROM RAILROAD COMMISSION OF TEXAS ON NOVEMBER 19, 2018.

LEGEND

PROPOSED SHIP CHANNEL DEEPENING
-40- EXIST CONTOURS
BEACH NOURISHMENT

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

BENEFICIAL USE SITE AND SECTION VIEW - MI MUSTANG ISLAND BEACH NOURISHMENT

County: Aransas and Nueces
State: Texas
Application By: Port of Corpus Christi Authority
Date: May 2019

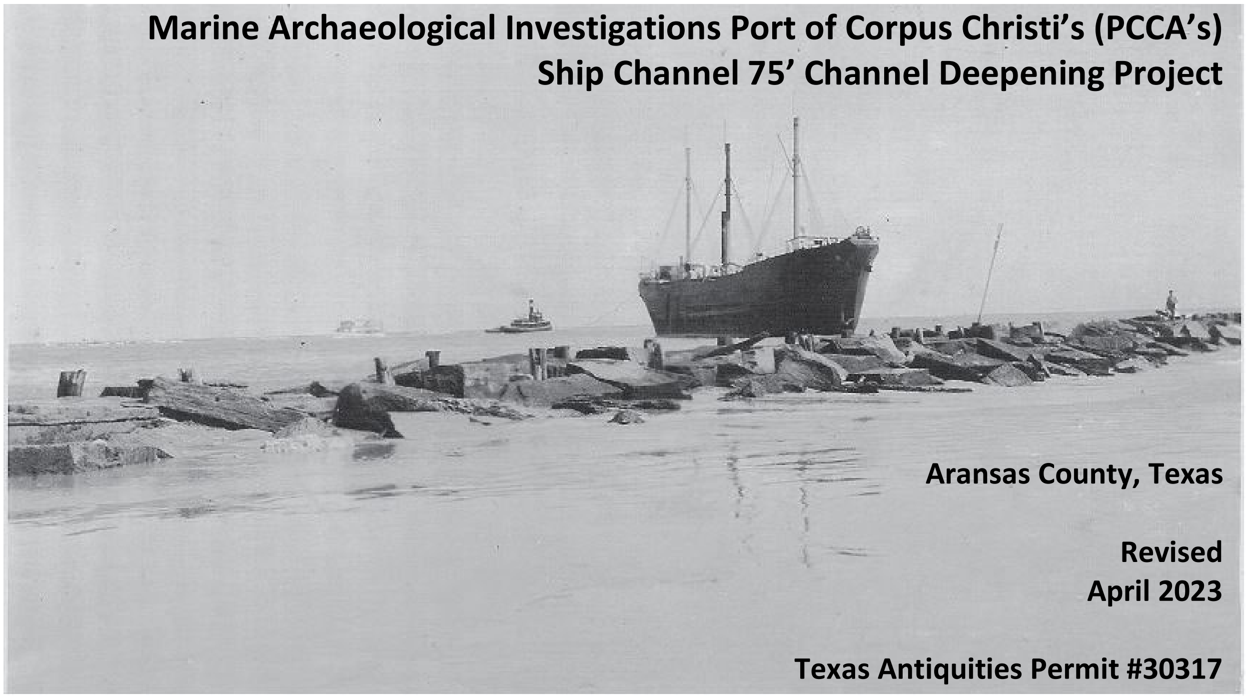
APPENDIX C
41NU153 Contact Sheet and Site Map

[redacted]

Appendix F3

Cultural Resources Marine Survey Report

Marine Archaeological Investigations Port of Corpus Christi's (PCCA's) Ship Channel 75' Channel Deepening Project



Aransas County, Texas

Revised
April 2023

Texas Antiquities Permit #30317

Prepared for:

Terracon Consultants, Inc.

And

Port of Corpus Christi Authority

By:

RECON Offshore

Some of the information contained in this report is confidential and not intended for public release or display. This information has been redacted from this report. In some instances the information was unable to be redacted and was therefore removed from this report.

Marine Archaeological Investigations Port of Corpus Christi's (PCCA's) Ship Channel 75' Channel Deepening Project

Aransas County, Texas

Texas Antiquities Permit #30317

By:

RECON Offshore
Jason Burns, Principal Investigator
Michael Krivor

Full Fathom Five
Dr. Jessica Cook Hale

BOB Hydrographics
Robert Gearhart

AmaTerra Environmental, Inc.
Mason Miller
Adam Parker
Sara Parkin
Leah Robertson

Prepared for:

Terracon Consultants, Inc.

And

Port of Corpus Christi Authority

Revised
April 2023

Cover Image:
Ship Utina, shortly before it collided with the South Jetty (Port Aransas South Jetty, March 7, 2013)

ABSTRACT

The Port of Corpus Christi Authority (PCCA) sponsored marine and terrestrial cultural resources surveys in support of the development of a Draft Environmental Impact Statement (DEIS) for the PCCA's 75-foot Channel Deepening Project. The terrestrial work was conducted by Terracon Consultants, Inc. under Texas Antiquities Permit #30312, while the current marine investigation was conducted by RECON Offshore under Permit #30317. The work was conducted in compliance with Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). Conduct of fieldwork, report preparation, and records curation adhered to the minimum requirements presented in the Texas Administrative Code, Title 13, Part 2, Chapters 26 and 28.

The PCCA has requested permit authorization (#SWG-2019-00067) from the US Army Corps of Engineers, Galveston District (USACE) to conduct dredge and fill activities related to the deepening of a portion of the Corpus Christi Ship Channel from Harbor Island into the Gulf of Mexico, covering 13.8 miles. The proposed project also involves the placement of dredged material into sand feeder berms offshore as well as on the beach at Mustang and San Jose Islands.

Marine survey of 2,730.8 acres took place over three deployments due to weather and sea conditions from October 18-22, 2021, February 9-11, 2022, and June 17-21, 2022. In total, two hundred eighty-one (281) magnetic anomalies and nineteen (19) side-scan sonar contacts were documented during the current marine investigation. Of these eight (8) magnetic anomalies and three (3) side-scan sonar contacts are associated with a known wreck site 41NU252, the SS *Mary*, four (4) magnetic anomalies and one (1) side-scan sonar contact are associated with another wreck of the *Utina*, 41NU264 and 41NU292 and one (1) side-scan sonar contact buffer is associated with 41AS119. Per Texas Administrative Code, Title 13, Part 2, Chapter 28, Rule §28.6, these anomalies/contacts will be avoided by all project activities. Avoidance buffers for *Mary* and *Utina* have been coordinated in agreements between the Texas Historical Commission, US Army Corps of Engineers, Galveston District and the Port of Corpus Christi Authority. Normal avoidance buffers extend into the existing shipping channel and have been modified not to extend past the top of the channel cut. If full avoidance is not feasible then further documentation or mitigation actions may be necessary. Permanent curation of data and reporting will be arranged with the Center for Archaeological Research at the University of Texas at San Antonio.

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1.0 Introduction

The Port of Corpus Christi Authority (PCCA) sponsored marine and terrestrial cultural resources surveys in support of the development of a Draft Environmental Impact Statement (DEIS) for the PCCA's 75-foot Channel Deepening Project. The terrestrial work was conducted by Terracon Consultants, Inc. under Texas Antiquities Permit #30312, while the current marine investigation was conducted by RECON Offshore under Permit #30317 (**Appendix A**). The work was conducted in compliance with Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). Fieldwork, report preparation, and records curation adhered to the minimum requirements presented in the Texas Administrative Code, Title 13, Part 2, Chapters 26 and 28. The PCCA has requested permit authorization (#SWG-2019-00067) from the US Army Corps of Engineers, Galveston District (USACE). The USACE Draft EIS (2021:1-3) project location and action are described as:

> The CDP channel alignment is within the existing channel bottom of the CCSC starting at Station 110+00 near the southeast side of Harbor Island. The CDP traverses easterly through Aransas Pass and extends beyond the currently authorized terminus at Station –330+00. The CDP extension terminates at an additional 29,000 feet into the Gulf of Mexico (Gulf) at Station –620+00, the channel's proposed new terminus. The approximate distance of the proposed PCCA CDP is 13.8 miles. The Federal navigation channel segments from Stations 110+00 to –72+50 (Jetties Channel's seaward limits) is currently authorized at –54 feet Mean Lower Low Water (MLLW). The Federal navigation channel segments from –72+50 to –330+00 (Offshore Channel's seaward limits) is currently authorized at –56 feet MLLW. For these segments, the Federally authorized channel bottom widths vary from 530 feet (inshore segments) to 700 feet (offshore segments).
>
> The CDP would deepen the channel from its current authorized depth of –54 feet MLLW from Station 110+00 to Station –72+50 to –75 feet MLLW. From Station –72+50 to Station –330+00, the channel would be deepened from –54 feet MLLW to –77 feet MLLW. The proposed project includes a 29,000-foot extension of the CCSC from Station–330+00 to Station –620+00 and would be deepened to –77 feet MLLW. Two feet of advanced maintenance and 2 feet of allowable overdredge would be applied to each CDP channel segment.

The proposed project also involves the placement of dredged material into nine (9) sand feeder berms offshore as well as on the beach at Mustang, San Jose and Harbor Islands.

Marine survey took place over three deployments due to weather and sea conditions from October 18-22, 2021, February 9-11, 2022 and June 17-21, 2022.

1.1 Area of Potential Effects Description

The Area of Potential Effects (APE) for the marine portion of the archaeological investigations are defined as and detailed in **Figure 1**:

- Feeder Berms/Beneficial Use Areas offshore (B1- B9) including a 50-meter buffer;
- All new cut areas in the Corpus Christi Ship Channel from Station -330+00 to -620+00 offshore including a 200-meter buffer; and
- A 100-meter buffer only within the 3-mile limit of the existing previously dredged CCSC.

The previously dredged Corpus Christi Ship Channel is not included in this project.

The survey buffers meet or exceed Texas Administrative Code, Title 13, Part 2, Chapter 28, Rule §28.6 (within 3 nautical mile line the avoidance margin is 50 meters and beyond the 3 nautical mile line in the Gulf of Mexico it is 150 meters).

This report contains a cultural context covering paleo landscapes through modern history, a background review, the survey and data analysis methods and the results of the archaeological survey and the recommendations based on those results. The authors who contributed to the report include Principal Investigator, Jason Burns and marine archaeological data analyst Michael Krivor from RECON Offshore. All archaeological data analysis was conducted by Jason Burns and Michael Krivor. Dr. Jessica Cook Hale, Full Fathom Five, wrote the prehistoric cultural context and paleo landscape assessment, sonar mosaic creation was completed by Thompson Maritime Consulting and Matt Thompson, M.A., RPA. Marine geophysicist, Erick Huchzermeyer (Empire Ocean Services) contributed to the initial magnetic processing. Robert Gearhart, M.A, (BOB Hydrographics) conducted the final magnetic processing. Mason Miller, Adam Parker, Sarah Parkin and Leah Robertson with AmaTerra Environmental Inc. contributed the Historic Context and background research. Survey equipment and vessel support was provided by BIO-West during the October and February deployments with Josh Grotte serving as their representative while Jason Burns was the onboard marine archaeologist. Survey equipment and vessel support was provided by MREC Environmental and Gabe Johnson during the June deployment with Dr. Jessica Cook Hale serving as the onboard marine archaeologist.

Temporary curation of project data and reports will be done at the Terracon Consultants, Inc. office in San Antonio with backup copies to be stored at the offices of RECON Offshore in Pensacola, Florida. Permanent curation will be arranged with the Center for Archaeological Research at the University of Texas at San Antonio.

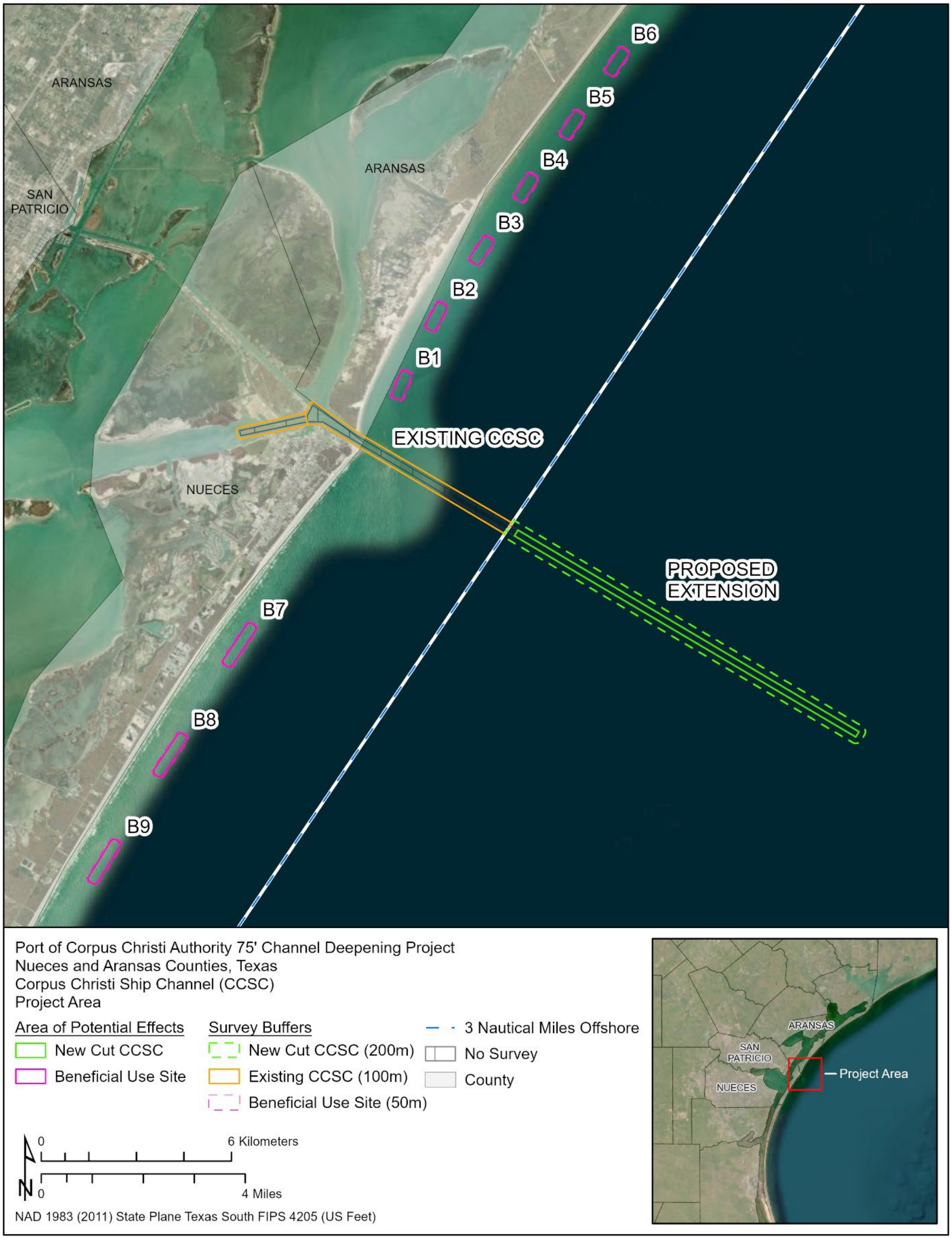

Figure 1. Project Area Location**.**

2.0 Cultural Context

The potential cultural context for surviving archaeological materials within the project area span the pre-contact and post-contact periods. This context includes an assessment of possible terrestrial occupations of the project area when it was still subaerial as well as an assessment of the post-submergence maritime landscape. Both components of this cultural context have been developed from review of peer-reviewed literature, and databases of known shipwrecks and other submerged obstructions. This chapter is organized such that the pre-contact archaeological context is followed by the post-contact maritime context.

Pre-Contact Periods (by Dr. Jessica Cook Hale)

The pre-contact archaeological context spans from the earliest entry of human populations into the project area until it was fully submerged during the last marine transgression. The deepest portions of the project area are around 80 feet (ft) (24 meters [m]) deep, and the shallowest portions of the project area are around 50 ft (15 m) deep. Due to the nature of marine transgression, deeper portions of the project area would have been submerged earlier than the shallower portions. Assessment of the regional relative sea level curve indicates that the deeper portion of the project area was initially submerged during the early Holocene, around 9,000 years ago and the shallower portion was submerged by around 8,000 years ago (Simms et al. 2007; Balsillie and Donoghue 2011; Joy 2019).

The project area could contain archaeological deposits dating from as early as the first human entry into the Western Hemisphere. Terrestrial occupation of the project area would have become impossible after the beginning of the middle Holocene around 8,000 years ago. Deeper portions of the project area would have been abandoned first, by 9,000 years ago, and the shallower portions of the project area would have been abandoned last, by 8,000 years ago. Thus, the project area could contain archaeological deposits dating to first human entry into the Western Hemisphere and as late as the beginning of the middle Holocene, at the end of the climate optimum (also known as the Holocene Altithermal or Holocene Hypsithermal).

It is important to note that Indigenous perspectives on cultural histories often depart from that of archaeologists trained in Western-style approaches to understanding the past. In some regions such as the Pacific Northwest, a variety of factors have led to better collaboration between Western-trained archaeologists and Indigenous knowledge holders in recent years, and these collaborations have increasingly validated Indigenous histories. Western archaeological speculations concerning population replacement, for example, have been discarded in favor of both historical and genetic evidence for population continuity (Rasmussen et al. 2015). Indigenous histories documenting early occupations of climate refugia during the Pleistocene followed by sea level rise events and ecological changes are increasingly supported by paleoenvironmental and archaeological research in multiple regions, such as the correlations between Indigenous histories and archaeological studies along the Pacific Northwest coast (Hebda et al. 2022). While these kinds of collaborative approaches are not as common for the

Texas coast, it is entirely possible that future endeavors will likewise demonstrate concordance between Indigenous histories and archaeological studies.

Such collaborative approaches could be highly effective in addressing considerable gaps in the archaeological record caused by poor preservation of material culture. Preservation for the earliest sites on the south-central Texas coast is not ideal due to geomorphological conditions and the comparative fragility of most cultural materials (except for stony items). Because information about cultural practices in pre-contact periods in the specific area around the project area is not abundant, the following cultural history focuses on the overall region. As such it uses many of the chronological periods generally employed by archaeologists across the Southeast and southern Plains (Anderson et al. 2007; Collins et al. 2014; Waters et al. 2018). Specific trends relevant to the project area are drawn from literature that directly addresses the southern plains and Texas coastal plain region (e.g., Ricklis 2004).

It is also important to note that many Indigenous nations do not agree with the use of some of the naming conventions for cultural periods as currently practiced by North American Western archaeologists. Accordingly, instead of cultural period names such as "Paleoindian" or "Archaic period", this cultural context assessment will refer to cultural periods by the geological and climatological period during which these groups lived. It will also discuss cultural groups according to signature tool types, such as Clovis or Folsom, to better tie this assessment to cultural practices as they are currently understood.

The initial dates of human habitation of the American continents have not been definitively established. However, identifiable cultural groupings can be archaeologically identified and given temporal ranges. The earliest pre-Contact period occurred during the terminal Pleistocene epoch (>17,000–11,500 years ago). Early occupants were clearly present within the central and southern portions of North America by at least 14,500 B.P. (Collins et al. 2014). Texas has several sites with secure radiometric dates earlier than the most visible PaleoAmerican culture, Clovis; both the Debra Friedkin site and the Gault site, in central Texas, retain archaeological deposits that date to before 13,500 years ago (Waters et al. 2011; Collins et al. 2014).

The cultural groups who inhabited the region had access to diverse regional landscapes and resources. The modern Texas coastline would have been an inland coastal plain with small fluvial systems draining into the western Gulf of Mexico. Inland lay highly valued resources such as the chert deposits within the Edwards Plateau, from which early Americans preferred to craft stone tools within this region. While no clear examples of Pleistocene-aged coastal sites exist in the Gulf of Mexico, visits to the coastline should be assumed, given the comparatively hospitable climate in the region at this time and the appearance of items such as a shark's tooth recovered from a Pleistocene burial located well inland from the Texas coast (Bousman et al. 2004).

These Pleistocene cultures were followed by the Holocene occupations that reflect cultural adaptations to changing climate and coastlines (11,500–3,000 years ago). Terminal Pleistocene and early to middle Holocene marine transgression flooded the coastal plain and creating highly productive estuaries where fluvial systems drained into the Gulf. Such estuaries would have been present near the project area in now-submerged locales such as Corpus Christi Bay and Copano Bay. The modern barrier islands appear to have begun forming at the end of the early Holocene (Anderson et al. 2014), and the project area itself was likely submerged around the same time (Ricklis and Blum 1997; Simms et al. 2007; Balsillie and Donoghue 2011; Joy 2019). Marine transgression and ravinement processes have probably eroded away any early Holocene barrier formations, had they existed. Lower lying estuarine deposits may be preserved and could retain evidence for increasing use of coastal resources as the shoreline moved landward and human groups adapted to these changing circumstances.

In summation, there is the potential for archaeological deposits dating from the earliest human occupations of North America until the middle Holocene, at which point the project area was submerged and unavailable for occupation (**Table 1**). The descriptive sections below provide additional details on settlement patterns, ecological constraints, material culture, and a context against which the significance of newly discovered archaeological sites may be evaluated. Finally, each section also discusses potential site types and cultural expressions that may be present within the project area.

Table 1. Cultural Periods along the South-Central Texas Coastline.

Period	Dates	Cultural Traits
Terminal Pleistocene (often referred to as "Paleoindian or PaleoAmerican"	>14,500–11,500 years ago	Small, mobile egalitarian groups following seasonal patterns in pursuit of game (probably focused on bison and smaller game). Some raw materials for lithic tools come from distant locations as far away as the Missouri, but most tool assemblages in Texas can be sourced to resources such as Edwards Plateau chert deposits.
Early Holocene (often referred to as "Early Archaic")	11,500–8,000 years ago	Multiple sites documented in the Nueces River region showing use of coastal resources by the end of this period. Shift to broader spectrum diet, partially dictated by extinction of Pleistocene megafauna and partially encouraged by expansion of coastal and estuarine resources.
Middle Holocene (often referred to as Middle Archaic)	8,000–5,000 years ago	Apparent cultural continuity with Early Archaic cultural traits, with an occupational hiatus after around 6,800 years ago.

<u>Terminal Pleistocene (>15,000 – 11,500 Years Ago)</u>

The earliest human entry into the hemisphere is a topic of evolving research but occurred sometime in the terminal Pleistocene epoch. The period is considered to come to an end at the end of the Pleistocene epoch, around 11,500 years ago, when glacial conditions fully terminated and many Pleistocene taxa went extinct, including iconic megafauna like mammoth (*Mammuthus colombi*), mastodon (*Mammut americanum*), horse (*equus equus)* and ancient bison (*Bison antiquus*).

How the earliest populations to arrive in the project area articulated with their landscape in the offshore zone is a question that requires understanding when and how their ancestors arrived there. This understanding has, to say the least, evolved considerably in the last 50 years.

Twentieth century archaeological models assumed that the Clovis cultural period, which dates to between 13,050-12,750 years ago across the continental United States (Waters et al. 2020) represented the first Americans in this hemisphere. Clovis people were thought to be composed of fast-moving, highly mobile hunting bands who rapidly adapted to a new continent using highly effective Clovis blades to supply their needs in almost any terminal Pleistocene environment found in North America (Surovell 2000; Haynes 2002). However, in the last 30 years, archaeological research has shown that this “Clovis First” model is incorrect and that populations sufficiently numerous to leave behind archaeological evidence were present before 13,500 years ago, including in Texas itself.

Clovis First models argued that Clovis people entered the hemisphere via an ice-free corridor across the exposed continental shelf of Beringia, called the Bering Land Bridge, around 14,000-13,500 years ago (Haynes 2002). However, archaeological sites dating from before this time are now well documented. Materials at Cooper’s Ferry along the Snake River valley in the Pacific Northwest date to as early as 17,000-18,000 years ago (Davis et al. 2019) while evidence from Paisley Caves in Oregon dates to 14,000 years ago (Jenkins et al. 2012), putting people in the Pacific Northwest at least 500 years, and more likely 3,500 years, before Clovis technology developed. Further south, the Gault and Friedkin sites in Texas were occupied between 15,500 and 13,500 years ago, again just before and right as Clovis culture appeared in the archaeological record (Waters et al. 2018). Just south of the Great Lakes, Meadowcroft Rock shelter in western Pennsylvania dates to at least 14,000 years ago and possibly earlier – again, at least a half a millennium before the first Clovis point was made (Faught 2008; Adovasio and Pedler 2014; Waters et al. 2018). In northern Florida, Page-Ladson securely dates to approximately 14,500 years ago, roughly contemporary with the Friedkin and Gault sites to the west in Texas and a thousand years before Clovis appeared (Halligan et al. 2016). In Virginia, the Cactus Hill site has yielded dates of around 18,500 years ago for a collection of blade tools lying conformably below a Clovis level (Wagner and McAvoy 2004). Every one of these sites has yielded clear evidence that the people who lived there pre-dated Clovis culture.

The current understanding of exactly when people arrived in the Western Hemisphere obviously turns on the dates of sites like these, but they may not represent the earliest occupations of this hemisphere. A rock shelter in Mexico returned dates of over 30,000 years old, but this site is hotly contested because the stone items interpreted as tools are not accepted as such by many archaeologists (Ardelean et al. 2020). Preserved footprints are another matter, however; it is difficult to argue that human beings did not leave them behind, though assigning an accurate and precise date can be difficult. Such trackways have been uncovered, at White Sands, New Mexico, and careful examinations of datable materials found within the sediments associated with these footprints have been dated to around 22,000 years ago, during the last glacial maximum (LGM) (Bennett et al. 2021). Technical discussions concerning these sites remain ongoing, but the White Sands footprints in particular make it difficult to argue that human beings were not present in the Western Hemisphere before 18,000 years ago. Furthermore, they lived alongside the Pleistocene flora and fauna for millennia, even as the climate changed, and shorelines moved landward. They also did so quite successfully, given the continuity of settlement in this region.

Who were they and where did they come from? Though the Clovis First hypothesis no longer holds, extensive DNA studies still indicate that the first Americans came from northeastern Asia, just as the proponents of Clovis First also asserted (Rasmussen et al. 2014; Willerslev and Meltzer 2021). The question then becomes how they got here. Pollen analysis and other proxies for environmental conditions indicate when the ice-free corridor in Beringia was not free of ice and available for use by early populations until after 14,000 years ago. Furthermore, this ice-free corridor may not have supported plant and animal life sufficient to support human occupants until after 13,000 years ago when steppe species can be detected in the paleoclimate records for the region (Pedersen et al. 2016). The obvious implication then, is that the people who lived at places like Page-Ladson were descended from people who arrived in the Americas using a route that did not involve the ice-free corridor between the collapsing Laurentide and Cordilleran ice sheets, east of the Rocky Mountains. The most likely option was the Pacific coastline, which contained a comparatively much more moderate climate as well as more natural resources (Fladmark 1979; Braje et al. 2019; Davis et al. 2019; Hebda et al. 2022).

Moreover, the spatial patterning of Pre-Clovis sites and the material culture types found at these locations both argue against the single ice-free corridor entry (Faught 2008). First, as noted above, ecological analysis within the ice-free corridor indicates it was probably not available, or terribly hospitable, during the period when Clovis was developed. Second, there is some debate concerning the geographic origins of Clovis technology. Many of the sites west of the Great Basin and along the West Coast exhibit a stemmed point style associated with the earliest dates from those locations. These appear to overlap Clovis or maybe even pre-date Clovis (Waters et al. 2018; Brown et al. 2019; Davis et al. 2019; Erlandson et al. 2020). Finally, the distribution of Clovis points across the Americas does not fit a scenario that follows a pattern of entry through the ice-free corridor. Instead, the densest concentrations of them are found east of the Mississippi River (Anderson and Faught 1998; Faught 2008; Anderson et al. 2019). The sample size used for testing this observation was drawn from the Paleoindian Database of the Americas (https://pidba.utk.edu/main.htm;Anderson et al. 2019), which reviews patterns of Paleoindian tools at a continental level sufficient to account for biases such as differential preservation in the archaeological record. If Clovis was brought through the ice-free corridor, this analysis should have detected that spatial pattern. It did not.

It seems instead much more likely that a Pacific coastal settlement pattern was the initial route along which people entered this hemisphere. While the Cordilleran ice sheet had only just begun to retreat and expose the west coast of North America, the coastline was free of ice and rich in resources (Erlandson et al. 2016; Waters et al. 2018; Davis et al. 2019). At least some of these group used stemmed point technology (Jenkins et al. 2012). A second entry along the ice-free corridor could have occurred after 14,000 years ago as groups living in Beringia were able to travel south through disintegrating ice sheets to access more favorable territories, however, suggesting that people entered the Americas along multiple routes (Bourgeon et al. 2017; Waters et al. 2018; Vachula et al. 2020; Bourgeon 2021).

Entry along multiple routes is also suggested by the site patterns. This diffusion process occurred at least by 16,000-17,000 years ago when people occupied Coopers Ferry, along the Snake River in Idaho inland from the Pacific Northwest coastline (Davis et al. 2019). By 14,000 years ago people had established themselves in the northern Great Basin at Paisley Caves. Along the Pacific Northwest littoral, the Manis Site on the Olympic Peninsula of Washington site dates to around 13,800 years ago, indicating that at least one of these groups stuck closer to the coastline after some groups had moved into the interior (Waters et al. 2011; Jenkins et al. 2012). California's Channel Islands were settled by 11,700 years ago, if not earlier, indicating that the West Coast cultural groups had mastered open water navigation; this makes a great deal of sense if the early inhabitants of the West Coast were already coastally adapted (Erlandson et al. 2016, 2020). Inland groups, as noted above, made it to Texas by 15,500 years ago (Waters et al. 2011, 2018) while people clearly reached the Page-Ladson site in northern Florida by at least 14,500 years ago, if not before (Halligan et al. 2016). Some groups continued south and reached the southern portion of South America by 14,200 years ago (Braje et al. 2019). Given this evidence, it seems more likely that the Clovis culture developed from earlier cultures associated with the first Americans, or that the Clovis people represent a migration after earlier Pre-Clovis people (Waters et al. 2018).

To date, two sites unequivocally associated with pre-Clovis people in Texas have been documented: the Debra L. Friedkin site and the Gault site (Waters et al. 2011, 2018; Collins et al. 2014). Closer to the coast, the McFadden Beach finds demonstrate clear evidence for Clovis-aged occupations (Turner and Tanner 1994; Stright et al. 1999). These three sites are thus the best cognate sites for potential Pleistocene occupations in the project area. The coastal plain of Texas extended further east during the period when human groups occupied the Friedkin, Gault, and McFadden Beach sites, suggesting that any sites associated with the earliest human occupations in the project area are likely to take similar forms to these inland occupations. Given the complexity of ecological conditions and the time depth of human occupation in Texas, then, it is likely that any evidence for human occupation left behind in the project area could potentially pre-date the Clovis period. Any such hypothetical occupations could also add to the body of knowledge concerning human entry routes into North America.

<u>Ecological Conditions and Early Human Occupation in Texas</u>

The last sea level high stand on the Texas coast occurred sometime around 125,000 B.P., after which point the coastline receded seaward (Rodriguez et al. 2000; Anderson et al. 2014). During the LGM at around 24,000 B.P., sea levels dropped approximately 135m (nearly 450 ft) below today's levels and did not fully reach the modern shoreline until around 3,000 years ago (Balsillie and Donoghue 2011; Joy 2019). Consequently, the entire continental shelf of Texas was exposed and was an ecological extension of the lower coastal plain for around 120,000 years. The project area lies within this coastal plain, which contains multiple Paleoindian sites (Bousman et al. 2004), and it is logical to assume that these people could have also occupied this area of the landscape, also.

Syntheses of paleoenvironmental indicators for the terminal Pleistocene suggest that this portion of Texas likely experienced reduced seasonality as well as generally more humid conditions during this time (Stright et al. 1999; Warny et al. 2012). Further to the north and east lay what is now the eastern woodlands ecological zone, while the southern Plains extended to the south closer to the project area (Stright et al. 1999). The project area would have been an inland location during the terminal Pleistocene; during the LGM, the coastline was around 80 miles (around 130 km) away. Stranded barrier island chains would have been a prominent landscape feature on this inland coastal plain, trending parallel to the shoreline as topographic highs above the low gradient coastal plain; one such example has been documented off Matagorda Bay, in around 50 ft. (15 m) of water dating to the interstadial climatological period before the LGM, around 35,000 years ago(Rodriguez et al. 2000). Fluvial systems took an incising form during the Pleistocene due to the increased hydraulic gradient created by marine regression and lower relative sea levels.

The coastal plain itself does not contain abundant geological resources (typically cryptocrystalline quartz/chert) known to have been favored by Paleoindian populations. Such resources existed to the north and west along the Edwards Plateau (Stright et al. 1999). The Nueces paleo-valley is located south of the project area and would have provided abundant freshwater as well as aquatic resources and could have facilitated access to the coast itself (Ricklis 2004; Anderson et al. 2014). In sum, the Project area lay within a region that was likely ecologically attractive to early human groups spanning times during which such groups were known to be present in the region, offering ample food and water, with raw materials for high quality stone tools available via longer range treks or down-the-line trade networks facilitated by coastal plain waterways.

<u>Material Cultural and Settlement Patterns</u>

Pleistocene-aged sites in south-central Texas are not common, despite the general abundance of such sites across Texas. A review of the PIDBA databases indicates that 1,106 Pleistocene-aged types of projective points have been identified in Texas overall, but only three (3) have been recovered in Nueces County, nearest the project area (Anderson et al. 2019). The paucity and opacity of Pleistocene sites in this region is probably due to poor archaeological preservation in this region. Most known Pleistocene sites in Texas have been found in eroded surface contexts, and few stratigraphically intact sites have been documented (Bousman et al. 2004).

The three projectile points recovered in Nueces County were all of the Folsom type, which is associated with the final part of the Pleistocene, during the Younger Dryas climate episode that saw increased aridity across the region (Fastovich et al. 2020). In the southern Plains, Folsom cultural groups appear to have focused on hunting bison (MacDonald 1998; Blackmar 2001). The appearance of this type of projectile point suggests that these groups ranged at least this far south. There is no evidence for earlier occupations, but poor preservation is just as likely to explain this as lack of evidence instead of actual absence.

Aside from the Folsom finds in Nueces County, material cultural patterns can be inferred from a broader review of sites across Texas. Multiple bison kill sites are documented from the earliest occupations in Texas, along with quarrying sites. Studies of faunal assemblages across Texas have clearly demonstrated that Pleistocene cultural groups in this region not only hunted bison and other large game, but smaller prey, as well (Bousman et al. 2004). This is consistent with other studies of Pleistocene subsistence across North America that have shown, time and again, that these groups relied not only on highly visible, high value prey such as mega-fauna, but a broad spectrum of foods that included small animals and various floral taxa (Cannon and Meltzer 2004, 2008; Newsom 2006).

Large aggregation sites are implied by large sites such as Gault and the Debra Friedkin sites on the Edwards Plateau, and these site types could extend onto the coastal plain, as well. This inference is based on the admittedly enigmatic McFadden Beach site, on the upper Texas coast near the paleo Sabine river valley (Turner and Tanner 1994; Stright et al. 1999). McFadden Beach has yielded a large assemblage of stone tools, including large numbers of Pleistocene forms ranging from the earliest known occupations to the end of the Younger Dryas and into the Holocene (Stright et al. 1999). This assemblage is not water-worn or otherwise rounded, suggesting recent erosion from whatever sedimentary formation preserved them, possibly in situ (Stright et al. 1999). Tools are made from cryptocrystalline quartz (chert) sourced from sources in the southern Plains, though at least one tool was crafted from chert possibly from as far afield as the Missouri River valley (Stright et al. 1999). The size and composition of this assemblage both suggest a large site, probably a large aggregation site, where people met probably on a seasonal basis for multiple cultural and possibly subsistence-related purposes.

There is a large salt dome formation just offshore of McFadden Beach. This is of note because it may indicate the reason for such a large site occurrence on this portion of the coastal plain, as well as potentially other cultural associations. Along the chenier plain of southern Louisiana, north and east of the project area, but within the zone these cultural groups appear to have used, Pleistocene-aged sites are rare but typically found in association with salt dome features; the Avery Island site is one such example (Rees 2010). Tool forms from McFadden Beach generally appeared to be more consistent with forms found further to the east along the northern Gulf of Mexico and into the panhandle of Florida, suggesting cultural ties to these regions (Stright et al. 1999). The presence of tools possibly made as far away as the northern Plains region indicates links to this region, as well. Salt domes are outstanding sources for iodine uptake needed by large herbivores such as bison, mastodon, or mammoths (Haynes 2002). Such features would have attracted herds of these animals, and thus in turn served as magnets for the human groups who preyed on them. It is logical to hypothesize that McFadden Beach could be the remains of a large aggregation site occupied by cultural groups who gathered, possibly over long distances, to prey on bison or elephant herds that visited the nearby salt dome during the course of seasonal migrations. Interestingly, there are three salt dome formations in region of Corpus Christi (Hamlin 2006).

Finally, it is important to note that Texas has a large number of Pleistocene-aged burials compared to other regions of North America (Bousman et al. 2004). Interments are rare in general for such early periods, and the tendency for Pleistocene cultural groups on the Plains and into the southeastern United States to inter cremated remains along with red ochre makes them difficult to detect in archaeological deposits (Jones and Tesar 2000; Owsley et al. 2001; Rasmussen et al. 2014). Such sites are obviously highly sensitive in nature and subject to strong legal protections.

Potential Site Types in the Project Area

As noted above, PIDBA data indicates that only three Pleistocene projectile point types have been recovered in Nueces County, and they are all of the late Paleoindian Folsom type (Anderson et al. 2019). Folsom culture is widely assumed to have focused on big game hunting on the Plains, including the southern Plains, particularly with hunting bison (Bousman et al. 2004). Folsom people are thought to have been highly mobile, and likely observed a seasonal round that incorporated their hunting habits along with either visits to, or trade to obtain, stone tools made of high quality material such as Edwards Plateau chert as well as materials from as far away as New Mexico and possibly the Missouri River valley (MacDonald 1998; Stright et al. 1999; Blackmar 2001; Bousman et al. 2004).

Visits to the coastline during the Pleistocene can be assumed from the appearance of a shark's tooth in a terminal Pleistocene burial in Texas at the Wilson-Leonard site (Bousman et al. 2004). Pleistocene use of the now-submerged coastal plain is confirmed by the large assemblage recovered from McFadden Beach, on the upper Texas coastline, along the paleo Sabine (Turner and Tanner 1994; Stright et al. 1999). Site types could include hunting camps where bison were processed, and perhaps even large aggregation sites, if the McFadden Beach site is any indication. The presence of salt domes in the region could have acted as attractors, as well. There is also a clear stratigraphic association of Pleistocene sites with the Deweyville deposits that overlie the Beaumont terrace formations within fluvial valleys. Seabed conditions in the project area should especially scrutinize preserved fluvial margins, especially given the appearance of three salt domes in the Nueces County area (Hamlin 2006).

Holocene Cultures, Also Termed Archaic Period (10-000 – 3,000 Years Ago)

Based on changes in material culture, the Archaic Period has been subdivided into Early, Middle, and Late periods that correlate roughly to climate oscillations that have occurred since the beginning of the Holocene 11,500 years ago. Early and middle Holocene cultures following the Pleistocene occupations predate the use of horticulture. They are generally characterized by evidence for technological and cultural adaptations to changing climates, coastlines, and resource distributions.

Early Holocene cultures (11,500 to 8,000 years ago)

Early Holocene cultures developed during the onset of the early Holocene epoch, during which time the arid conditions brought on by the Younger Dryas eased and rainfall returned, at least temporarily (Warny et al. 2012). However, these conditions appear to have been followed by increasing aridity across the region (Ricklis and Cox 1998; Bradley 2006). Relative sea level change remained fairly rapid, shifting from between 165 to 33 ft. (50–10 m) below modern levels. Fluvial systems with incising valleys during the Pleistocene began to flood during this time, changing the channel systems to meandering forms and allowing the development of estuarine conditions along the coastline after around 9,000 years ago (Ricklis and Blum 1997). Megafauna such as mammoth, mastodon, and horse all went extinct at the end of the Pleistocene, and their ecological niches were likely occupied on the southern plains by modern bison (Bousman and Vierra 2012).

Material Cultural and Settlement Patterns

Human groups appear to have responded by contracting their territories and changing their subsistence patterns in comparison to Paleoindian populations, likely due to diminishing coastal plain ranges due to sea level rise combined with rising populations supported by new subsistence resources. Research indicates that early Holocene social groups moved within smaller territories than their Pleistocene ancestors, practicing an increasingly generalized subsistence strategy. On the south-central Texas coastline, this shift in subsistence strategy included the incorporation of estuarine resources by around 9,000 years ago (Ricklis and Blum 1997). Early Holocene occupations are thus possible within the project area and would likely have been oriented around the local fluvial systems, which would have offered access to both inland resources and the coastal zone.

Material cultural changes in the early Holocene tend to reflect generalized changes across the entire eastern U.S. While terminal Pleistocene tool types show continuity with Clovis forms, retaining lanceolate shapes with or without central flutes, early Holocene bifaces switched to notched points, the use of standardized to expedient cores, the exploitation of local bedrock and secondary lithic sources, and the appearance of woodworking tools (Anderson et al. 2007; Yerkes and Koldehoff 2018). The diagnostic artifacts most closely associated with the early Holocene in Texas are side and corner notched projectile points and stemmed or corner-notched points (Webb et al. 1971). Such changes to the primary toolkit likely represent more substantial site occupations and decreases in residential mobility, as well as technological adjustments designed to support subsistence systems based around early Holocene resources (Webb et al. 1971; Bousman and Vierra 2012). A degree of continuity with Pleistocene populations is inferred by many researchers in the region, as well (Bousman and Vierra 2012).

Potential Site Types in the Project Area

Early Archaic occupations are more archaeologically visible in the region of the project area. Across the Corpus Christi region, multiple excavations have recovered early Holocene materials, often in association with shell midden materials. This archaeological evidence along with environmental and relative sea level constructions suggest that Corpus Christi and Copano bays both began to flood with brackish estuarine waters by this time (Ricklis and Blum 1997; Anderson et al. 2014). The appearance of coastally adapted occupations suggest that early Holocene sites just offshore are most likely similar. Sites tend to be found resting unconformably over the Pleistocene sediments, usually the Beaumont formation, indicating that erosional conditions existed between the terminal Pleistocene and these early Holocene deposits (Ricklis and Cox 1998).

Middle Holocene cultures (8,000 to 6,000 years ago)

The Middle Archaic Period coincides roughly with the onset of the middle Holocene. This climate is marked by continued aridity in the region (Ricklis and Cox 1998). This is assumed based on geoarchaeological studies that have indicated erosional conditions consistent with minimal plant cover. Warming appears to have continued, and sea levels shifted from around 33 ft. (10 m) below modern sea levels at the beginning of this period to nearly the modern position by the end of it, likely standing around 7 ft. (2 m) below modern sea level by 5,000 years ago. This continued marine transgression caused a change in the project area from being a part of the coastal zone itself to being fully submerged.

Material Cultural and Settlement Patterns

Archaeological studies in Nueces County have indicated an apparent occupational hiatus during the middle Holocene after around 6,800 years ago (Ricklis and Blum 1997; Ricklis and Cox 1998). There is minimal evidence for use of this part of the Texas coastline at this time, while prior occupations appear to show continuity with early Holocene settlement and material cultural patterns. Additionally, increasing aridity along the coastline appears to have possibly reduced hydraulic discharge volume in regional fluvial systems, leading to increased salinity in the bays and a shift in resource availability (Ricklis and Cox 1998).

Potential Site Types in the Project Area

Archaeological studies in Nueces County have indicated an apparent occupational hiatus during the middle Holocene after around 6,800 years ago (Ricklis and Blum 1997; Ricklis and Cox 1998). This, taken with the relative sea level curve data suggesting the establishment of the barrier island formations at their modern positions, suggest that middle Holocene sites are likely to be minimal in the project area. Should any such sites exist in the project area, they are likely to reflect coastal adaptations, including the use of shellfish from estuarine contexts.

Historical (by Mason Miller, Adam Parker, Sara Parkin and Leah Robertson)

The following narrative presents the maritime history of Aransas Pass, Port Aransas, and their associated communities. The discussion also characterizes the potential for historic shipwrecks in the vicinity of the project area. Knowledge of the types and frequency of maritime traffic within the study area throughout its recorded history will provide insight into the probability for shipwrecks from different periods.

Historic/Post-Contact Period

The Texas Coast's Post-Contact, Historic Period begins in the early sixteenth century with the first European explorers visiting the region and documenting their observations. The Historic Period then continues to the modern day. The Texas Gulf Coast consists of several barrier islands, bays, ports, and channels whose history is closely tied to early maritime exploration, eighteenth and nineteenth century settlement, and twentieth century trade and development. By the mid-nineteenth century, most development in the region stayed closest to the coast (Long 2020a).

Early European Maritime Exploration

In 1519, Governor of Jamaica, Francisco de Garay, authorized an expedition to explore the Gulf Coast between Florida and the Río Pánuco of Mexico (at modern-day Tampico, Veracruz, Mexico) in the hopes of finding a waterway that would lead to Asia. Lieutenant Alonso Álvarez de Piñeda was chosen to lead four ships and a contingent of 270 men on the voyage. Between the early spring and late fall of 1519, Piñeda's team documented many prominent features along their voyage, such as the mouth of the Mississippi River, and produced the first known chart of the Gulf Coast that includes the study area region (Weddle 2021; Lowery 2020). Piñeda is credited with naming the Corpus Christi Bay system, claiming it for the Spanish King on the Feast of Corpus Christi Day, in June of 1519 (Leatherwood 2021a).

Nearly a decade later, in 1528, Álvar Núñez Cabeza de Vaca and his crew were among a large expedition party that wrecked along the Texas Coast while documenting the Coast between the Rio Grande and the Cape of Florida. Cabeza de Vaca's group was among the few who survived when they wrecked on Galveston Island (Long, 2020a). Over the next six years, Cabeza de Vaca and his companions walked west to the Pacific Coast then headed south, eventually to Mexico City. Along their journey they visited the study area. His account is regarded as Texas' first ethnological study of the region's Indigenous populations and is an often-cited resource for Texas archaeologists interpreting prehistoric lifeways from sites and features (Chipman 2021; Thoms et al. 2021).

The French explorer Robert Cavelier, Sieur de La Salle was the next prominent European explorer to visit the area. La Salle and 300 crew and settlers sailed from France in 1684 with four ships—*La Belle*, *l'Aimable*, *Le Joly*, and *Le Saint-Francois*—to find the mouth of the Mississippi River and set up a permanent settlement (Bruseth and Turner, 2005). La Salle's flagship, *La Belle*, sank in Matagorda Bay during a storm in 1686 and was the subject of an extensive archaeological excavation in the 1990s (41GM86; Bruseth and Turner, 2005). The earliest known map thought to depict the Copano Bay region from LaSalle's voyage provides possible evidence La Salle reached Aransas and Corpus Christi bays (Dowling et al. 2010).

Prudencio de Orobio y Basterra, the Spanish Governor of the Province of Texas, commissioned a map of Texas in 1739 that is the first known to name the natural pass between Mustang and San Jose islands as Aransas Pass, labeling it "Aranzazu" (a Basque phrase meaning "Our Lady of Thorns"; Leatherwood, 2021; USFWS, 2019). In 1746, Colonel José de Escandón built Fort Aranzazu at Live Oak Point (at the entrance to Copano Bay to the north) to defend the bay from the French. With little Spanish activity occurring along the Texas Coast, the area fell victim to piracy, smuggling, and illegal trading (Dowling et al. 2010).

Twenty years later, Escandón, then Governor of Nuevo Santander, authorized Captain Blas María de la Garza Falcón to explore the coast between the Rio Grande and Garza Falcón's ranch outpost, Estancia de Santa Petronila, south of present-day Corpus Christi. Garza Falcón settled the area, as well as provided a report of Padre Island in 1766. The report included descriptions of the landscape: small clumps of stunted laurels and willows, red grass, and ships' timbers littering the beach. While waiting for Garza Falcón's report, Escandón received information from fisherman and settler, José Antonio de Garabito, describing the Texas Coast between the Rio Grande and the Nueces River as “large pastureland surrounded by lagoons.” He noted sandbanks, which became fully submerged during a storm surge, and therefore, the area could not be identified as an island (Weddle 2020).

In September of that year as tensions rose between the French and Spaniards, Garza Falcón led 25 soldiers in support of Ortiz Parilla’s expedition. He and the soldiers set camp along the Laguna Madre, located between Padre Island and the mainland, referring to it as Playa de la Bahía de Corpus Christi, or Playa de Corpus Christi. Ortiz Parilla’s expedition produced a map, including an accurate depiction of Padre Island and Corpus Christi Bay, Mustang Island, Copano Bay (referred to as Bahía de Santo Domingo), and San José Island. However, the Nueces River is missing from the sketches (Weddle 2020).

Post Contact Native American Tribal History in the Region

The Karankawa people were the primary occupants of the Texas Gulf Coast when European explorers first arrived in the region. Their name means “dog lovers” in their native language (Calhoun County Museum, 2020; Bruseth and Turner 2005). These early Texas inhabitants were nomadic; they seasonally occupied the barrier islands in the Gulf Coast and retreated to the Texas inlands in the off season. They lived in small huts, made of a ring of poles drawn together at the center and covered with hides or mats (Bruseth and Turner 2005). The Karankawas navigated between the islands and the Texas interior maritime pathways on large dugout canoes. Fishing, hunting, and foraging were their main form of subsistence (Lipscomb, 2020). Early written accounts depicted the Karankawas as tall, with body piercings and linear or animal-shaped tattoos (Calhoun County Museum, 2020; Bruseth and Turner 2005).

The Karankawa people were familiar with Spanish and French interests in the region and were known to have clashed with both groups in the early years of European exploration. Following La Salle’s tepid claim to the region in the early eighteenth century, Spain bolstered its efforts to colonize the region and convert the local inhabitants to loyal Spanish citizens. The Karankawas resisted the conversion to Catholicism and more violence ensued. The Spaniards used the Karankawa-Spanish War as justification for their eradication and as an opportunity to gain control of the Texas Coast. Conflicts continued for more than a decade (Lipscomb, 2020; Seiter, 2020).

When Texas fell under Mexican control in 1821, the Mexican government encouraged white settlers to immigrate to the underpopulated region that the Karankawa had called home. Anglo-American Texans flooded in, straining the region’s natural resources. The settlers waged constant war against the Karankawa to drive them off. During the Texas Republic era, the Karankawas were politically demonized and pushed into Mexico, then back into Texas. To survive, many of them took Mexican last names or allied themselves with white ranchers and assimilated into those communities. The last band of Karankawas was eradicated in 1858 in Rio Grande City along the Texas/Mexico border (Lipscomb, 2020; Seiter, 2020).

Modern Karankawas call themselves “the Karankawa Kadla,” meaning mixed or partial Karankawa. While they have made considerable efforts to revitalize their language and cultural traditions in the region, they are not a Federally recognized Tribe (Lipscomb 2020).

Merchant Vessels and Harbors of the Eighteenth and Nineteenth Centuries

Ports developed along the lower Texas Coast supported various industries, including fishing, cattle and sheep ranching, and ship building. Local leaders saw the economic advantages the bay area could bring if further developed. Families settled into the area, businesses and schools opened, and a system of channels and harbors supported maritime shipments. White settlers were not permanently established in the Corpus Christi Bay area until September 1839 when entrepreneurs Henry Lawrence Kinney and his partner, William P. Aubrey, established a trading post that grew to become the City of Corpus Christi (Long, 2020a; 2020b). Eleven years later, between 1850 and 1855, Robert A. Mercer, an English immigrant, established a small sheep and cattle grazing station on Mustang Island called El Mar Rancho that would eventually become the community of Port Aransas. Mercer operated the Mercer Docks from the site, from which regular steamship service began running between Mustang Island and New Orleans (Upchurch 2021; Port Aransas Museum 2021). Even with the added commerce, the project area had a small population overall relative to more prominent and well-established coastal areas such as Galveston (**Figure 2**).

Figure 2. Approximate project area depicted in John Bachmann’s (1861) *Birds Eye View of Texas and Part of Mexico*.

Aransas Pass Light Station

As Mercer's settlement and docks were becoming established, vessel traffic had increased sufficiently to warrant the construction of a lighthouse. The United States government began construction of the Aransas Pass Light Station (Lydia Ann Lighthouse) at the eastern edge of Harbor Island, just inside the Pass in 1855. The octagonal, brick, pyramidal lighthouse tower rose 55 feet above the island when it was first lit two years later. When Texas broke from the Union during the Civil War, Confederate forces tried to blow the lighthouse up to hamper Union Naval operations. They did severely damage the lantern and brickwork over the course of three separate attempts, but they never demolished it completely. The tower was rebuilt shortly after the war and raised another 10 feet (to 65 feet; **Figure 3**). Over time, the Aransas Pass inlet shifted southward, leaving the lighthouse gradually farther and farther from the entrance it was intended to signify. The lighthouse was roughly one mile away from the Pass by the early 1900s when engineers had sufficiently stabilized the channel (see below). The United States Coast Guard decommissioned the lighthouse in 1952 for a newer structure at their station at Port Aransas (USCGHO, 2019). The lighthouse, which overlooks the northern extent of the study area, is listed on the National Register of Historic Places and has the distinction of being the second-oldest lighthouse on the Texas Coast and the oldest structure in the area (Long 2021).

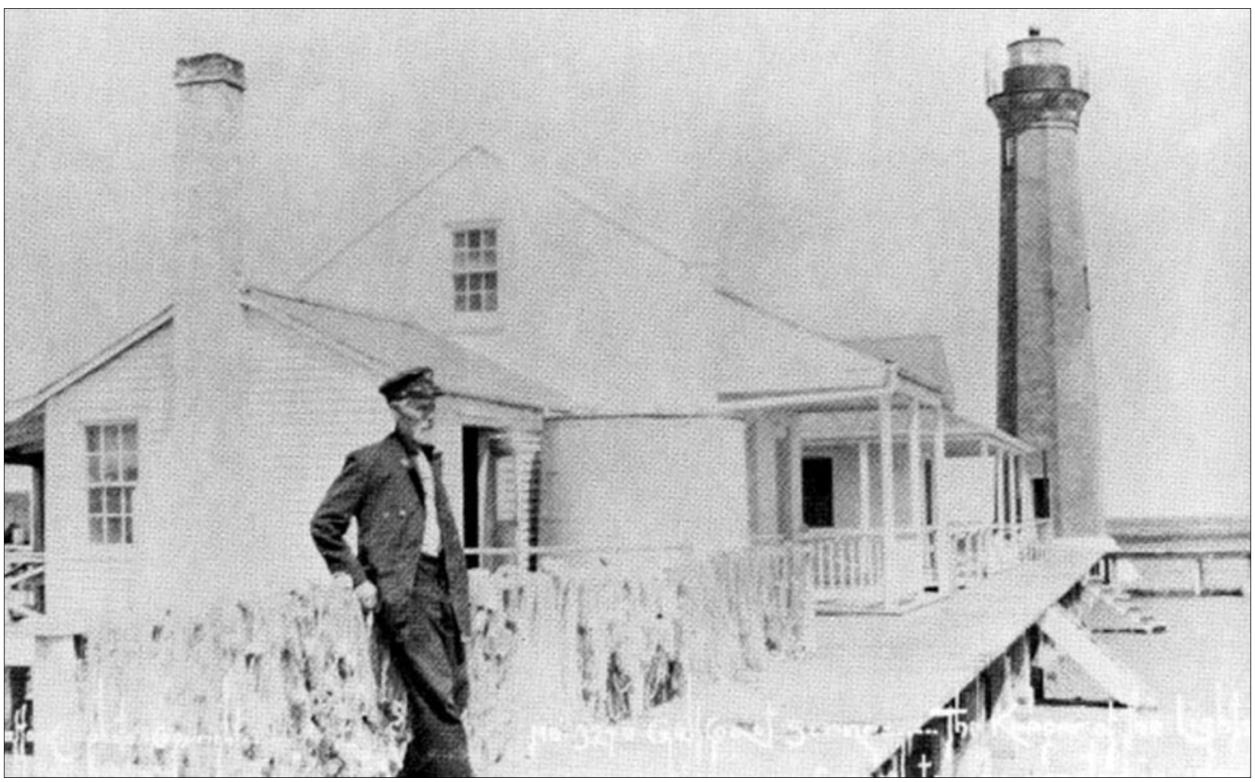

Figure 3. Undated photograph of the Aransas Pass Light Station complex (Port Aransas Museum of History, 2021).

The Project Area During the Civil War

The Civil War reached the study area in the summer of 1862, during the Battle of Corpus Christi. A part of the Texas Coast from Pass Cavallo to Corpus Christi was under blockade by United States Ship (USS) *Arthur.* Commerce, however, continued through the port at Corpus Christi because USS *Arthur* had too deep of a draft to pass through the barrier islands. Lieutenant John W. Kittredge, commander of *Arthur,* later received two vessels from New Orleans, *Corypheus,* a yacht, and *Sachem,* a steamer, both of which could pass through the shallow waters and into the interior waterways of Corpus Christi. Once inside, his shallow-drafted Union vessels captured Confederate Ship *Reindeer* and Confederate Ship *Belle Italia* and converted them into Union gunboats. On August 12, 1862, Kittredge commanded a fleet made up of *Corypheus*, *Sachem*, *Reindeer*, and *Belle Italia* into Corpus Christi Bay, and captured Confederate Ship *Breaker* (Delaney 2020).

A conflict between the Union naval fleet and Confederate ground forces at Corpus Christi ensued after civilians fled the area. Confederate forces managed to drive back the Union fleet despite being outgunned and outmanned but keeping the city under Confederate control was hardly a celebratory victory. The years after the Battle of Corpus Christi left many of the area's residents unprotected from encroaching United States' forces and cut off from supplies (Delaney 2020). Residents faced starvation and constant turmoil until the war ended.

After Union forces began to take the upper hand over the following year, United States President Abraham Lincoln's attentions could expand beyond the battlefield. He had grown increasingly concerned that the French, who controlled portions of Mexico at the time, might try to seize the isolated southern portions of Texas while American interests were elsewhere. In addition, Lincoln wanted to curb the relatively free flow of cotton into Mexico through Brownsville. In October of 1863, the United States Army launched the Rio Grande Expedition out of New Orleans under the command of Major General Nathanial Banks. Banks' forces sailed south and invaded and occupied Brownsville on November 2, 1863. Banks then worked his way up the Texas coast, seizing Confederate fortifications and occupying cities along the way. By the start of the new year, Union forces controlled the Gulf Coast as far north as Rio Grande City (**Figure 4**; Townsend 2001; Marten 2021).

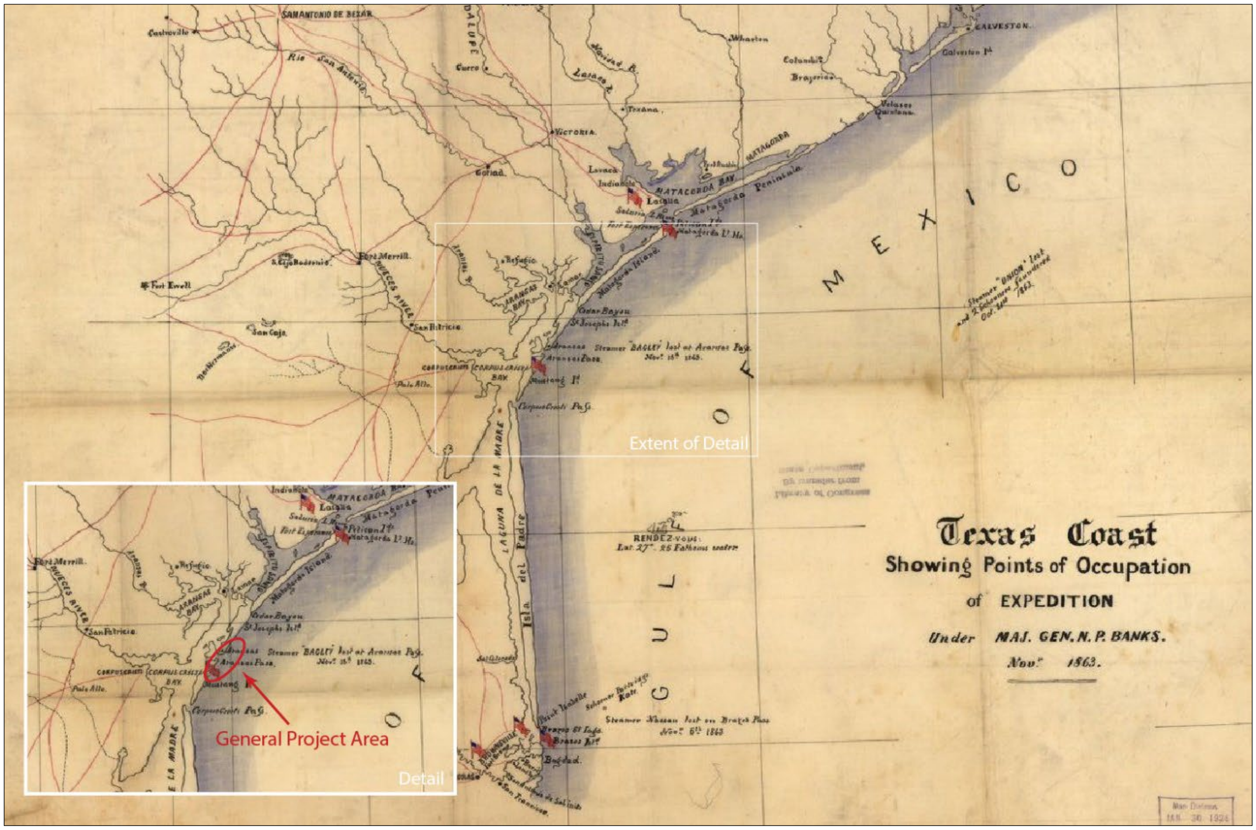

Figure 4. Approximate project area depicted in *Texas Coast Showing Points of Occupation of Expedition Under Maj. Gen. N. P. Banks* (1863) map. Detail depicts location of "Steamer *Bagley* lost at Aransas Pass Nov. 13, 1863."

On October 30, 1863, while Union ships carried Banks' forces south from New Orleans, they encountered a severe storm off Aransas Pass. Sailors needed to lighten the troop- and supply-laden ships by tossing objects overboard. At the same time, the steamer *General Banks* ran out of fuel during the storm and had to be towed from there. It is impossible to determine the ships' precise location relative to the current project area from the records.

Union forces returned to the project area two weeks later as they advanced northward. A November 23, 1863 article of the *Houston Tri-Weekly Telegraph* describes the action to its readers (from Townsend 2001:96-97):

> *The Yankees are advancing to this direction and have affected a foothold at Aransas Pass. On the night of the 16th they landed a force supposed to be 3,000 strong in the lower end of Mustang Island, and marched on the fort at the Pass. These troops were conveyed in five sailing vessels (transports). On the morning of the seventeenth, they made the attack with this force and five steamers from the sea cooperating. The engagement lasted two hours and twenty-five minutes, when our troops surrendered, being overwhelmed with numbers. The plan of the enemy appears to be to take such points as he can up the coast, with*

the view of getting a base near his proposed field of operations. There can be no doubt that he meditates the conquest of the State."

The contemporary map of Banks' expedition (see **Figure 4**) includes a call-out: "Steamer 'BAGLEY' lost at Aransas Pass, Nov. 18, 1863," just outside of the project area. Captain C. Barney (1865) references a "*Wm. Bagley"* as a "small coast steamer" in his *Recollections of Field Service with the Twentieth Iowa Infantry Volunteers* but he doesn't mention the ship in the context of its loss. It is unclear where *Bagley* sunk relative to the project footprint. Confederate troops eventually retook the project area after General Banks recalled more than half of the occupying forces he had left behind him in preparation for invasion into Louisiana.

The Project Area in the Post-Civil War Era

Following the Civil War, the communities surrounding the project area rebuilt around a sheep- and cattle-ranching-based economy. William and Ed Mercer, whose father, Robert had settled on Mustang Island before the war, built the island's first store in 1880. Sometime later, Elihu Harrison Ropes, a New Jersey native and Union general and veteran, envisioned building Texas' first deep-water port at Corpus Christi when he visited the already well-established port of Galveston. He then created the Port Ropes Company in 1888 and purchased Mustang Island (for $25,000) and a dredge in the hopes of cutting a deep navigation channel to Corpus Christi through the island. The United States Postal Service established a post office in the Mercers' store that same year, which they named "Ropesville," presumably in Elihu's honor or at his direction. Ropes, plagued with technical and logistical problems from the beginning, abandoned Mustang Island quickly for other, more successful, ventures in and around Corpus Christi (Coalson 2021).

Mustang Island, though still strongly supporting cattle and sheep ranching, had also become known as a recreational, sport-fishing destination. Ropesville's citizens changed their community's name to "Tarpon" in 1896 to capitalize on this interest. The island has remained an angler's paradise ever since (**Figure 5**). President Franklin Roosevelt famously boarded a destroyer – and later the Presidential Yacht *Potomac* - to fish for tarpon off the Pass in 1937 (Port Aransas History Museum, 2016; Ford, 2014). In April of 1911, the community abandoned the name in favor of its now permanent "Port Aransas." (Upchurch 2021).

Figure 5: Tourists' cars and campers on the beach at a typical Port Aransas fishing camp, photographed in February of 1939 (Lee 1939).

Aransas Pass Maritime History

Merchant ships frequented the project area, carrying a range of goods, livestock and wool, building supplies, and other materials to and from Corpus Christi and smaller ports nearby, largely through Aransas Pass. Robert Mercer, split his time as a rancher when he was appointed as the County Wreck Master. In this role, he oversaw the salvage of vessels wrecked at the pass. Robert's sons, John and Ned served as bar pilots, guiding ships through the (at the time) shallow, erosion-prone, and unpredictable pass. Throughout the late 1800s, cargo on import ships often needed to be offloaded onto shallow-drafted scows, called lighters, to make it across the Aransas Pass bar and continue on to their destination. One such merchant vessel was the Steamship (SS) *Mary* (41NU252) which struck a buoy when entering the Pass in November of 1876 and sank. The *Mary*'s sinking prompted the United States government to commission the Mustang Island Life Saving Station, which would eventually become the Coast Guard station (Ford 2014).

Navigational charts of the area from the late 1800s show limited development in and around Aransas Pass. The Aransas Pass Light Station is the only structure depicted in the project vicinity on the 1867 "Texas Coast from Galveston to Corpus Christi" chart (**Figure 6**). By 1884, the Aransas

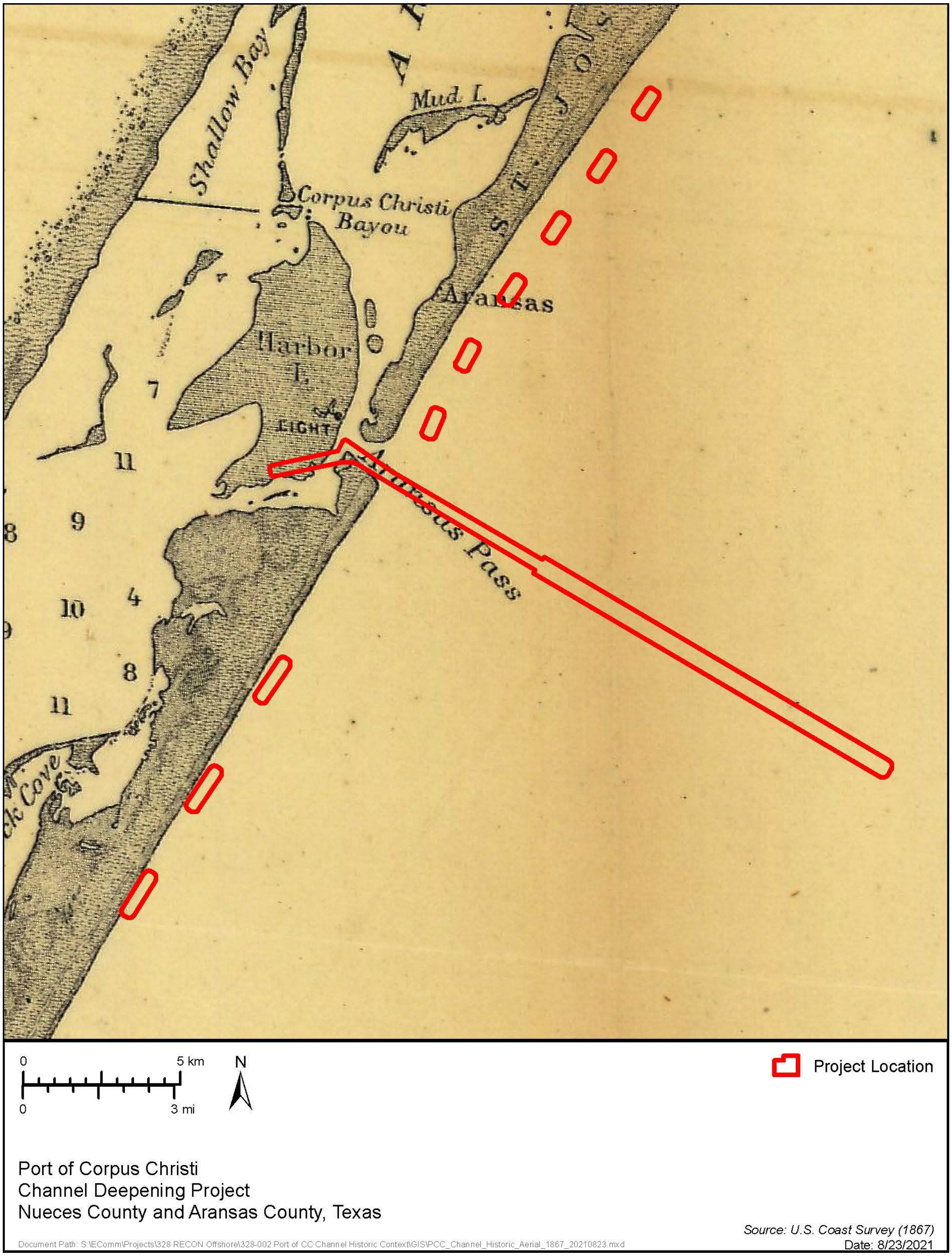

Figure 6. The CCSC APE overlaid on the 1867 "Texas Coast from Galveston to Corpus Christi" chart (U.S. Coast Survey 1867).

Pass channel is better defined but with a shallow bar down its center (**Figure 7**). The Mustang Island Life Saving Station had been constructed by that time and is depicted on the chart while the lighthouse on Harbor Island is now offset from the inlet due to erosion. The 1900 "Aransas Pass, Aransas, and Copano Bays, Texas" sounding chart is the first to depict the community of Tarpon, which would become Port Aransas (**Figure 8**). While soundings inside the Aransas Pass channel reach between 22 and 45 feet, soundings at the westward turn toward Corpus Christi are less than five feet. This highlights the need to transfer cargo from deep-draft ships to lighters. Engineers and workers began a major effort to deepen the channel through Aransas Pass in 1890 first by constructing two jetties, then by blasting through it with thousands of pounds of dynamite. Neither worked. Officials fought the natural conditions as they tried to deepen the channel permanently with further improvements over the following decades and by the early 1920s the channel had deepened enough to allow deep-draft vessel traffic. The communities of Aransas Pass and Rockport developed into deep-water harbors shortly thereafter (Leatherwood 2021; Long 2020a).

Significant changes are visible in the portions of the 1913 "Aransas Pass, Aransas, and Copano Bays, Texas" chart that correspond with the current project area (**Figure 9**). The navigation channel to Aransas Pass to the northwest through Harbor Island had been dredged parallel to the rail line and causeway (also new on this depiction). The early stages of the permanent navigation channel to Corpus Christi are also visible on the chart running westward through Turtle Cove. This channel is marked as "Dredged to 8½ Feet." Workers had also constructed or added a southern jetty at the Aransas Pass inlet. Soundings within the Aransas Pass inlet channel most often measured between 20 and 27 feet with a maximum of 36 feet. This is shallower in some places than the soundings from 1900 (see **Figure 8**). This is likely a testament to the ongoing engineering challenges of maintaining consistent depths within the Pass.

After hurricanes devastated the region in 1916 and 1919, the United States Army Corps of Engineers was keen to name a deep-water port at a protected location inside the channel islands. The Corps selected Corpus Christi and, with the help of prominent US Congressman John Nance Garner, President Harding authorized a permanent deep-water channel within Nueces Bay that would connect Aransas Pass with the city. Workers finished dredging the Corpus Christi Ship Channel and deep-water port in 1926 (Leatherwood 2021; Long 2020b).

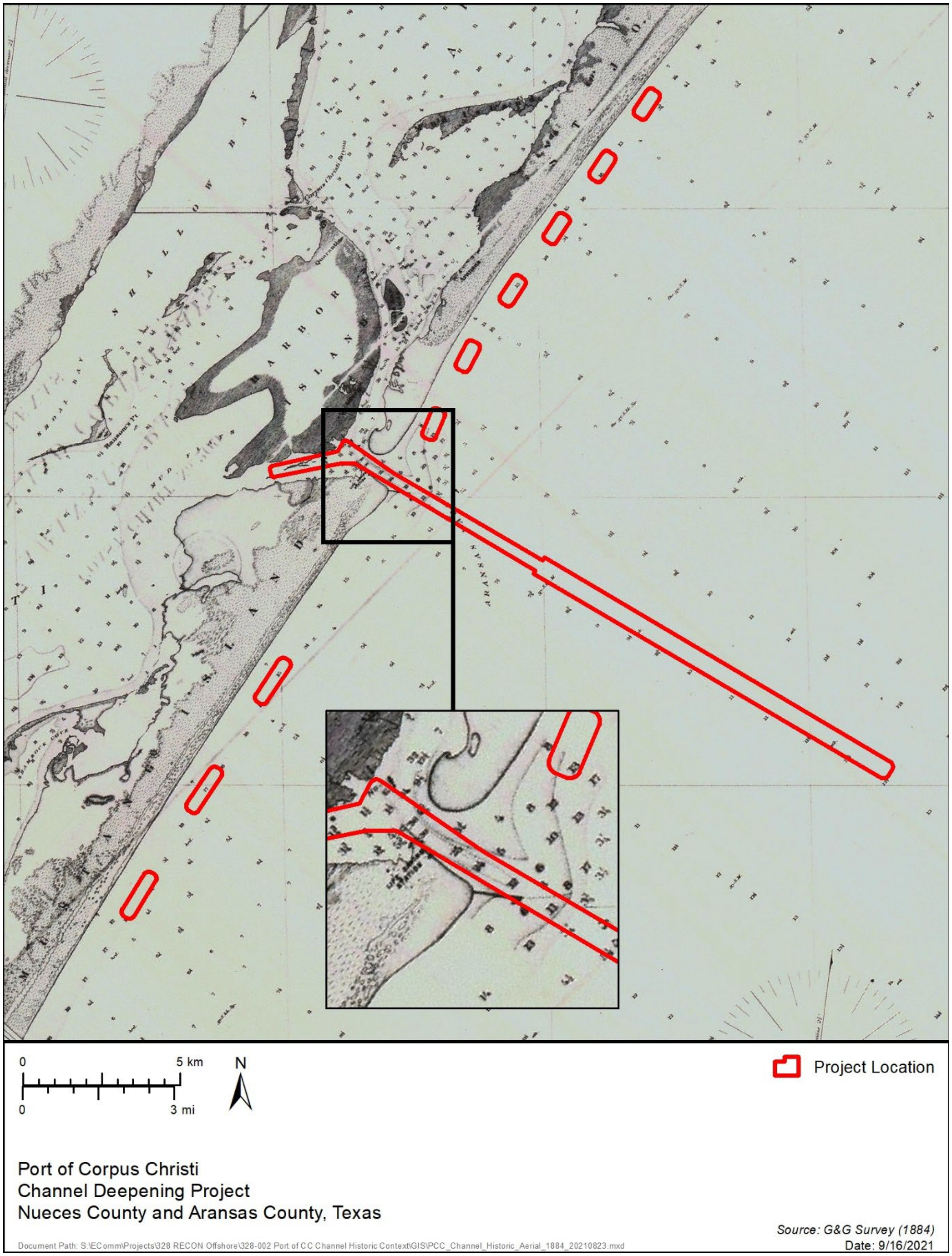

Figure 7. The CCSC APE overlaid on the 1884 "Aransas Pass, Aransas and Copano Bays, Texas" chart (U.S. Coast Survey 1884).

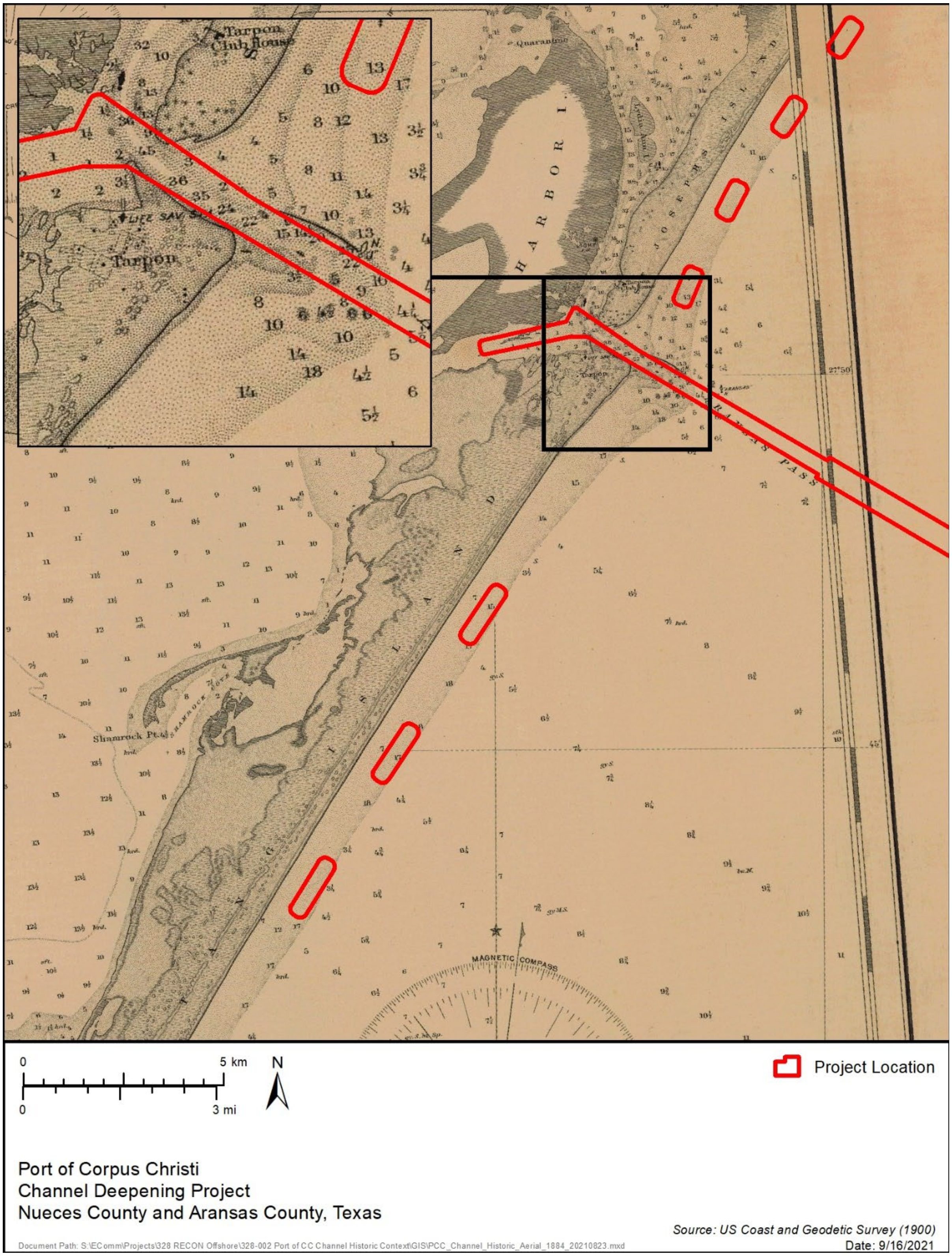

Figure 8. The CCSC CDP APE overlaid on the 1900 “Aransas Pass, Aransas and Copano Bays, Texas” chart (U.S. Coast & Geodetic Survey 1900).

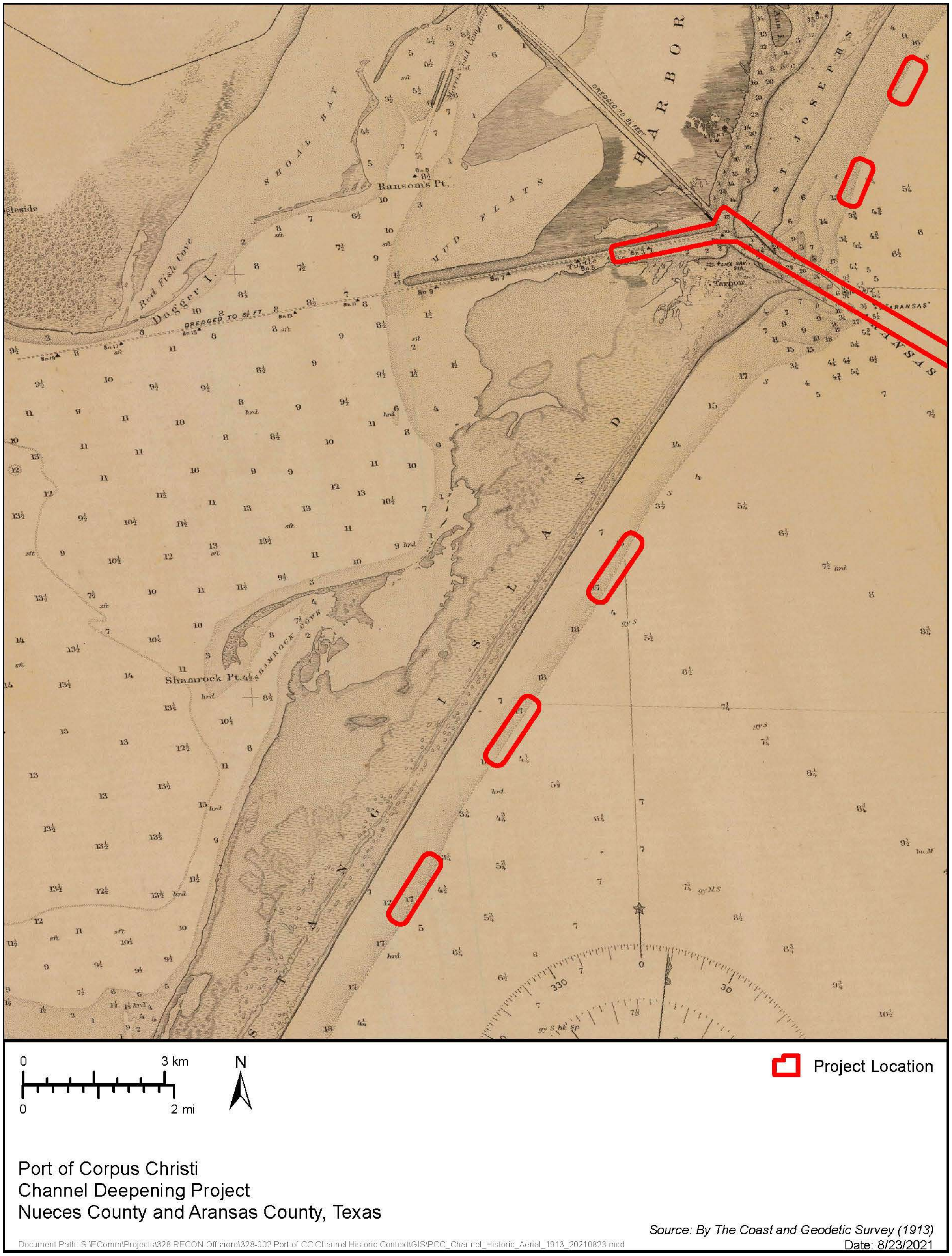

Figure 9. The CCSC APE overlaid on the 1913 "Aransas Pass, Aransas, and Copano Bays, Texas" chart (U.S. Coast & Geodetic Survey 1913).

The 1928 "Aransas Pass to Baffin Bay" chart dates to two years after the Corpus Christi Ship Channel was finished (**Figures 10 and 11**). The Aransas Pass channel is a consistent enough feature at this point that individual soundings are not presented. Instead, it is listed as "27½ Feet, 150 ft Wide" at the entrance, deepening to 46 feet before the westward turn into Turtle Cove at Cline Point (see **Figure 11**). Presumably problematic sedimentation along the south jetty has caused some shoaling that would appear to narrow the pass at the entrance. It is possible that such shoals within a prominent navigation channel could have been a hazard to vessel captains who were unfamiliar with the area. Also of note, the Aransas Pass deep-water port is clearly visible off the northeast point of Mustang Island. "Spoil Banks" parallel the new Corpus Christi Ship Channel's southern edge on the chart as well; remnants of the dredging activities that brought the waterway down to a marked consistent depth of "25 feet" (see **Figure 10**).

Oil, discovered in Nueces County in 1930, helped the region weather the economic impact of the Great Depression (Long, 2020b). By the 1940s, Port Aransas was the nation's twelfth largest oil exporting port (Port Aransas History Museum, 2016). The shrimping industry also made a significant impact on the region, around the same time, particularly out of Rockport. By the 1950, Rockport fishermen harvested roughly 51-million pounds of shrimp from the waters of the project area, doubtlessly shipping a significant portion of them through Aransas Pass (Long, 2020a). Shipbuilding, also largely out of Rockport, was yet another commercial sector that boosted the regional economy in the early-to-mid twentieth century, most significantly during wartime years (Long, 2020a).

In 1965, the Port of Corpus Christi began dredging the navigational channels that are being upgraded as part of the current undertaking (Long, 2020b; **Figure 12**). The 1969 "Corpus Christi Bay" navigation chart presents a largely modernized Ship Channel with a straight inlet, no sedimentation or shoaling, and tabulated channel dimensions: (31.5–42 feet deep and 600-700 feet wide). Such substantial dredging and maintenance activities likely would have damaged any shipwrecks that lay within it, particularly any that may have struck the shoals within the jetties as depicted in **Figure 10** or destroyed them altogether.

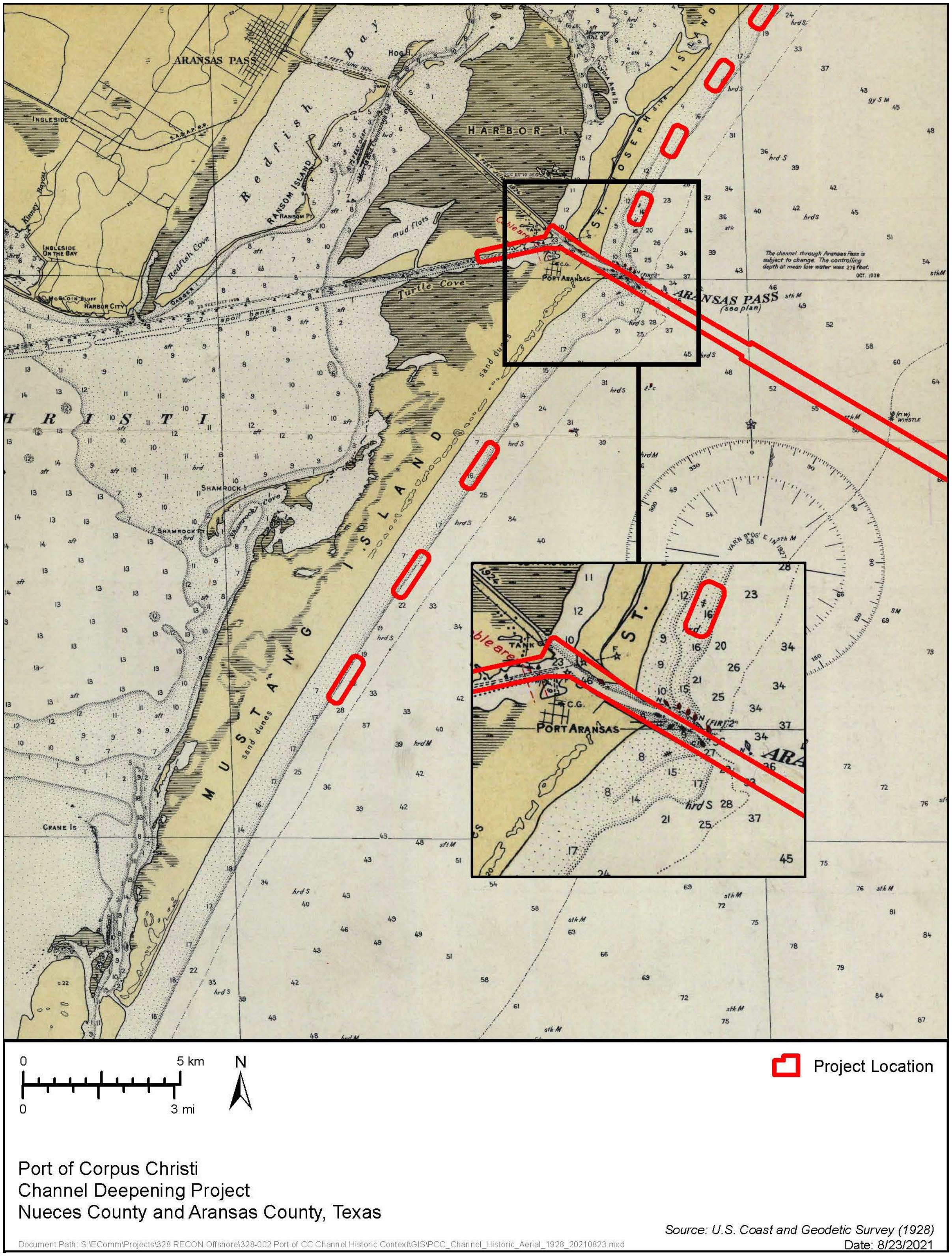

Figure 10. The CCSC APE overlaid on the 1928 "Aransas Pass to Baffin Bay" chart (U.S. Coast & Geodetic Survey 1928).

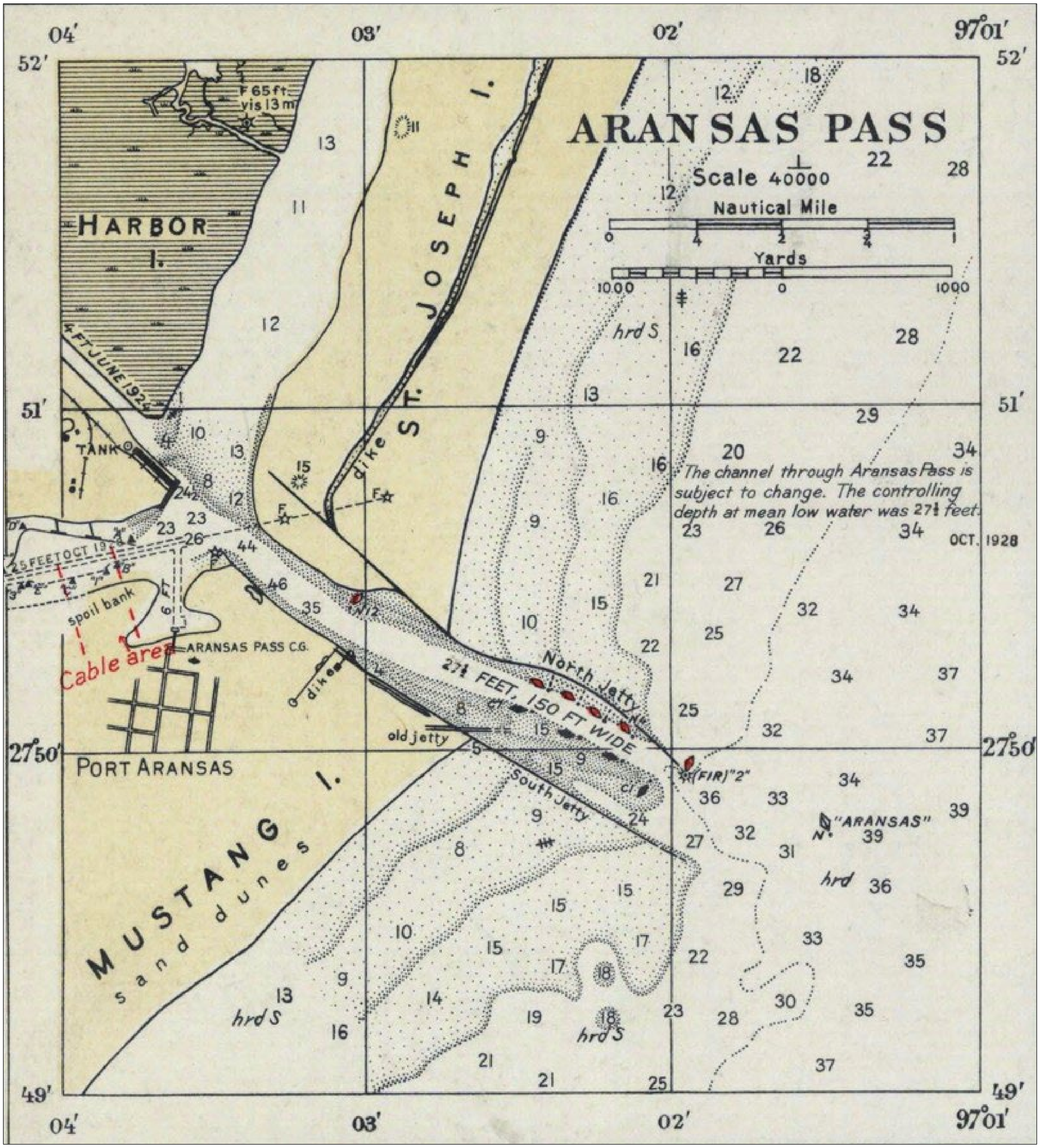

Figure 11. "Aransas Pass" detail inset in the 1928 "Aransas Pass to Baffin Bay" chart (U.S. Coast & Geodetic Survey 1928).

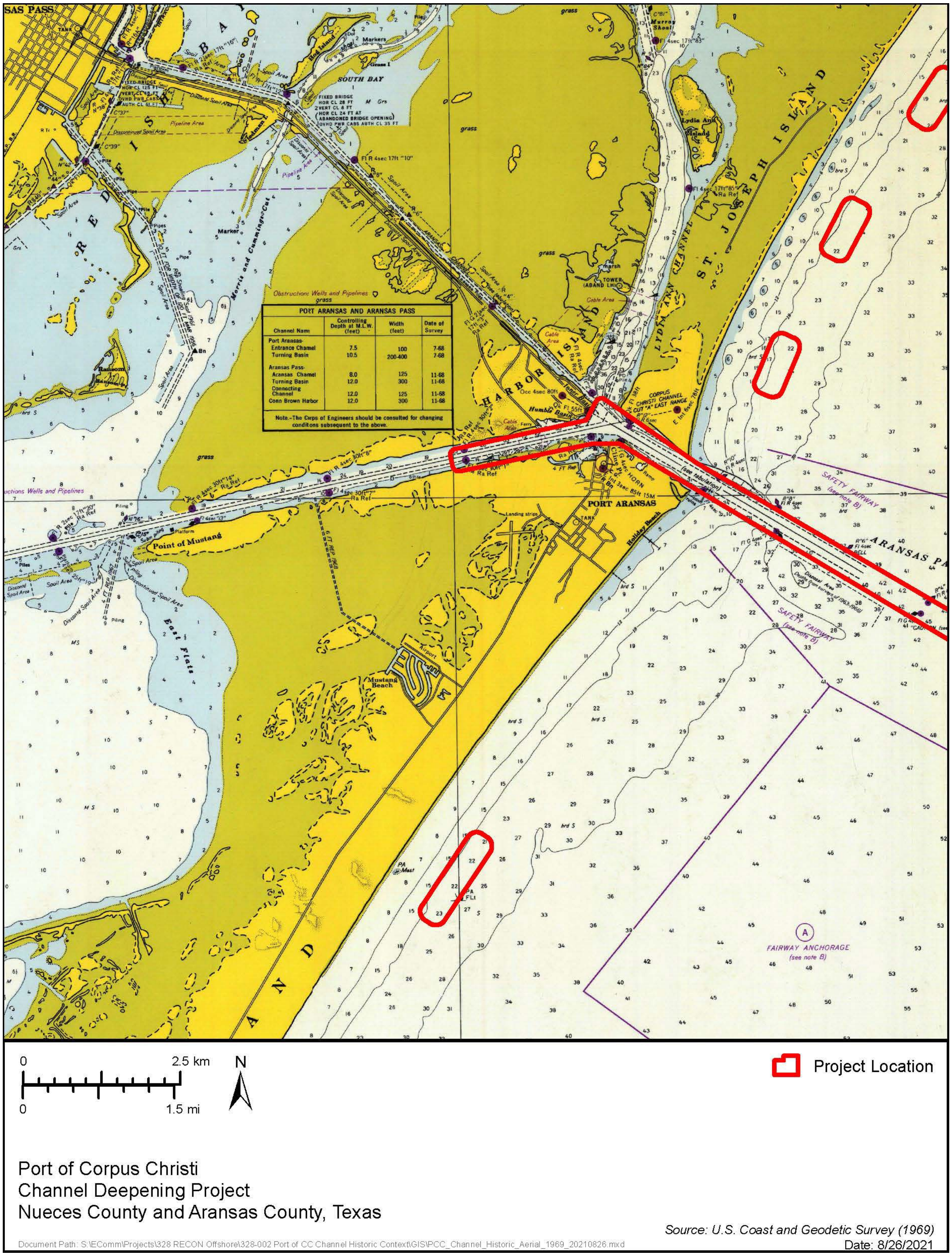

Figure 12. Portions of the CCSC APE overlaid on the 1969 "Corpus Christi Bay" chart (U.S. Coast & Geodetic Survey 1969).

The Gulf Intracoastal Waterway

The proposed deepening project crosses the Gulf Intracoastal Waterway (GIWW), a significant inland navigational and commercial waterway that parallels the Gulf coast, as it passes through the barrier Mustang and San Jose islands into Nueces Bay. The GIWW is a 1,100-mile-long, shallow-draft (approximately 12 feet deep) canal system and interior waterway that runs continuously from the Port of Brownsville, Texas to Saint Marks, Florida. More than 30 percent of the entire GIWW (379 miles) follows Texas' coast (TxDOT, 2020). Engineers and government leaders formulated the first concepts for the GIWW as an internal commercial system of interconnecting canals and roads as early as 1808, but, beyond occasional survey approvals, little physical progress was made throughout most of the nineteenth century. Engineers developed the first plans for the Texas part of the GIWW in 1875, but the dominant railroad industry successfully hindered most efforts to build it well into the twentieth century (Leatherwood, 2021b). Prospectors' discovery of oil at the Spindletop field near Beaumont ushered in an oil boom that pushed canal development further, but the GIWW did not reach the study area until 1941 (Leatherwood, 2021b). Construction began in earnest when the United States entered World War II when the Gulf of Mexico became a hunting ground for German U-Boats (submarines). The US needed a safe transport corridor to carry supplies out of the Gulf and into the open Atlantic Ocean. The GIWW was expanded and extended to its current dimensions during the war (TxDOT 2020; Leatherwood 2021b).

3.0 Overview of Known Cultural Resources

Databases that were reviewed for reported shipwrecks as well as previous marine archaeological surveys included:

- National Oceanic and Atmospheric Administration's (NOAA) Automated Wreck and Obstruction Information System (AWOIS);
- NOAA Nautical Charts/Electronic Navigation Charts (ENC);
- Texas Archaeological Sites Atlas;
- The Texas General Land Office Offshore Resource Management Code (RMC) Database;
- The Bureau of Ocean Energy Management (BOEM) Gulf of Mexico Shipwreck Database; and
- Consultation with the State Marine Archeologist for previously recorded avoidance anomalies and recorded surveys.

Properties and or Districts listed on the National Register of Historic Places (NRHP) include the Tarpon Inn (NR Reference #79003002) and the Aransas Pass Light Station (NR Reference #77001423). The Tarpon Inn is the only NRHP-listed property within 1,000 meters of the project APE. This historic hotel was built in 1886 from surplus Civil War-era barracks materials. The Tarpon Inn served vacationers - particularly anglers - from then on. Hurricanes repeatedly damaged the hotel over the decades but it was rebuilt and reconfigured each time. The hotel was listed on the NRHP in 1979 (Beck 1979).

Aransas Pass Light Station is a NRHP-listed District that stands just outside of the 1,000-meter project APE buffer. As described above, the lighthouse stands on Harbor Island, approximately 0.5 miles north of the northern terminus, overlooking the Lydia Ann Channel of the GIWW. The property's National Register Nomination Form (Holland, Jr. 1977) states that the district contains several historically significant buildings that are remnants of Texas' second oldest-surviving lighthouse. The district's period of significance extends from 1857 to 1938 and includes the original brick light tower, a brick keeper's house, a wooden assistant's dwelling, storage structures, wharves, and other support facilities. The district's recorder (Holland, Jr. 1977) noted "A bayou slices through the property and gives access to the station's structures. It is an integral part of the scene and any effort to widen it would have an adverse effect upon the historical setting of the light station." Though the channel deepening APE is near this District's boundaries, no dredging or spoils placement is proposed that is likely to alter the site, or the bayou in particular. This resource was not called out in previous project-related cultural resource coordination with the USACE and THC as being of particular concern (email THC to Jayson Hudson, 7/3/2020, THC Tracking #202014182; letter Jerry Androy to Sarah Garza, June 15, 2020).

One historic cemetery, the Mercer Cemetery, is located on East Oaks Avenue, between Mercer Street and North Station Street in the center of Port Aransas (approximately 680 meters southwest of the nearest portion of the APE). The cemetery is a small, family plot with seven graves dating from the late nineteenth to early twentieth century.

Three previously recorded terrestrial archaeological sites, 41NU92, 41NU187 and 41AS91, have components located within 1,000 meters of the APE. No data is available for 41NU92. Site 41NU187 is located approximately 550 meters west of the pass, just south of Port Aransas. William Seals recorded the site in 1981. It contains the remains of two circular concrete gun emplacements, with a steel-face concrete pivot at the center of each. No artillery remains on site. The site form dates the emplacements to the Second World War; however, it notes that they might represent coastal defense from earlier conflicts, including the Civil War (THC Atlas 2021).

Site 41AS91 is located approximately 370 meters northeast of the pass, at the southern end of San Jose Island. Tim Perttula originally documented the site in 1995 and it was revisited by Charles Pearson and Joe Simmons in 2001. The site contains structural foundation remains which Perttula interpreted were the remains of a Mexican-American War era supply depot. Pearson and Simmons revise this, stating that this portion of San Jose Island was submerged at the time of the Mexican-American War and that the site is instead likely the remains of a 1934 factory (THC Atlas 2021). Neither of these sites will be impacted by the project's underwater components.

Underwater Archaeology Surveys in the Project Vicinity

Eight (8) previous surveys are located at or near the APE (**Table 2**). Underwater archaeologist Jack Hudson performed a remote sensing survey in 1976 on behalf of Energy Reserve Group in advance of pipeline construction. The survey lies north of beneficial use area B9, outside the buffer. The surveyors did not find any cultural resources within their survey footprint (THC Atlas 2021).

Table 2. Previous Underwater Archaeology Surveys Conducted Within 1,000 m of the APE.

Permit #	Year	Firm	Sponsor	Title	PI	Atlas #	Location
n/a	1976	n/a	Energy Reserve Group	Archaeological Survey Report, Mustang Island Block 747 to Shore, Offshore, Texas.	Hudson, Jack	8700000161	Just north of B9, outside APE and buffer
858	1989	Espey, Huston & Associates	USACE	National Register Assessment of the SS *Mary*, Port Aransas, Nueces County, Texas.	Hoyt, Steven D.	8700000027	Within APE
1008	1991	Coastal Environments	USACE	Magnetometer Survey and Ground Truthing Anomalies, Corpus Christi Ship Channel, Aransas and Nueces Counties, Texas.	Pearson, Charles	8700000181	Within APE

Permit #	Year	Firm	Sponsor	Title	PI	Atlas #	Location
1261	1993	Coastal Environments	USACE	Underwater Archaeology of the Wreck of the Steamship *Mary* (41NU252) and Assessment of Seven Anomalies, Corpus Christi Entrance Channel, Nueces County, Texas.	Pearson, Charles	8700000033	Within APE
1457	1994	Espey, Huston & Associates	USACE	Mapping of the *Utina* (41NU264), Corpus Christi Entrance Channel, Nueces County, Texas.	Pearson, Charles	8700000037	Within APE
1543	1994	Coastal Environments	USACE	Magnetometer Survey of the Gulf Intracoastal Waterway (GIWW), Port Aransas to Live Oak Point, Aransas and Calhoun Counties, Texas.	Pearson, Charles	8700000087	Within APE
2407	2001	PBS&J	USACE	Marine Remote-Sensing Survey and Diving Assessment for Historic Properties Investigations, Corpus Christi Ship Channel Improvements and La Quinta Ship Channel Extension, Corpus Christi Bay, Texas	Gearhart, Robert	8700000012	Within APE
8672	2019	BOB Hydrographics	Lloyd Engineering	Marine Archaeology Assessment in Support of the Bluewater SPM Project, Nueces and Aransas Counties, Texas and Adjoining Federal Waters	Gearhart, Robert L.	8700000312	Across B1

In 1989/1990, archaeologists with the USACE and Espey, Huston, and Associates performed a remote sensing survey under Antiquities Permit 858 to relocate the wreck of SS *Mary* (41NU252), a sidewheel steamer that sank in 1876. The investigators recorded eight anomalies (Anomalies 1-8) that corresponded with the wreck (**Table 3**). They returned for two weeks of diving to determine the site layout and NRHP eligibility. Hazardous dive conditions and equipment limitations prevented a full site investigation; however, the archeologists concluded that the site was eligible for inclusion on the NRHP. The investigators recommended that if future actions would affect the site, a complete investigation and excavation should take place (Hoyt 1990).

Table 3. Summary of Recorded Avoidance Anomalies Within 1,000 m. of the APE (Source: Texas Historical Commission Marine Archaeology).

Target #	Permit #	Identification	Recommended for avoidance?	Report Title (Date)	APE
1	858	wreckage scatter	yes	National Register Assessment of the SS *Mary*, Port Aransas, Nueces County, Texas (1990)	Within
2		wreckage scatter	yes		Within
3		wreckage scatter	yes		Within
4		wreckage scatter	yes		Within
5		wreckage scatter	yes		Within
6		wreckage scatter	yes		Within
7		wreckage scatter	yes		Within
8		wreckage scatter	yes		Within
16	1008	unknown	yes	Magnetometer Survey and Ground Truthing Anomalies, Corpus Christi Ship Channel, Aransas and Nueces Counties, Texas (1991)	Within
20		unknown	yes		Within
23		unknown	yes		Within
24		unknown	yes		Within
25		unknown	yes		Within
31		wreckage scatter	yes		Within
32		vessel, unknown data	yes		Within
16	1261	natural feature or gouge	no	Underwater Archaeology of the Wreck of the Steamship *Mary* (41NU252) and Assessment of Seven Anomalies, Corpus Christi Entrance Channel, Nueces County, Texas (1993)	Within
20		undetermined; inaccessible	yes		Within
23		modern debris and pilings	no		Within
24		modern debris	no		Within
25		not relocated; likely modern debris	no		Within
31		41NU264	yes		Within
32		not relocated	yes		Within
M01	2407	modern debris	no	Marine Remote-Sensing Survey and Diving Assessment for Historic Properties Investigations, Corpus Christi Ship Channel Improvements and La Quinta Ship Channel Extension, Corpus Christi Bay, Texas (2001)	Within
M02		41NU264	yes		<250 m
M03		modern debris	no		Within
M04		inconsistent with shipwreck, not studied further	no		Within
M05		inconsistent with shipwreck, not studied further	no		<1,000 m
M08		modern debris	no		Within
M39		41NU292	yes		<250 m

Target #	Permit #	Identification	Recommended for avoidance?	Report Title (Date)	APE
2	8672	41AS119	Yes	Marine Archaeology Assessment in Support of the Bluewater SPM Project, Nueces and Aransas Counties, Texas and Adjoining Federal Waters (2019)	<250 m
3		Unknown	Yes		<250 m

Coastal Environments, Inc. and Panamerican Consultants, Inc. underwater archaeologists performed a survey in the Corpus Christi Ship Channel in 1991 under Antiquities Permit 1008 on behalf of the USACE. The surveyors identified 55 side-scan and 86 magnetometer anomalies during their survey (Side-scan Targets 1–55; Magnetometer Targets 1–86). After analysis, the archaeologists selected eleven of these anomalies for further investigation (Targets 16, 20, 23-25, 31-32, 40, 47, 53, 84). The mapped locations of Targets 16, 20, 23, 24, 25, 31, and 32 correspond with the current project vicinity while the remainder are plotted well outside of the study area. Of the anomalies recommended for further work within the current study area, divers could only access Target 31 during ground-truthing investigations.

Divers determined that Target 31 was a dense scatter of metal wreckage (pipes, metal plates, small-gauge railroad track(?), and wooden planking) consistent with a "small, barge-like structure" (James and Pearson 1991:37–39). The wreckage was designated as Site 41NU264. 41NU264 and the remainder of the significant targets (Targets 16, 20, 23, 24, 25, and 32) were recommended for avoidance or further investigations if avoidance was not possible (see **Table 3**) (James and Pearson 1991).

Coastal Environmental, Inc. and Panamerican Consultants archaeologists working under Antiquities Permit 1261 revisited the anomalies in the Corpus Christi Ship Channel Entrance recommended for avoidance two years earlier (Targets 16, 20, 23–25, 31–32). All but the previously-investigated Target 31 were determined to be of modern or natural origin and not associated with historic-age shipwrecks. Divers concluded that Target 31 was the remains of the World War I wooden ship *Utina* (41NU264, as it was then recognized, later identified as more likely debris from the ship's hull: 41NU292 – see below). The investigators concluded that *Utina* was eligible for inclusion in the NRHP (Pearson and Simmons 1995b). The archaeologists also conducted survey, diving and minimal collection of exposed artifacts on SS *Mary* (41NU252). Despite adverse dive conditions, archaeologists created a detailed map of the SS *Mary* wreck site and documented artifacts and features.

In 1994 Espey, Huston, and Associates archaeologists, working on behalf of the USACE under Antiquities Permit 1457, carried out diving assessments on the *Utina* wreck site to map its extent in relation to the USACE's planned south jetty maintenance and dredging activities (then recognized as 41NU264; see **Table 3**). They also supplemented their field investigations with archival research and historic context development, providing additional information regarding the vessel's origins, construction methods, and her loss (Schmidt and Hoyt 1995). The authors conclude that the *Utina* was a large (281.5-foot overall length [268 feet between perpendiculars]; 45-foot beam), Ferris design, wooden, steam-powered freighter built for the Emergency Fleet Corporation (EFC) in Louisiana near the end of World War I (EFC Hull 208). Like many EFC vessels (Borgens and Rowland 2017; Miller et al., 2020; NOAA 2019), the War ended before *Utina* was fully complete. In 1920, she was surplussed and sold to a private company, who converted her to an oil transport barge. The *Utina* foundered on the south jetty on her maiden voyage while being towed out of the channel on November 25, 1921. Historical accounts suggest that at the time, the wreck was salvageable and such work was scheduled to commence, but there is no record of the amount of salvage that ultimately took place.

The divers had a limited time window to work on the *Utina* wreck (Schmidt and Hoyt 1995). They focused on identifying and mapping prominent wreck features and delineating the maximum extent of scattered wreckage on the bottom. The authors recorded the wreck site roughly 50 feet below the surface between the jetty and the channel. At the time of recording, it was composed of five major structures (roughly 5 – 10 feet tall), oriented along a roughly north-south axis, and an associated debris field of angular objects, plating and piping extending 100 feet to the south-southwest. The authors (1995) interpreted that the amount of wreckage on the bottom was significantly less than what would be expected for a vessel of this size. They postulated that that most of the wreckage had been salvaged sometime after the *Utina* foundered. They also considered the possibility that, given the size discrepancy, the wreck may not be that of the *Utina*. The Principal Investigator reversed the earlier determination that Site 41NU264 was eligible for the NRHP under Criterion D (potential for yielding new data), concluding that the site was not likely to yield significant information and that researchers would learn more from the historical record alone than they would from additional archeological investigations (Hoyt and Schmidt 1995:77).

In 1994, Coastal Environments, Inc. performed a remote sensing survey of 45 miles along the GIWW under Antiquities Permit 1543 in advance of maintenance dredging (Pearson and Simmons 1995a;). This survey's western terminus corresponds with current survey's intersection with Lydia Ann Channel. The surveyors identified 31 side-scan sonar or magnetometer targets - all well east of the current project area, none of which were interpreted as significant. Additionally, the archeologists recorded 41AS88, the *John T. Worthington* shipwreck.

PBS&J archeologists performed a remote sensing survey and diver assessment of anomalies in the Corpus Christi Ship Channel in 2001 on behalf of the USACE under Antiquities Permit 2407. Archeologists documented 41 remote sensing anomalies during the initial survey (M1-M39, I-1, I-3). Either through preliminary analysis, close-order (tighter survey transect intervals for better resolution) remote-sensing survey, or diver assessments, all but Anomalies M2, M38, and M39 (see below) were excluded as potential historic-age shipwrecks and recommended for cultural resource clearance.

The archaeologists resurveyed the SS *Mary* (41NU252) wreck site and stated that the project would need to be altered to avoid disturbing the site. Additionally, the surveyors, like their predecessors at EH&A (Schmidt and Hoyt 1995) questioned if 41NU264 was correctly identified as *Utina*. PBS&J hypothesized that a newly discovered site, 41NU292 (Anomaly M39), may be directly associated with the main body of the *Utina* wreck site and that 41NU264 (Anomaly M2) is an associated debris field. They were not able to conclude this definitively without further archaeological investigations. Their final conclusions were that neither of the two *Utina* associated sites 41NU292 (hull) or 41NU264 (debris field) would be affected by their project. In addition the project identified site 41NU291 (Anomaly M38), potentially the remains of the steamship *Dayton*. They recommended additional archaeological testing to determine 41NU292's NRHP eligibility (Enright et al. 2003).

In 2019, BOB Hydrographics, LLC, carried out a remote sensing survey in advance of the Bluewater pipeline construction under Antiquities Permit 8672, on behalf of Lloyd Engineering. The survey crossed Beneficial use area B1. The Principal Investigator recommended two remote sensing anomalies (Anomalies 2 and 3) within the current study area for avoidance. Anomaly 2 was newly designated as Site 41AS119 while both anomalies 2 and 3 closely correspond with THC Shipwreck #1528, an unidentified wreck site which appears to have sunk between 1884 and 1900 (Gearhart 2019).

Recorded Shipwrecks

Five (5) shipwrecks have been documented in the Texas Archaeological Sites Atlas within 1,000 meters of the APE including 41AS119, 41NU252, 41NU264, 41NU282, and 41NU292. **Table 4** documents other potential shipwrecks found in the remainder of the databases.

- 41AS119: Robert Gearhart recorded this wreck site during a spring 2019 survey for a proposed single point mooring project in the Gulf portion of Aransas County off San Jose Island. The site is located 125 meters west of the Beneficial Use Area B1. Designated as Anomaly 2, the wreck measures 136 feet long and 34 feet wide. One end of the wreck may be broken, and thus the total length may be longer than the 136 feet measured in sonar imagery. The site is completely submerged and lies outside the surf zone. Because it is located outside the surf zone in a low-dynamic environment, the hull is still approximately 75 percent intact. Boilers, visible in the collected side-scan sonar imagery indicate that the wreck is a steam ship. The visible boilers suggest the main deck and superstructure are no longer intact. Gearhart stated the position correlated with THC wreck 1528, an unidentified vessel that sank between 1884 and 1900 (Gearhart 2019). Gearhart recommended the site for avoidance; however, no diver investigations have occurred on the wreck thus far to determine the site's eligibility for inclusion in the NRHP.

- 41NU252: J. Barto Arnold recorded the wreck site in 1987, then acting as the State Marine Archeologist at the Texas Historical Commission, determined the wreck to the remains of the steamer, SS *Mary*. It is located within the channel APE near the landward end of the south jetty. *Mary* was an iron-hulled sidewheel steamer operating for the Morgan Line. It was built in Wilmington, Delaware by the Harlan and Hollingsworth Company in 1866 and foundered in 1876. The wreck site was later relocated by Espey, Huston, and Associates in 1989 under Antiquities Permit 858 and further investigated by diver investigation. Initial investigations were limited due to diving hazards, but archaeologists were able to record enough data to recommend the vessel eligible for inclusion in the NRHP (Hoyt 1990).

Coastal Environments, Inc. and Panamerican Consultants, Inc. thoroughly recorded the site in 1995 under Antiquities Permit 1261 (Pearson and Simmons 1995a). This investigation produced a site map with several wreck features identified. The ship disarticulated after sinking, and its wreckage settled in a southwest-northeast axis. The ship's bow was intact, and hull plating was scattered to the northeast of the wreck site. In the middle of the site, several engine and propulsion features were present, including tubing, the engine's walking beam, engine condenser, and portions of both the port and starboard paddlewheel shafts. The 1995 investigation agreed with earlier surveys and concluded that the site was eligible for inclusion in the NRHP and as a State Archaeological Landmark (SAL). In 2003, PBS&J conducted a survey in the area for ship channel improvements and noted that 41NU252 would be negatively impacted by the dredging activity (Enright et al., 2003). *Mary* is listed a SAL and has been determined to be eligible for the NRHP.

- 41NU264 and 41NU292: Panamerican Consultants, Inc. first recorded the wreck site in 1991 during a remote sensing survey but were unable to determine the vessel's identity (James and Pearson 1991). The site was assigned the trinomial 41NU264 at that time. Divers later investigated the wreck in 1995 and collaborated archival data to identify the wreck as *Utina* (Pearson and Simmons 1995; Schmidt and Hoyt 1995). The site is located 85 meters from the channel APE, immediately off the seaward end of the south jetty.

  The *Utina* was a large (281.5-foot overall length [268 feet between perpendiculars]; 45-foot beam), Ferris design, wooden, steam-powered freighter built for the Emergency Fleet Corporation (EFC) in Louisiana near the end of World War I (EFC Hull 208). Like many EFC vessels (Borgens and Rowland 2017; Miller et al., 2020; NOAA 2019), the War ended before *Utina* was fully complete. In 1920, she was surplussed and sold to a private company, who converted her to an oil transport barge. The *Utina* foundered on the south jetty on her maiden voyage while being towed out of the channel on November 25, 1921. Historical accounts suggest that at the time, the wreck was salvageable and such work was scheduled to commence, but there is no record of the amount of salvage that ultimately took place.

  The site is approximately 135 feet long and 74 feet wide and is perpendicular to the south jetty. PBS&J archaeologists revisited the site 2003 for navigational improvements in the CCSC and the La Quinta Ship Channel (Enright et al. 2003). An additional magnetic target was identified adjacent to the wreck site, described as anomaly M39 (41NU264 was identified in the survey as anomaly M2). PBS&J archaeologists did not conduct any dives on the wreck due to earlier investigations, but, through updated field data and additional archival research, they concluded that 41NU292 was likely the actual *Utina* vessel hull and that 41NU264 is associated wreckage. The Principal Investigator reversed the earlier determination that Site 41NU264 was eligible for the NRHP under Criterion D (potential for yielding new data), concluding that the site was not likely to yield significant information and that researchers would learn more from the historical record alone than they would from additional archeological investigations (Hoyt and Schmidt 1995:77).

- 41NU282: J. Barto Arnold recorded the wreck site in 1995 during a magnetometer survey. He identified the wreck as the remains of *Baddacock*. It is located 225 meters south of the channel APE, near the seaward end of the south jetty. *Baddacock* was a steel-hulled tug built and wrecked in 1920. The wreck measures approximately 140 feet long and is approximately 75 percent intact. The site's NRHP eligibility status is currently undetermined (THC Atlas 2021).

Table 4. Shipwrecks Recorded in the Texas Historical Commission's Shipwreck Database and the NOAA AWOIS and ENC within 1,000 m of the APE.

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
5	-	Henrietta	1888	-	yes	sailing ship, merchant	1.0 mile	-
51	4175	Mary	1876	41NU252	yes	sail-steam, merchant	"exact"	THC, AWOIS
115	-	Cardena	1834	-	yes	sailing ship, merchant	3.0 miles	THC
137	191	Atlanta	1957	-	no	unknown	1.0 mile	THC, AWOIS, ENC
141	-	Baddacock	1920	41NU282	no	sail tug	-	-
153	-	Bertha	1917	-	no	unknown	5.0 miles	-
175	-	Chuckadee	1963	-	no	shrimp boat	1.0 mile	-
192	-	Colonel Yell	1847	-	yes	sail-steam, merchant	2.0 miles	THC
197	-	Coral Sands	1955	-	no	unknown	-	THC
286	-	Guyton No. 1	1916	-	no	barge	1.0 mile	THC
423	-	Philadelphia	1868	-	yes	sail-steam, merchant	1.0 mile	-
469	-	San Jacinto	1960	-	no	oil screw	5.0 miles	-
512	-	Umpire	1852	-	yes	sail-steam, merchant	0.5 miles	THC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
513	11022(?)	Unknown (*Utina*?)	-	41NU264	no	-	-	THC, AWOIS
609	-	Mary E. Lynch	1902	-	no	sailing ship, merchant	1.5 miles	-
616	-	Blue Fin	1957	-	no	oil screw	1.0 mile	THC
653	-	Mattie	1873	-	yes	sailing ship, merchant	0.5 miles	THC
655	-	Mary Agnes	1862	-	yes	sailing ship, merchant	5.0 miles	THC
658	-	Lottie Mayo	1886	-	yes	sailing ship, merchant	3.0 miles	-
659	-	Louisa	1865	-	yes	sailing ship, merchant	5.0 miles	-
858	4162	Hill Tide	1967	-	no	-	1.0-3.0 miles	THC, AWOIS, ENC
1019	-	Unknown	pre-1928	-	no	unknown	0.25 miles	THC
1024	4190	Unknown	-	-	no	unknown	-	THC, AWOIS, ENC
1027	-	Unknown	pre-1968	-	no	unknown	0.25 miles	THC
1028 (1940?)	195	De Rail	1972	-	no	cabin cruiser	0.25 miles	THC, AWOIS
1030	-	Unknown	pre-1950	-	no	unknown	0.25 miles	THC
1031	4177	Jimbo	1965	-	no	fishing boat	0.35 miles	THC, AWOIS
1045	-	William Bagley	1863	-	yes	sail-steam, merchant	3.0 miles	THC
1047	-	Unknown	pre-1935	-	no	unknown	0.25 miles	THC
1049	-	Ramyrez	1882	-	yes	unknown	0.25 miles	THC
1056	-	Unknown	pre-1853	-	yes	schooner	0.5 miles	THC
1232	4998	Bahia Honda	pre-1968	-	no	shrimp boat	0.25 miles	THC, AWOIS, ENC
1272	-	L'éclair	1866	-	yes	sailing ship, merchant	5.0 miles	THC
1411	-	Two Marys	1882	-	yes	sailing ship, merchant	0.5 miles	THC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
1412	-	Tex Mex	1882	-	yes	sailing ship, merchant	0.5 miles	THC
1417	-	Silas	1902	-	no	sailing ship, merchant	2.0 miles	THC
1420	-	Ellen	1901	-	no	sailing ship, merchant	0.25 miles	THC
1422	-	Mary Lorena	1900	-	yes	sailing ship, merchant	1.0 mile	THC
1449	-	Reindeer	1870	-	yes	sailing ship, merchant	0.5 miles	THC
1450	-	Sea Bird	1870	-	yes	sailing ship, merchant	3.0 miles	THC
1457	-	Surprise	1871	-	yes	sailing ship, merchant	1.0 mile	THC
1459	-	Mary Hanson	1870	-	yes	sailing ship, merchant	3.0 miles	THC
1528	-	Unknown	pre-1900	41AS119	yes	unknown	0.25 miles	THC
1535	-	Unknown	pre-1950	-	no	unknown	0.25 miles	THC
1536	-	Unknown	pre-1971	-	no	unknown	0.25 miles	THC
1537	-	Unknown	pre-1950	-	no	unknown	0.25 miles	THC
1938	4183	Eagle's Cliff	1981	-	no	freighter	10.0 miles	THC, AWOIS
1940 (1028?)	-	De Rail	1972	-	no	yacht	3.0 miles	THC
1941	-	Liberia C	1964	-	no	-	5.0 miles	THC
1942	-	Cabezon	1959	-	no	-	5.0 miles	THC
1943	-	Princess Pat	1958	-	no	-	2.0 miles	THC
1944 (1954?)	-	Jiffie	1955	-	no	-	5.0 miles	THC
1954 (1944?)	-	Jiffie	1955	-	no	-	5.0 miles	THC
2186	-	Tramp	1919	-	no	-	5.0 miles	THC
2187	-	Ring Dove	1919	-	no	-	5.0 miles	THC
2209	-	American Star	1970	-	no	-	5.0 miles	THC
2215	-	Baetty Sca	1966	-	no	-	5.0 miles	THC
2218	-	Bill Hollis	1970	-	no	-	3.0 miles	THC
2224	-	Buckroy	1959	-	no	-	-	THC
2239	-	Coral Chipper	1961	-	no	-	-	THC
2260	-	Georgiana	1951	-	no	-	5.0 miles	THC

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
2282	-	Little Saran	1959	-	no	-	-	THC
2287	-	Mert	1970	-	no	-	-	THC
2334	-	Taasinge	1970	-	no	-	-	THC
2430	-	*Utina* (Hull 1)	-	41NU292	no	-	"exact"	THC, ENC
2545	-	Unknown	pre-1900	-	-	steamship	"exact"	THC
2561	-	Unknown	pre-1908	-	-	-	0.25 miles	THC
-	4172	"Blue Hull Airboat"	1984	-	-	airboat	-	AWOIS
-	4186	Margie B	-	-	-	-	-	AWOIS, ENC
-	5014	Moon Glow	-	-	-	-	-	AWOIS, ENC
-	11022	Unknown	-	-	-	shipwreck	-	AWOIS
-	13346	Unknown	-	-	-	fishing vessel	-	AWOIS, ENC
-	13347	Bertram	1992	-	-	fishing vessel	-	AWOIS, ENC
-	4163	Obstruction	-	-	no	-	-	AWOIS
-	4168	Obstruction	-	-	no	-	-	AWOIS
-	4169	Obstruction	-	-	no	-	-	AWOIS
-	4170	Obstruction	-	-	no	-	-	AWOIS
-	4171	Obstruction	-	-	no	-	-	AWOIS
-	4173	Obstruction	-	-	no	-	-	AWOIS
-	4174	Obstruction	-	-	no	-	-	AWOIS
-	4176	Obstruction	-	-	no	-	-	AWOIS
-	4178	Obstruction	-	-	no	-	-	AWOIS
-	4179	Obstruction	-	-	no	-	-	AWOIS
-	4180	Obstruction	-	-	no	-	-	AWOIS
-	4181	Obstruction	-	-	no	-	-	AWOIS
-	4196	Obstruction	-	-	no	-	-	AWOIS
-	4999	Obstruction	-	-	no	-	-	AWOIS
-	5006	Obstruction	-	-	no	-	-	AWOIS
-	5009	Obstruction	-	-	no	-	-	AWOIS
-	5011	Obstruction	-	-	no	-	-	AWOIS
-	5093	Obstruction	-	-	no	-	-	AWOIS
-	5094	Obstruction	-	-	no	-	-	AWOIS
-	5096	Obstruction	-	-	no	-	-	AWOIS
-	7557	Obstruction	-	-	no	-	-	AWOIS
-	7910	Obstruction	-	-	no	-	-	AWOIS
-	9293	Obstruction	-	-	no	-	-	AWOIS
-	10959	Obstruction	-	-	no	-	-	AWOIS

THC Shipwreck Number	AWOIS Record #	Name	Year Lost	Trinomial	SAL	Vessel Type	Position Accuracy	Dataset
-	11028	Dump Site	-	-	no	-	-	AWOIS
-	14390	Obstruction	-	-	no	-	-	AWOIS

Until 2016, NOAA maintained and updated the Automated Wreck and Obstruction Information System database of reported shipwrecks and obstructions in the coastal waters of the United States. NOAA's Electronic Navigation Charts (ENCs) depicts reported shipwrecks as well. The AWOIS lists 19 shipwrecks and 25 obstructions (e.g., jetty infrastructure, buoys, snags, etc.) within 1 km of the project APE (44 total records; see **Table 4 and Appendix B**).

There are 14 ENC shipwrecks in the same area, most of which correspond with AWOIS records. Twenty of these records plot within the project APE and 11 plot within 250 meters of it. Most of the AWOIS records within the project APE (*n*=13) correspond with reported obstructions. The remainder are attributed to known and unknown shipwrecks: *De Rail* (Record 195), *Hill Tide* (Record 4162), *Mary* (Record 4175), *Jimbo* (Record 4177), *Eaglescliff* (Record 4183), *Bahia Honda* (Record 4998), *Bertram* (Record 13347), and two unknowns (Records 11022 and 13346). Most of these records plot within the jetties at the entrance to Port Aransas and are more modern in nature.

Texas General Land Office Resource Management Codes

The Texas General Land Office (GLO) owns the state's submerged lands from the shoreline to three marine leagues (9 US Nautical Miles) into the Gulf of Mexico. The GLO's RMC system defines various environmental and cultural resource management concerns within the hundreds of submerged tracts it controls. Two management codes relate to submerged cultural resources: "MK" and "MJ." RMC "MK" denotes tracts that have a high potential for containing submerged cultural resources, whether they are known or not. Submerged tracts are coded "MJ" if they lack sufficient data regarding the presence/absence of cultural resources, though in practice they tend to be interpreted as having a lower potential than "MK" tracts. Most of the project footprint corresponds with "MK"-coded tracts (**Figure 13**).

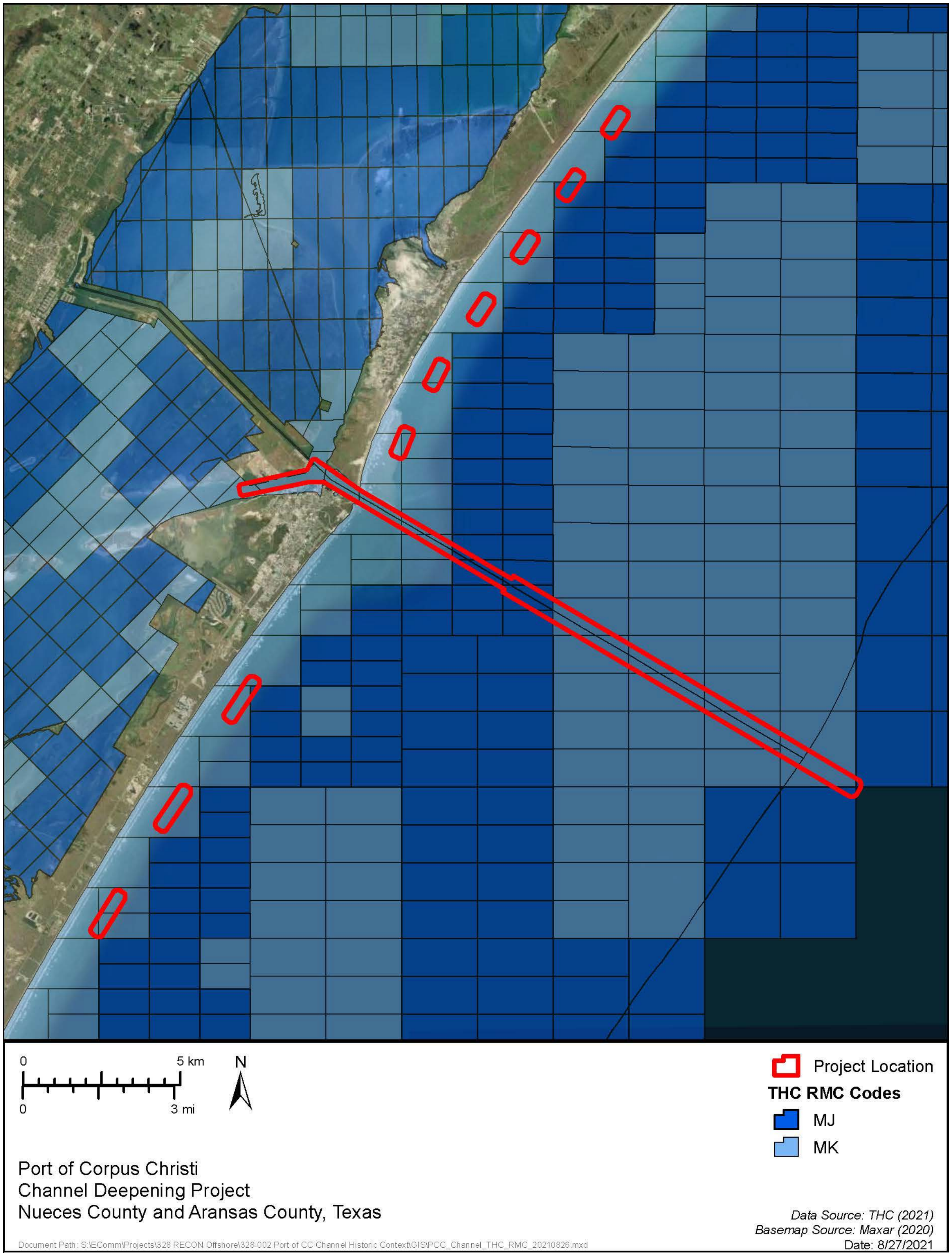

Figure 13. The CCSC APE overlaid on the Texas GLO's Resource Management Codes (RMC's) Submerged tracts.

4.0 Potential for Submerged Cultural Resources (by Dr. Jessica Cook Hale)

Submerged pre-contact archaeological sensitivity assessments rely on predictive modeling to a significant degree (Garrison et al. 2012a). This is because pre-contact sites on the continental shelf are, at present, poorly understood and very few in number compared to their terrestrial counterparts (Bailey and Flemming 2008; Bailey 2014; Flemming 2021). Predictive modeling includes review of both archaeological trends onshore to best project what trends might extend into the offshore zone, and landscape reconstructions to understand how these trends might be expressed in the offshore zone. Thus, it is comprised of review of known site locations in the region, incorporation of relevant archaeological theory concerning human landscape use, assessment of relevant paleoclimate and paleoecology, and assessment of the effects of sedimentological processes such as marine transgression on the project area. This multi-threaded approach allows for reasonable inferences to be made for a given project area based on its regional characteristics instead of broad-brush approaches that focus solely on landforms or other single-variable models.

The probability of encountering a pre-contact archaeological site depends on three factors: human occupation of a location; sufficient activity to leave material evidence of that occupation; and preservation of that material evidence during and after occupation. Submerged pre-contact sites are only detectable where all three conditions are present. Relative, qualitative probabilities can be assigned based on the degree to which these conditions are met in a given location.

One general model for sensitivity was described in the most recent BOEM environmental study to address archaeological site preservation potential along the Atlantic continental shelf (Garrison et al. 2012a). This study designated areas in a general manner: none, low, and high sensitivity. Areas that are submerged too deeply to have ever been inhabited by human beings as areas of no sensitivity; areas that became submerged between the last glacial maximum and the earliest dates of human occupation in the western hemisphere are designated as low sensitivity; and areas that became submerged since documented human entry into the western hemisphere are designated as high sensitivity. However, while this set of classifications provides baseline guidance, it does not address cultural trends or preservation potentials controlled by geological processes or the nuances in cultural historical trends in the pre-contact period.

Instead, the history of marine transgression in the project area acts as a control on the potential for pre-contact sites within it. Marine transgression has multiple effects. First, it controls whether the project area was subaerial and thus available for terrestrial occupations. Second, it controls the distribution of resources across the landscape; after the end of the Pleistocene, the rising relative sea levels transformed the project area from a coastal plain to a coastal/estuarine landscape, changing the types of potential food resources to include easy access to diverse aquatic resources within the developing bays and barrier islands. Third, the rate and timing of marine transgression can either quickly drown and preserve archaeological materials deposited on these formerly subaerial land surfaces, or it can erode and disarticulate such deposits during periods of slowed transgression (Swift 1968). Understanding the regional Quaternary geomorphology. sequence stratigraphy, and regional marine transgression trends is key to developing a predictive model for potential pre-contact site occurrences in the offshore environment.

Quaternary Geomorphology

The modern south-central Texas coastline itself is a Holocene-aged wave-dominated coastline that formed during the final stages of marine transgression during the end of the middle Holocene, around 9,000 to 7,000 years ago (Ricklis and Blum 1997; Flocks et al. 2009; Anderson et al. 2014). The modern coastline is comprised of elongate barrier islands formed by longshore sediment transport and wave action backed by brackish-water tidal sounds between the barrier islands and the mainland. Access to the Gulf of Mexico is possible in between barrier formations in channels regionally termed "passes"; some of the modern passes, such as the one at Port Aransas, have been deepened, widened, and stabilized to allow permanent access between mainland ports and the Gulf shipping lanes.

At the end of the LGM, around 22,000 years ago, the continental shelf break, 410 ft. (125 m) below modern sea levels, marked the edge of North America (Balsillie and Donoghue 2011; Joy 2019). The Mississippi, Pearl, Brazos, Nueces, and other rivers that now drain into the Gulf extended onto the exposed continental shelf, only reaching the ocean at the shelf break/paleo coastline. The modern Texas coastline was an extension of the coastal plain region, and the project area was an inland coastal plain environment.

The end of the LGM caused the large ice sheets mantling the continents to deteriorate and collapse, directly adding large amounts of freshwater to the oceans. This caused global (eustatic) sea levels to rise, as well as warming the climate (Rasmussen et al. 2006). The project area was never glaciated, but the process of deglaciation had several local effects that shaped its geomorphological evolution over the last 22,000 years. First, the project area shifted from an inland environment to a coastal, estuarine one by around 7,000 years ago thanks to the encroachment of the coastline (Ricklis and Blum 1997; Flocks et al. 2009). Second, stabilization of the coastal zone from the end of the Pleistocene and into the middle Holocene supported the development of the modern barrier island chain (Ricklis and Blum 1997; Anderson et al. 2014). The project area was likely submerged after around 7,000 to 8,000 years ago, rendering it unavailable for human occupation after this point. However, the evolution of this coastal zone changed the distribution of resources available to human cultural groups significantly between the LGM and submergence during the middle Holocene. This had impacts on how such groups articulated with their broader environment through time, leading to changes in archaeological deposits.

Sequence Stratigraphy

The late Pleistocene sediments in this region are primarily composed of the Beaumont and Deweyville Terraces. This sequence developed between the last full interglacial period ~125,000 years ago, and the last glacial maximum, at around 22,000 years ago. The Beaumont Terraces represent deposits dating to sometime after 125,000 years ago, while the Deweyville Terraces are younger, overlying the Beaumont Terraces where fluvial incision followed by alluvial deposition has infilled late Pleistocene fluvial valley systems.

The Beaumont Terraces are composed of clastic materials dominated primarily by clays and sands deposited in alluvial and near shore environments. Borehole studies along the Texas coast have indicated the clear development of a land surface on these late Pleistocene sediments during the time it was exposed. The Beaumont Terraces have been incised by multiple fluvial systems draining to the Gulf of Mexico. They are now buried beneath 2 to 10 ft. (0.5 to 3 m) of modern Holocene sediments, depending on proximity to the modern coastline where overlying sediments are currently experiencing erosion and ravinement (Stright et al. 1999; Pearson et al. 2014; Anderson et al. 2014).

The Deweyville deposits are also clastic materials but, as noted, are younger materials than the Beaumont Terraces. These younger sediments were probably deposited during periods of marine transgression, when the hydraulic gradient was lowered as relative sea levels moved landward. This caused fluvial systems to transition from incising forms to meandering ones, allowing for the resumption of depositional conditions instead of erosional ones (Ricklis and Blum 1997). Near the coastline, bayhead deltas formed where fluvial systems meet the Gulf once marine transgression slowed at the end of the middle Holocene (Ricklis and Blum 1997). Lower lying components of the Deweyville and Beaumont Terraces are flooded now, with overlying Holocene sediments capping them where coastal and near-coastal processes have promoted deposition. These Holocene sediments include the modern bayhead deltas as well as the modern barrier island formations.

One feature of the northern, and to a lesser extent, the western Gulf, is the development of salt dome formations since the end of the Cretaceous. These formations develop where salt deposits migrate upward along fault planes in overlying sedimentary formations due to their lower density compared to surrounding rock (Hamlin 2006). While these are more common in the northern Gulf, three domes are south and west inland of Corpus Christi, suggesting the potential for such formations along the shallow shelf (Hamlin 2006).

Marine Transgression and the Regional Relative Sea Level Curve

Assessment of the region for marine transgression is based on several relative sea level curves constructed for the Gulf of Mexico (Simms et al. 2007; Balsillie and Donoghue 2011; Anderson et al. 2014; Joy 2019). At the LGM, RSL likely lay around 410 ft. (125 m) deeper than the modern coastline position. As the LGM terminated, marine transgression was initially gradual, but accelerated around 18,000 years ago, jumping at least 100 ft (30 m). Gradual transgression resumed after 16,000 years ago but accelerated again, even more dramatically, around 14,500 years ago, when it rose from around 50 ft (15 m) in only about 500 years. Another rapid marine transgression event occurred between 13,000 and 12,000 years ago, when the shoreline shifted around 130 ft. (40 m). The Younger Dryas stadial, which marks the end of the Pleistocene and onset of Holocene conditions (described further below) saw a drawdown of about 30 ft. (10 m), but marine transgression resumed after 11,000 years ago. Marine transgression slowed during the early Holocene, which ended around 8,000 years ago. The project area was inundated at this point, making it unavailable for human occupation.

Marine transgression rates were most rapid during the terminal Pleistocene, particularly in three sub-periods: between 18,000 and 16,000 years ago, between 14,500 and 14,000 years ago, and between 13,000 and 12,000 years ago. Rapid submergence tends to lead to better preservation of archaeological materials because archaeological deposits spend less time in the active surf zone, which is highly erosive (Swift 1968). Slower periods of marine transgression thus increase the potential for erosion and ravinement to destroy deposits in the coastal zone. This in turn logically implies that archaeological deposits from the three time periods of rapid marine transgression during the Pleistocene are the most likely to have been preserved. Human occupation is documented in North America during all of these time periods, making terminal Pleistocene archaeological deposits the most likely to be preserved in the project area, should any exist. Younger early and middle Holocene deposits, conversely, are less likely to have been preserved due to decreased rates of marine transgressive and correlative increased potential for erosion.

Paleoclimate

Paleoclimate reconstructions are also necessary to better understand the changes across the Project area and implications thereof for any potential human occupations prior to the present. Paleoclimate is typically reconstructed using proxy data such as preserved ancient pollen assemblages, fossils, and microfossils, especially marine taxa that prefer specific temperature and salinity conditions. Because preservation of such indicators can be uneven across any given region, these reconstructions are not always complete. They do, however, provide at least broad suggestions as to how the environment was different during the past, and in turn, how pre-contact populations might have lived on these landscapes. The following summary discussion of paleoclimate in the region of the project area is drawn from peer reviewed literature that addresses conditions across the region, as there are no studies available for the exact region of the project area.

Pleistocene

The terminal Pleistocene climate, on a global scale, was considerably cooler and drier than that of today due to the considerably amount of water frozen, and thus unavailable for circulation in water cycles that control precipitation rates and types. Pollen studies from northern Louisiana and the upper Texas coast nearer to the Sabine River indicate that this region lay at a boundary between the more arid plains environment and a more humid eastern woodland zone composed of warm, mixed temperate forest (Delcourt and Delcourt 1984; Stright et al. 1999). Seasonality appears to have been reduced during this time, as well, and this region lay within a zone identified as being influenced by warmer tropical airmasses (Delcourt and Delcourt 1983, 1984).

It is unlikely that warm temperate forest dominated the coastal plain of south central Texas, but regional studies do suggest greater amounts of precipitation during the Pleistocene than today (Stright et al. 1999). Such increased precipitation could have supported intermittent tree cover similar to the parkland environment documented on the Georgia coastal plain (Garrison et al. 2012b), but this is purely speculative. Paleoclimate studies of south-central Texas are lacking in detail currently, so it is difficult to project the exact nature of floral taxa present in the area. The best characterization of the area is that it was cooler and probably more humid than today's climate (Stright et al. 1999).

Younger Dryas Stadial

The Younger Dryas climate episode occurred when a slowed Atlantic Meridional Overturning Current (AMOC) caused the warmer Gulf Stream waters to weaken. This led to a temporary cooling during which time near-glacial period temperatures were re-established across the northern hemisphere. Ice sheets advanced and rainfall levels dropped. This period lasted around 1,000 years, ending around 11,500 years ago, after which point the Holocene epoch began. The Younger Dryas was historically thought to have caused cooler temperatures across all of North America, but recent reassessments have instead shown that in the southeastern part of the United States, including within the project area, the climate continued to warm (Fastovich et al. 2020). However, proxy data from Camel Lake and Page-Ladson in northern Florida indicate increased aridity, known regionally as the Bolen drought (Thulman 2009; Dunbar 2016; Halligan et al. 2016). It is not clear if this aridity extended to the project area. However, it is reasonable to infer that the Younger Dryas climate episode likely did not cause the project area to experience significant cooling.

Holocene

The Holocene epoch marks the end of glaciation across the globe. It is designated by the termination of the Younger Dryas climate episode, after 11,500 years ago. Ice sheets underwent final collapse by the middle Holocene and marine transgression slowed. The Holocene Altithermal, during the middle Holocene from around 8,000 to around 5,000 years ago, saw the warmest temperatures since the LGM due to changes in planetary orbital mechanics that increased the amount of solar radiation inputs to the higher latitudes. Since that time, orbital mechanics have slightly shifted such that radiation has decreased, and after 5,000 years ago, the late Holocene climate of today was established (Delcourt and Delcourt 1984; Rasmussen et al. 2006; Kendall et al. 2008; Clark et al. 2012).

The early Holocene climate appears to have possible involved continued aridity in the project area, but this may have been punctuated by local and regional episodes that brought increased precipitation, at least intermittently. Offshore pollen assemblages from High Island, Texas, indicate the establishment of warm, humid conditions after the onset of the early Holocene (Warny et al. 2012).There is a hiatus in deposition both north and east of the project area during the early to middle Holocene as well as evidence for subaerial erosional regimes in onshore sites nearby in Nueces County, suggesting reduced plant cover and probably increased aridity (Delcourt and Delcourt 1984; Watts et al. 1992; Ricklis and Cox 1998). It may thus be the case that the western Gulf Coast experienced temporarily warmer, more humid conditions after the end of the Younger Dryas, but that this shift did not last. Arid climate regimes were re-established in the region of the project area by around 9,000 years ago, and lasted through the middle Holocene (Ricklis and Cox 1998).

Examination of regional Quaternary geomorphology, sequence stratigraphy, and marine transgression rates indicate that the potential for submerged pre-contact archaeological deposits exists within the project area to varying degrees. Terminal Pleistocene occupations that demonstrate continuity with the inland cultural trends, including bison hunting, are possible, as are early to middle Holocene coastal occupations and deposit types such as shell middens. The project area was submerged during the middle Holocene, probably by 8,000 years ago and or as late as 7,000 years ago, making it unavailable for terrestrial occupations. Rapid rates of marine transgression during the Pleistocene increase the odds for preserved archaeological deposits from this period, with conversely poorer preservation potentials once marine transgression slowed after around 11,500 years ago.

Historical (by Mason Miller)

Preservation of sunken watercraft primarily depends on their hull material and the pace and way they become buried (i.e., complete and sustained burial or dynamic periods of partial burial). Alternatively, vessels may have grounded on sand bars and were unable to be refloated. In this case, the vessel's weight, along with wave action, may cause it to break apart, resulting in a larger, scattered debris field rather than a more self-contained site. Vessels constructed of iron and steel are just as susceptible to these factors as their wooden counterparts, but metal hulls are still exposed for longer periods post-deposition in the saltwater contexts along the Texas coast.

Wooden-hull vessels are endangered by biological organisms that bore into the lower hull throughout their time afloat, particularly the Teredo worm in the warm waters of the Gulf of Mexico. Following a sinking event, the entire vessel structure becomes endangered by these organisms. In addition, water saturation degrades wooden components. Iron and steel-hulled wrecks degrade more slowly; however, salt water corrodes iron five times faster than it would corrode on land. Additionally, iron artifacts tend to become concreted in saltwater environments. For both material types, quick and sustained sedimentation and burial that creates a low-oxygen environment that inhibits biological growth and infestation is the best scenario for vessel preservation.

The region's historical records suggest that there is a high potential for numerous kinds of submerged cultural resources, particularly those dating from the mid-to-late nineteenth century forward. While Native American groups lived in the project area before and after the first European contact, submerged remnants of their occupations would likely be scarce. Before the mid-nineteenth century, this portion of the Texas coast was sparsely populated by immigrants and explorers of European descent – groups that would use vessels that would be more likely to be detected using remote sensing methods.

From Robert Mercer's first livestock grazing operation on Mustang Island until 1920 when engineers' improvements made the channel was consistently deep, the shallow cut at Sabine

Pass prevented deep-draft vessels from entering Corpus Christi Bay through the project area. Instead, they frequently had to transfer cargoes to lighters. Any deep-draft vessel shipwrecks within the survey vicinity that predate the early 1900s will most likely be limited to the Corpus Christi Ship Channel's Gulf side and the Beneficial Use Sites. Any wrecks inside the cut of that age would more likely be associated with shallow-drafted, smaller vessels and personal craft.

Though the Corpus Christi Bay area was the site of two Civil War engagements (the Battle of Corpus Christi Bay, 1862; the Rio Grande Expedition, 1863-1864), most of the naval action took place elsewhere. General Banks' forces did note the loss of the steamer *(William) Bagley* at Aransas Pass, but there are no specific descriptions of the incident or its exact location in the sources that were consulted. It is possible that remnants of this wreck could lie within the project area. Most likely, any undocumented, submerged cultural resources within the study area would be associated with commercial (cargo and oil/gas) vessels dating to the period after the construction of the CCSC in 1926 or shrimping boats that post-date the 1940s.

Due to the intensity of its use since its construction in 1926, the CCSC itself is likely the site of many ship sinking episodes. Equally due to its prominence, many such potential shipwrecks would have been accounted for by either historical accounts from other ship traffic, periodic channel maintenance and dredging, or one of the many previous archaeological surveys that have been. Accordingly, the potential that previously unidentified archaeological resources are preserved within the main CCSC corridor is low. Project components beyond this corridor, including the channel expansion areas and the Beneficial Use Sites have a markedly higher potential for impacting wrecks.

5.0 Research Design and Methods

The investigation was conducted in accordance with Texas Administrative Code for the conduct of activities regarding historic shipwrecks (Title 13, Part 2, Chapter 28, Rule 28.6). The goal of the Administrative Code is to provide rules for minimum reporting and curation standards, professional qualifications, antiquities permit requirements, protections for historic shipwrecks and associated requirements for survey and data presentation. The Area of Potential Effect was defined by the Scope of Work (**Appendix C**) as:

- Feeder Berms/Beneficial Use (B1- B9) including a 50-meter buffer;
- All new cut areas in the Corpus Christi Ship Channel from Station -330+00 to -620+00 offshore including a 200-meter buffer; and
- A 100-meter buffer only within the 3-mile limit of the Corpus Christi Ship Channel.

The previously dredged Corpus Christi Ship Channel was not included.

Marine survey took place over three deployments due to weather and sea conditions from October 18-22, 2021, February 9-11, 2022 and June 17-21, 2022.

The following methods were implemented to fully describe and define newly and previously identified resource(s) (including archaeological sites, anomalies, and shipwrecks) within the project area. This included information on type, period(s) of occupation, and location of all cultural resources within the project area, including previously recorded resources, to the extent possible to aid in the determination of eligibility for inclusion on the National Register of Historic Places.

Project Personnel
Jason Burns, MA, RPA served as the Principal Investigator and Michael Krivor, MA, RPA served as the marine archaeological data analyst from RECON Offshore. All archaeological data analysis was conducted by Jason Burns and Michael Krivor. Dr. Jessica Cook Hale, PhD, RPA, Full Fathom Five, wrote the prehistoric cultural context and paleo landscape assessment, sonar mosaic creation was completed by Thompson Maritime Consulting and Matt Thompson, MA, RPA. Marine geophysicist, Erick Huchzermeyer (Empire Ocean Sciences) contributed to the initial magnetic processing. Robert Gearhart, M.A, (BOB Hydrographics) conducted the final magnetic processing. Mason Miller, Adam Parker, Sarah Parkin and Leah Robertson with AmaTerra Environmental Inc. contributed the Historic Context and background research. Survey equipment and vessel support was provided by BIO-West during the October and February deployments with Josh Grotte serving as their representative while Jason Burns was the onboard marine archaeologist. Survey equipment and vessel support was provided by MREC Environmental and Gabe Johnson during the June deployment with Dr. Jessica Cook Hale serving as the onboard marine archaeologist.

Geodetic Parameters

During the current investigation RECON collected all remote sensing survey data in the following geodetic parameters (**Table 5**).

Table 5. Geodetic Parameters Utilized During the Current Investigation.

Predefined Grids	Ellipsoid	Zone	Distance Unit
State Plane NAD-83	WGS-84	TX-4205 Texas South	US Survey Foot

Survey Layback

One of the more important aspects of any remote sensing survey includes the accuracy of the survey instrument layback. Layback includes the X, Y, and Z distance (in feet) from the center ("zero-point") of the survey vessel to the location of the DGPS antenna and various tow point locations of the remote sensing instruments. The following laybacks were physically measured and input into survey software prior to the remote sensing survey and corroborated at the end of the survey during data processing (**Table 6**). For the magnetometer a towfish device driver (towfish.dll) was implemented in Hypack™ which utilizes cable out and a catenary factor to accurately determine the position of the towfish during the survey. Two different survey vessels (*Ms. Kendle* and MREC) were utilized over the three deployments and are presented below.

Table 6. Remote Sensing Instrument Layback (in feet).

Instrument	X (Starboard)	Y (Aft)	Z (Vertical)
BIO-West Ms. Kendle			
GPS	3.50	-0.50	6.00
Magnetometer	-3.50	-55.00	0.75
Side-scan Sonar	-6.25	-3.00	-1.75
Echosounder	2.00	-12.00	-0.25
MREC			
GPS (Center)	0.00	0.00	0.00
Magnetometer	0.00	-69.00	0.00
Side-scan Sonar	5.83	0.00	-1.75
Echosounder	5.50	-3.00	-0.25

Survey Line Spacing, Vessel Speed, and Conditions

Per Section 7.02 of the Scope of Work (SOW) the transect interval was not to exceed 20 meters (65.6 feet) within the three nautical mile limit and 30 meters (98.4 feet) beyond the three nautical mile limit. Both survey stipulations were adhered to during the current investigation. Vessel speed did not exceed 5 knots. Planned and run Survey lines are included as **Appendix D**. The survey had to be accomplished over three deployments to ensure conditions met survey specifications. Seas needed to be less than 3 feet with wind not exceeding Beaufort Wind Scale 4 (https://www.weather.gov/mfl/beaufort).

Equipment

The survey adhered to the Texas Administrative Code (TAC) for the conduct of activities regarding historic shipwrecks (Title 13, Part 2, Chapter 28, Rule 28.6). Instrumentation for the survey met or exceeded TAC. Specifications are included as **Appendix E**. On the *Ms. Kendle* the following equipment was utilized:

- Hemisphere® VS110 DGPS, Trimble R10 Model 4 RTK;
- EdgeTech® 4125 Chirp 400/900 kilohertz (kHz) side-scan sonar (SSS) sensor (towfish) and EdgeTech 3100 topside processor with DISCOVER acquisition software;
- Teledyne Odom Hydrographic, Inc. E20™ 200 kHz single beam echo sounder;
- Geometrics, Inc.® G-882 cesium-vapor marine magnetometer.
- HYPACK survey software for planning, navigation and acquisition of all DGPS, magnetometer and single beam echosounder data.

The MREC Vessel utilized:

- Trimble MPS865 Marine GNSS, Trimble SPS 461 DGPS;
- EdgeTech® 4125i Ultra High Resolution 600/900 kHz side-scan sonar (SSS) sensor (towfish) and a portable EdgeTech 3100 topside with DISCOVER acquisition software;
- Teledyne Odom Hydrographic, Inc. CV100™ 200 kHz single beam echo sounder;
- Geometrics, Inc.® G-882 cesium-vapor marine magnetometer.
- HYPACK survey software for planning, navigation and acquisition of all DGPS, magnetometer and single beam echosounder data.

Magnetic sampling met or exceeded TAC at 10kHz for the February deployment and 1 kHz for the other deployments. The towfish height was maintained off the seabed through speed and cable out and did not exceed TAC at 6 meters (19.6 feet) in deeper water. The magnetometer had to be monitored closely inshore as the water depth reached less than a meter at times. The side scan sonar was also monitored closely as water depths changed. These instruments were used to collect information on magnetic anomalies and side-scan sonar contacts to locate and evaluate their potential historical significance, and assess the need for (and scope of) future investigations or avoidance measures. Prior to survey each instrument was calibrated, and data reviewed to ensure the validity of the data acquired.

Survey Vessels of Opportunity

The remote sensing team operated from two vessels over the three deployments, the 29-foot Ms. Kendle (**Figure 14**), operated by BIO-West and the 24-foot MREC (**Figure 15**) operated by Marine Research Ecological Consulting. Both vessels operated inshore and offshore and were suited to the project environments The vessels were equipped to meet all US Coast Guard regulations.

Figure 14. BIO-West's *Ms. Kendle*.

Figure 15. MREC survey vessel.

Data Security and Preservation
Vessel navigation and positioning data, along with field data files from all sensors were saved to a computer file and backed up on an external hard drive daily. All data collected during field operations (navigation, positioning, and ancillary data) were duplicated and stored on two hard drives (typically, a primary laptop and an external hard drive). This storage occurs as soon as possible after collection but within the same day, depending on the field deployment. While on site, backup media are stored separately from the field computer.

Daily survey areas were defined to optimize survey coverage for various sea states and weather conditions. A preliminary evaluation of the data collected was made at the end of each survey day to identify the need to adjust the survey methodology or correct the quality of data within the previously surveyed area. During return from the field, computer and backup media are transported separately whenever feasible but at least one copy travels in personal possession.

Data Analysis
Following completion of the fieldwork, the analysis of the field data sets was accomplished to identify, characterize, and evaluate the anomalies, targets, and features for potential historical significance and the need for, and scope of, future investigation or avoidance measures. As a final deliverable all datasets will be submitted to the Port of Corpus Christi Authority.

<u>Magnetic Data Processing (by Robert Gearhart)</u>
Magnetometer data was processed and contoured by Robert Gearhart of BOB Hydrographics. Magnetometer data illustrated in this report have been thinned to a 5-foot (0.5-second) average interval between data points. Low-frequency fluctuations in magnetic data caused, for example, by diurnal passage of the sun or by geologic gradients were removed, prior to contouring, using a filter algorithm. The algorithm treats short-term fluctuations, exceeding a selected amplitude threshold (0.5 nanoTesla [nT]), as anomalous values. The result is a dataset in which abnormally high and low magnetic amplitudes (anomalies) are centered around zero (representing the ambient level). All amplitude shifts, smaller than the threshold value, are reduced to near zero and are treated as ambient background. This process removes low frequency data, leaving potentially significant anomalies intact, and allows a color representation of anomaly polarity.

Diurnally corrected magnetometer data was contoured using Blue Marble's Global Mapper software (Version 20.1) at a 5-nT contour interval. Positive amplitude is indicated by red contours and negative amplitude is drawn as blue contours. Magnetic amplitudes between +5nT and -5nT are considered insignificant. Contour maps omit the 0-nT contour level to prevent a cluttered appearance.

<u>Magnetometer Data Analysis</u>
Magnetic anomalies detected by marine geophysical surveys are created by the presence of ferro- or ferrimagnetic materials on the seabed (Milsom 2003). Magnetometry is thus a proxy method for identifying potentially significant cultural features such as shipwrecks, which contain such materials in greater abundance than pre-contact features. However, marine debris that is

not significant can also be composed of magnetically susceptible materials, and thus magnetometer analysis relies on both qualitative and quantitative assessments of multiple characteristics found in magnetometer datasets to differentiate between archaeologically significant features such as shipwrecks versus modern marine debris and trash.

This is not a simple process, because magnetic signatures associated with shipwrecks can vary greatly. This is primarily because "iron content, condition, and distribution of a wreck all influence the intensity and configuration of the magnetic signature produced" (Pearson et al. 2015:3-5). However, diagnostic patterns can be delineated. Pearson noted that "watercraft remains do tend to exhibit characteristic magnetic signatures that tend to aid in differentiating them from other types of anomalies…and when used in conjunction with other data (historic accounts, use patterns of the area, diver inspection) other remote-sensing technologies, and prior knowledge of similar targets, it can often lead to a reasonable estimation of identity" (Pearson et al. 2015:3-5). Stated more simply, magnetic signatures must be analyzed for multiple quantitative characteristics as well as in conjunction with their overall environmental and cultural contexts.

The following attributes of magnetic targets are useful for identification of archaeological material:

- Magnetic signature type (monopole, dipole, and multicomponent);
- Total amplitude in nanoteslas (nT) (sometimes termed gamma deviation);
- Duration (in meters or feet);
- Declination (orientation with respect to the earth's magnetic field and poles);
- Other associated magnetic anomalies;
- Other geophysical data sets such as side-scan sonar returns.

The degree to which each of these characteristics is useful in interpreting magnetometer data, as well as how these must be assessed in tandem with the others, has been a topic of discussion and analysis by practitioners for over 40 years. Current best practices are the result of this decades-long debate (VonFrese 1986; Garrison et al. 1989; Pearson et al. 1991; Breiner 1999; Enright et al. 2003, 2006; Enright 2009; Gearhart 2004, 2011). Below is a discussion of this literature, focusing on each characteristic in turn. This is followed with a summary of the current best practices today.

Each of these characteristics represents a specific physical effect of a source's magnetic properties. Signature type describes the effect of a source's magnetic properties when compared to the earth's ambient field. It may present as a monopolar anomaly ("monopole") showing an amplitude change in one direction from the ambient background, a dipolar anomaly ("dipole") that shows a single positive and negative signature from the ambient background, or a multicomponent anomaly that includes multiple monopole or dipole peaks. The amplitude measures the deviation (either positive or negative) in nanoteslas from the Earth's background magnetic field reading; higher amplitudes can be created by sensor distance, target size, and/or target composition, and must be assessed considering these variables. Duration is the length over which the anomaly can be detected along a survey transect. Declination is the difference between an anomaly's orientation and either the north or south magnetic poles. This must be considered because it can indicate whether a magnetic signature is created by remnant or induced magnetism, which in turn is function of the composition of an anomaly's source materials (Milsom 2003). Finally, the overall context of the anomaly is considered, including other anomalies as well as results from other geophysical methods such as side-scan sonar

Magnetic signature clearly varies depending on target type. Magnetic anomalies with a monopole signature are usually not composed of archaeologically significant materials (e.g., modern debris like a 55-gallon drum or pipe). Monopolar anomalies can thus generally be ruled out as potential archaeological targets, subject (as always) to contextual interpretation. Dipole or multicomponent target(s), however, have a higher potential to represent a potentially significant resource. Dipoles and multicomponent targets require further assessment in parallel with assessment of other characteristics.

Anomaly amplitude increased when a target is composed of highly magnetically susceptible material such as iron, but it can also increase when sensor distance to target decreases. Thus, amplitude is important, but so is anomaly duration along a survey trackline. Analysis by Garrison and colleagues determined that shipwrecks tend to correlate to complex magnetic anomalies (multiple dipoles/multicomponent anomalies) spread over areas greater than 10,000 m^2 (approximately 2.5 acres), appearing over multiple survey tracklines along a gentle magnetic gradient (Garrison et al. 1989:223). Pearson and colleagues simplified this perspective and proposed that analysts use a threshold of 50 gamma (nT) amplitude measured as the total magnetic deflection from background and a linear duration of greater than 24 meters (80 feet) to identify potentially significant shipwrecks on the seabed (Pearson et al. 1991). Pearson revised his measurements and eliminated targets with less than a 20-meter (66 ft.) duration (Pearson 2010).

A 2002 study by Gearhart and a later 2003 study by Watts et al. considered the magnetic declination (orientation of an anomaly with respect to magnetic north and south) of an anomaly(Gearhart 2002 and Watts et al. 2003). Shipwreck sites that were well characterized by dipolar anomalies oriented roughly parallel with the earth's magnetic axis. Anomaly declination showed a median value of 9.4 degrees, a mean variation of 12.6 degrees, and a maximum value of 31 degrees (Enright et al. 2006:136). Gearhart's 2011 analysis found that orientation averaged 10 degrees and did not exceed 26 degrees when comparing twenty-nine shipwrecks to sixteen debris sources (Gearhart 2011:99-102). It is critical to note that of all the above magnetic characteristics, declination is a useful one for determining if an anomaly is created by debris or a shipwreck (Gearhart 2011:107). Gearhart's current 2021 data includes 42 verified shipwreck anomalies, noting that all 42 wrecks have an orientation "with their primary negative pole situated north of their positive pole" (Gearhart 2021:28).

Other studies have also recognized that a variety of additional factors beyond amplitude, anomaly type, duration, and declination can affect the accurate identification of potential shipwreck sites. Vessel type (wood hull versus iron hull), size, propulsion (i.e., sail versus steam), cargo, and site formation processes also play important roles in determining magnetic signatures for shipwrecks (Krivor 2014). This underscores the importance of comprehensive evaluations taking all applicable variables, including cultural contexts, into account (Coastal Planning and Engineering 2014:66).

Current studies thus incorporate qualitative as well as quantitative characteristics into account when consideration of magnetic anomalies. For example, Gearhart noted the high potential for modern debris at/or near the waters where industrial traffic occurs; such a survey area can be reasonably interpreted following the "strong physical correlations between anomalies and navigation channels or industrial developments suggest a temporal correlation between the same. By this line of reasoning, most anomalies occurring near such features likely are contemporaneous with those features." (Gearhart 2011:44).

Finally, survey design is critical. Line spacing plays an important role in the detection and identification of potential shipwreck sites. Pearson and colleagues recommended that surveys reduce line spacing from 50 meters (164 feet) to 30 meters (98 feet) for high probability areas (Pearson et al 2003:7–18). This recommendation results from the persistent observation that shipwreck anomalies tend to occur on adjacent survey tracklines (Garrison et al.1989; Gearhart 2011:95-96). Gearhart also recommended survey trackline spacing be reduced to 20 meters (66 feet) instead of 30 (98 feet) to improve spatial resolution of complex magnetic anomalies (Gearhart 2011).

Current Survey

The magnetometer data was reviewed for ferromagnetic/manmade objects using location (collected in State Plane NAD-83, TX-4205 Texas South, US Survey Foot), gamma deviation/amplitude (in nT), duration (in feet), type (i.e., monopole, dipole, multi-component), declination, and association with other anomalies. Spacing of survey lines is critical, as well. Smaller shipwrecks tend to create anomalies of similar shape and size as some debris features (Garrison 1989; Gearhart 2011). However, 20-meter survey trackline spacing has demonstrated a near 100 percent detection rate of small wooden-hulled sailing vessel anomalies (on two adjacent track lines) (Gearhart 2004, 2011). Accordingly, the current survey utilized 20- to 30-meter line spacing according to the Scope of Work.

All magnetic data was contoured to determine the complexity of the anomaly as well as association with other remote sensing targets, known wrecks/obstructions, pipelines, navigation aids, and other manmade features. This format offers improved visual presentations that allow the analyst to visually identify potentially significant anomalies (Enright et al 2006:148). This practice has been used since the 1980s. but the increasing accessibility of digital methods for analysis make this approach virtually mandatory (Gearhart 2011:95-96). A contour spacing of five nanoteslas was used; such spacing allows for delineation of the multi-component, complex anomalies typical for shipwrecks (Gearhart 2011:97).

Anomalies were reviewed to determine if they were monopoles, dipoles, or multicomponent. Monopoles were removed from consideration due to their high correlation to debris instead of culturally significant materials. RECON also only considered magnetic anomalies detected on more than one survey track line (spaced at 20 and 30 meters). Dipole or complex anomalies were only considered to be potentially significant if they exceeded 50 gammas/nanoteslas in strength and 20-meters (66 ft.) in duration. Declination was considered as well, given the strong correlation between low angles of declination and anomalies associated with shipwrecks (Gearhart 2011:107-109, figure 4.4 and 2021: figure 14).

Review and comparison of additional data sets is also an important step in interpreting remote sensing data. For the current investigation, all magnetic targets were compared with contacts documented by the side-scan sonar. As discussed by Hall (2008):

> *Shipwrecks–large or small–often have distinctive acoustic signatures, which are characterized be geometrical features typically found only in floating craft. Most geometrical features identified on the bottom (in open water) are manmade objects. Often an acoustic signature will have an associated magnetic signature. Generally, if the acoustic signature demonstrates geometric forms or intersecting lines with some relief above the bottom surface and have a magnetic signature of any sort; it can be characterized as a potentially significant target. Often, modern debris near docks, bridges, or an anchorage is easily identified solely based on the characteristics of its acoustic signature. However, it is more common to find material partially exposed. Frequently, these objects produce a record that obviously indicates a man-made object, but the object is impossible to identify or date. In making an archaeological assessment of any sonogram record, the history and modern use of the waterway must be taken into consideration. Naturally, historically active areas tend to have greater potential for submerged cultural resources…*
>
> *Shipwrecks that occur in regions with hard bottoms, with little migrating sand, tend to remain exposed and are often visible on sonogram records. A magnetic anomaly that is identified in a hard bottom area and has no associated acoustic signature frequently can be discounted as being a historic shipwreck. Most likely, such an anomaly is modern debris, such as wire rope, chain, or other ferrous metal.*
>
> *Soft migrating sand or mud can bury large wrecks, leaving little or no indication of their presence on the bottom surface. The types of magnetic signatures that a boat or ship might produce are infinite because of the large number of variables including position, chemical environment, other metals, vessel type, cargo, sea state, etc. These variables are what determine the characteristics of every magnetic target signature. Since shipwrecks occur in a dynamic environment, many of the variables are subject to constant change. Thus, in making an assessment of a magnetic anomaly's potential to represent a*

significant cultural resource, investigators must be circumspect in their predictions. (Hall 2008:14–15)

Lastly, the body of water and its historic usage was considered when assessing the potential for historic shipwrecks. The presence of commercial traffic, pipelines, navigational aids, and manmade shoreline features/structures all impact the ability to accurately discern historic shipwrecks. Therefore, increased attention was afforded to the review of the additional data sets collected for this survey, primarily the side-scan sonar records.

<u>Side-scan Sonar Data Analysis</u>

Side-scan data processing was performed using SonarWiz software. Following the creation of the project in the software, the project geodesy was set to use NAD-83 Texas South reference format. A base map was created using a georeferenced NOAA electronic navigation chart (ENC) of Aransas Pass in the vicinity of the Port of Corpus Christi. This type of base map is vital in terms of data processing in that the water depths, ledges, structures, and other features are visualized so they be readily identified in the sonar data record. The unit of measurement for this survey was U.S. feet and all spatial measurements are in this format for compatibility.

Both high frequency (HF) and low frequency (LF) side-scan datasets were imported into SonarWiz. The datasets were divided into subgroups and processed individually to determine which were best suited for specific tasks and deliverables. The processing procedures are the same for both HF and LF datasets; however, there were slight variations in their overall appearance and resolution. The initial step of side-scan data processing was bottom tracking in which the first signal return is identified. The SonarWiz7 software is capable of performing bottom tracking using a system which detects the bottom; however, open water surveys, such as the Port of Corpus Christi survey, are often inundated with acoustic noise in the water column as a result of numerous factors and require manual bottom tracking. The manner in which the side-scan sonar tow fish was employed using a fixed mount, any vessel movement was transferred to the side-scan sonar sensors; thus, increasing the susceptibility to streaking and reduced tracking.

The positional offsets of the side-scan sonar sensor varied according to which vessel was performing data acquisition. The offsets for each deployment were entered into SonarWiz software and confirmed so that all data was as closely aligned as possible to the true position.

The final side-scan data processing procedure involved adjusting the gains which an averaged gain table was created and applied to all the side-scan data files. The use of the averaged gain table was sufficient and did not require further adjustment of the gain settings to improve the appearance of the data for an overall mosaic or target identification.

<u>Single Beam Echosounder</u>

Data collected with the single beam echosounder is utilized for archaeological planning purposes only. No processing of the data was required for the current investigation.

6.0 Remote Sensing Results

The following represents the results of the Marine Archaeological Investigations Port of Corpus Christi's (PCCA's) Ship Channel 75' Channel Deepening Project. The PCCA sponsored marine cultural resources surveys in support of the development of a Draft Environmental Impact Statement (DEIS) for the PCCA's 75-foot Channel Deepening Project. The work was conducted in compliance with Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). Fieldwork, report preparation, and records curation adhered to the minimum requirements presented in the Texas Administrative Code, Title 13, Part 2, Chapters 26 and 28. The PCCA has requested permit authorization (#SWG-2019-00067) from the US Army Corps of Engineers, Galveston District to conduct dredge and fill activities related to the deepening of a portion of the Corpus Christi Ship Channel from Harbor Island into the Gulf of Mexico, covering 13.8 miles. The proposed project also involves the placement of dredged material into feeder berms/beneficial use areas offshore as well as on the beach at Mustang and San Jose Islands.

Marine survey took place over three deployments due to weather and sea conditions from October 18-22, 2021, February 9-11, 2022 and June 17-21, 2022. At the conclusion of fieldwork, all magnetometer data was processed, contoured, and analyzed for potential submerged cultural resources. The criteria outlined above was applied to all magnetometer targets, including those targets that demonstrated a dipole signature with the negative (colored blue) pole oriented north of the positive pole (colored red) oriented south, had sufficient magnetic deviation/duration, and were documented on more than one survey track line. The side-scan sonar data supplemented the magnetometer data by providing imagery of the bay/seafloor and any exposed remains consistent with potential shipwreck sites. Side-scan sonar mosaics of all areas are presented in **Appendix F**. All targets were then cross referenced with additional data sets (i.e., Texas Archaeological Sites Atlas, AWOIS, Railroad Commission of Texas (RRC), etc.) for a final determination. All plotted track lines, wreck sites, obstructions, wellheads, and pipelines gathered from these additional data sets are presented on magnetic contour maps included in **Appendix G**.

B1

Beneficial Use Area B1 (Area B1) is located immediately northeast of the Corpus Christi Entrance Channel. The area was successfully surveyed on October 19, 2021. Water depths within Area B1 ranged from 14 ft. nearshore to 27 ft. offshore.

<u>Magnetometer</u>

Review of the magnetometer data documented a total of 27 magnetic anomalies within Area B1 (**Appendix G: Sheet 9**) (*High Resolution Imagery can be found in Appendix F and G*). After contouring of the magnetometer data each target was tabulated including location (easting/northing), peak-to-peak gamma deviation (in nanoteslas [nT]), duration (in feet), type (monopole, dipole, multi-component), association, and any additional notes.

Sixteen of the anomalies are small, isolated targets indicative of single-source targets. None of these isolated anomalies retain sufficient deviation, duration, or type indicative of a potentially significant submerged cultural resource. The remaining 11 anomalies are associated with four clustered targets. Clustered targets consist of two or more magnetic anomalies recorded over two or more adjacent track lines. Review of the clustered targets indicate none retain characteristics commensurate submerged cultural resources.

Review of the Texas Historical Commission (THC) database suggests two wreck sites plot within Area B1. This includes the *Eagles Cliff* and *Coral Sands*. Plotting the wrecks indicate no magnetics at/near the plotted location of the *Eagles Cliff*. Magnetic Target M90 plots close to the reported location of the *Coral Sands* but is only a small (15 gamma) dipole not indicative of a shipwreck.

Examination of all magnetic anomalies and contour attributes confirms the likelihood that all targets are debris versus potentially significant submerged cultural resources.

Side-scan Sonar

All side-scan sonar data collected within Area B1 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 9**). Only one side-scan sonar contact was documented during the survey of Area B1 (Table 7 and **Figure 16**). For location and dimensions of Contact008 please refer to **Appendix F and H**.

Table 7. Side-scan Sonar Contact Associated with 41AS119.

[redacted]

Review of the location of Contact008 indicates it correlates with State Site 41AS119. In 2019, BOB Hydrographics, carried out a remote sensing survey in advance of the Bluewater pipeline construction under Antiquities Permit 8672, on behalf of Lloyd Engineering. The survey crossed beneficial use area B1. The Principal Investigator recommended two remote sensing anomalies (Anomalies 2 and 3) for avoidance. Anomaly 2 was newly designated as Site 41AS119 while both anomalies 2 and 3 closely correspond with THC Shipwreck #1528, an unidentified wreck site which appears to have sunk between 1884 and 1900 (Gearhart 2019).

Site 41AS119 is located 125 meters west of the Beneficial Use Area B1. The wreck measures 136 feet long and 34 feet wide. One end of the wreck may be broken, and thus the total length may be longer than the 136 feet measured in sonar imagery. The site is completely submerged and lies outside the surf zone. Because it is located outside the surf zone in a low-dynamic environment, the hull is still approximately 75 percent intact. Boilers, visible in the collected side-scan sonar imagery indicate that the wreck is a steam ship. The visible boilers suggest the main deck and superstructure are no longer intact. Gearhart recommended the site for avoidance; however, no diver investigations have occurred on the wreck thus far to determine the site's eligibility for inclusion in the NRHP.

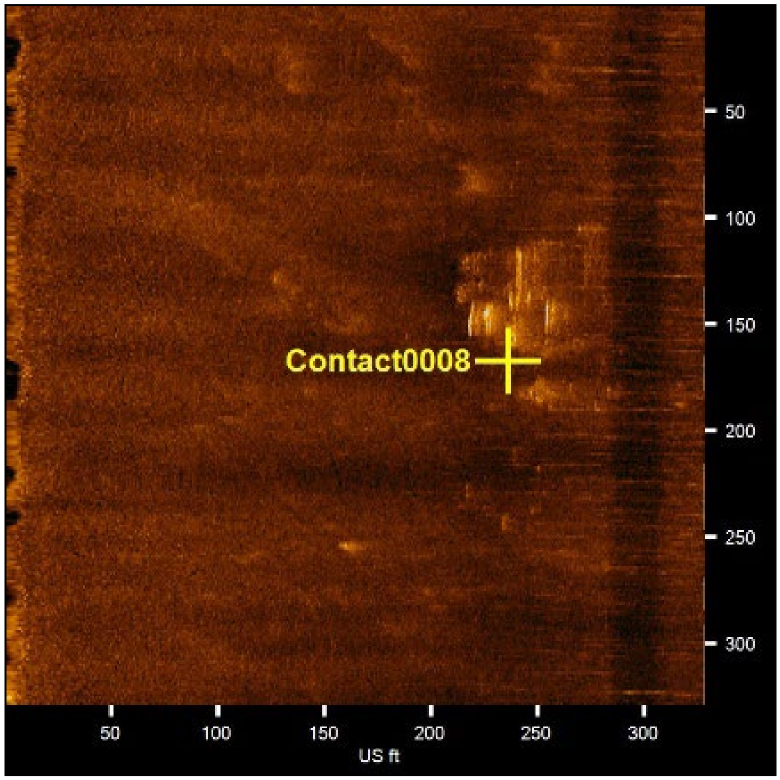

Figure 16. Side-scan sonar Contact 0008 correlates to 41AS119.

Assessment of Potential Significance

All magnetic anomalies and side-scan sonar targets documented within Area B1 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. Side-scan sonar Contact0008 represents a recorded shipwreck and a 50 meter avoidance zone around its location 125m northwest of the APE and buffer zone indicate it will not be affected by proposed project activities. The buffer zone will still need to be avoided by any project activities. No additional investigations are warranted for Area B1.

B2

Located northeast of Area B1, Beneficial Use Area B2 (Area B2) was successfully surveyed from October 19-20, 2021. Water depths in Area B2 ranged from 14 ft. nearshore to 25 ft. offshore.

Magnetometer

Analysis of the magnetometer data from Area B2 indicates a total of 14 magnetic anomalies within Area B2 (**Appendix G: Sheet 10**). Of these, nine (9) are located within the APE and five (5) are located within the buffer zone. Plotting the anomalies and contouring the data suggests eight (8) are isolated targets indicative of single-source ferrous metal objects (likely modern debris) and the remaining six (6) anomalies form three (3) clustered targets. While clustered targets have a higher potential to represent submerged cultural resources, review of the intensity (in nT), duration (in ft.), type (monopole, dipole, multicomponent) indicate the three clustered targets within Area B2 are likely debris. None of the magnetic anomalies retain characteristics of submerged cultural resources.

Side-scan Sonar

All side-scan sonar data collected within Area B2 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone **(Appendix F: Sheet 10**). No side-scan sonar contacts were documented within Area B2 or associated buffer zone.

Assessment of Potential Significance

All magnetic anomalies documented within Area B2 were assessed for potential significance relative to criteria outlined above. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. No side-scan sonar contacts were documented within the area. No additional investigations are warranted for Area B2.

B3

Beneficial Use Area B3 (Area B3) is located further up the coast from Area B2 and was successfully surveyed on October 20, 2021. Water depths in the area range from 15 ft. nearshore to 21 ft. offshore.

Magnetometer

A total of 18 magnetic anomalies were documented within Area B3 (**Appendix G: Sheet 11**). Of these eight (8) are isolated and the remaining 10 constitute five (5) clustered targets. All eight isolated targets are low in intensity (in nT) and are likely small, single-source ferrous metal objects likely modern debris.

Two clustered anomalies, composed of Targets M92/M94 and M115/M121, are low intensity and are also likely modern debris. Targets M97, M102, M112, M126 form another large, clustered anomaly that does not meet the criteria for a submerged cultural resource.

Review of the Texas GLO database for oil or gas wells do pinpoint two “Plugged and Abandoned” wellheads in the area. Nearby Magnetic Anomalies M93, M108, M118, and M120 also form a linear pattern extending northwest from this cluster suggesting the potential remains/debris of a removed pipeline. Review of the Railroad Commission of Texas (RRC) database does identify three wellheads in the general area but no associated pipelines.

Side-scan Sonar

All side-scan sonar data collected within Area B3 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 11**). No side-scan sonar contacts were documented within the area.

Assessment of Potential Significance

All magnetic anomalies documented within Area B3 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. No side-scan sonar contacts were documented within the area.

B4

Beneficial Use Area B4 (Area B4) is located further up the coast from Area B3 and was successfully surveyed on October 21, 2021. Water depths in the area range from 18 ft. to 24 ft. offshore.

Magnetometer

A total of 22 magnetic anomalies were documented within Area B4 (**Appendix G: Sheet 12**). After contouring the data, it is apparent that 13 are isolated with relatively low intensity (in nT) and likely represent single-source ferrous metal objects. None are considered potentially significant.

The remaining nine (9) anomalies constitute four (4) clustered targets. Review of the Texas GLO database for oil or gas wells does report two gas wells in proximity of Magnetic Target M103 and M114. Review of the RRC database also identifies one pipeline (No. 2351634) traversing the APE oriented almost due north/south. The other three clustered targets (comprised of M99/M109/M157, M137/M143, and M146/M156) are all low intensity anomalies that do not fulfill the criteria outlined above.

Side-scan Sonar

All side-scan sonar data collected within Area B4 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 12**). No side-scan sonar targets were documented within Area B4.

Assessment of Potential Significance

All magnetic anomalies documented within Area B4 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. No side-scan sonar contacts were documented within the area. No additional investigations are warranted for Area B4.

B5

Beneficial Use Area B5 (Area B5) is located further up the coast from Area B4 and was successfully surveyed on October 21, 2021. Water depths in the area range from 14 ft. inshore to 25 ft. offshore.

<u>Magnetometer</u>

Review of the magnetometer data identified a total of five (5) magnetic anomalies within Area B5 (**Appendix G: Sheet 13**). Once contoured and the anomalies plotted it is evident that all five anomalies are isolated indicating they are all single-source ferrous metal objects, likely debris. All are less than 10 gammas in intensity and have either monopole or dipole signatures. No multicomponent targets were documented in the area.

<u>Side-scan Sonar</u>

All side-scan sonar data collected within Area B5 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 13**). No side-scan sonar targets were documented within Area B5.

<u>Assessment of Potential Significance</u>

All magnetic anomalies documented within Area B5 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. No side-scan sonar targets were documented within Area B5. No additional investigations are warranted for Area B5.

B6

Beneficial Use Area B6 (Area B6) is located further up the coast from Area B5 and was successfully surveyed on October 21, 2021. Water depths in the area range from 15 ft. inshore to 24 ft. offshore.

<u>Magnetometer</u>

A total of 11 magnetic anomalies were documented within Area B6 (**Appendix G: Sheet 14**). Of these, three (3) are isolated and the remaining eight (8) constitute four (4) clustered targets. Review of the contours and magnetic anomalies do not reveal and submerged cultural resources and the magnetic anomalies are not considered potentially significant.

<u>Side-scan Sonar</u>

All side-scan sonar data collected within Area B6 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 14**). No side-scan sonar targets were documented within the area.

<u>Assessment of Potential Significance</u>

All magnetic anomalies documented within Area B6 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. No side-scan sonar contacts were documented within Area B6. No additional investigations are warranted for Area B6.

B7

Beneficial Use Area B7 (Area B7) is located southwest of the Corpus Christi Entrance Channel and was successfully surveyed on October 22, 2021. Water depths in the area range from 15 ft. nearshore to 22 ft. offshore.

Magnetometer

Once the magnetometer data was edited, analyzed, and contoured it is evident there are no magnetic anomalies within Area B7 (**Appendix G: Sheet 15**).

Side-scan Sonar

All side-scan sonar data collected within Area B7 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 15**). No side-scan sonar targets were documented within the area.

Assessment of Potential Significance

No magnetic anomalies or side-scan sonar contacts were documented within Area B7. No additional investigations are warranted for Area B7.

B8

Beneficial Use Area B8 (Area B8) is located southwest of Area B7 and was successfully surveyed on October 22, 2021. Water depths in the area range from 16 ft. nearshore to 26 ft. offshore.

Magnetometer

A total of four (4) magnetic anomalies were documented within Area B8 (**Appendix G: Sheet 16**). After contouring the data, it is apparent that Target M168 is isolated with relatively low intensity (in nT) and likely represents a single-source ferrous metal object.

The remaining three (3) anomalies (M166, M167, and M169) form one target in the southwest portion of Area B8. Review of the magnetic contour suggests the cluster is a linear target (i.e., wire rope, pipe) with a maximum intensity of 8.7 nT. Assessment of the contours suggest this target is likely to represent debris versus a potentially significant submerged cultural resource. None of the magnetic anomalies within Area B8 are considered potentially significant.

Side-scan Sonar

All side-scan sonar data collected within Area B8 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 16**). Only one side-scan sonar contact was documented during the survey of Area B8 (**Figure 17**). Contact0015 is approximately 52.55 ft. in length and 57.47 ft. in width (**Appendix F**). Close review of the contact suggests a cluster of objects within a scour area. Regardless of the identity of the object, plotting the contact indicates it is located outside the APE and 50-meter buffer zone and will not be affected by proposed project activities.

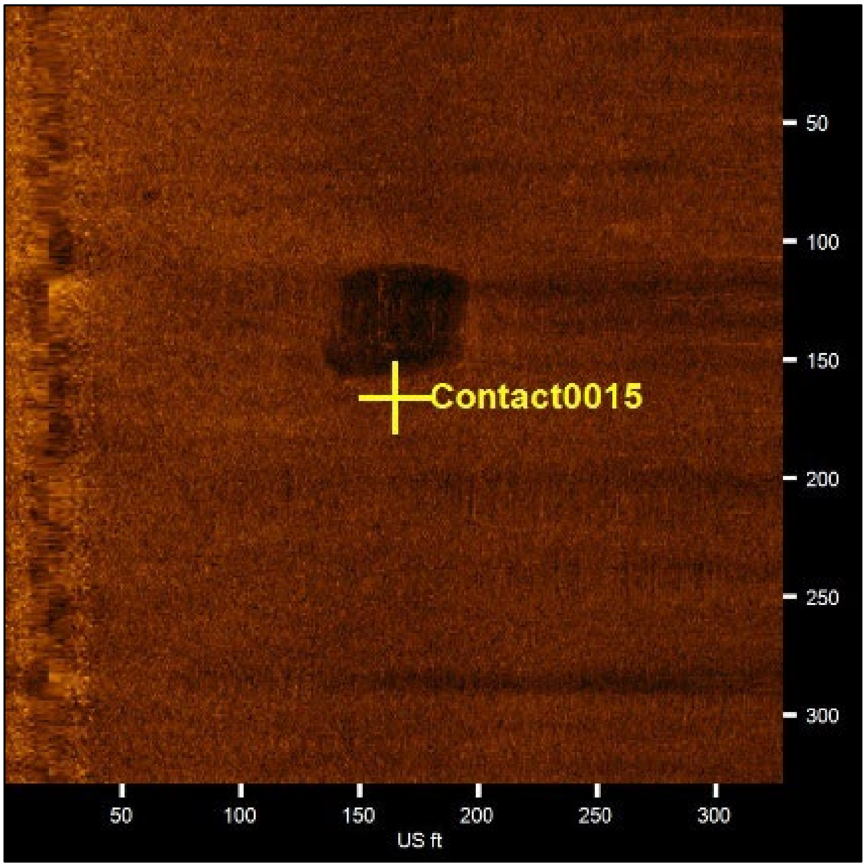

Figure 17. Side-scan sonar Conact0015 is located outside the APE and 50 m buffer zone and will not be affected by proposed project activities.

<u>Assessment of Potential Significance</u>

All magnetic anomalies and side-scan sonar contacts documented within Area B8 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. Although Side-scan sonar Contact0015 may represent a potential resource its location outside of the APE and buffer zone indicate it will not be affected by proposed project activities. No additional investigations are warranted for Area B8.

B9

Beneficial Use Area B9 (Area B9) is located southwest of Area B8 and was successfully surveyed on February 9, 2022. Water depths in the area range from 17 ft. nearshore to 26 ft. offshore.

Magnetometer

Results of the magnetometer survey documented a total of 37 anomalies within Area B9 (**Appendix G: Sheet 17**). It is evident from the contouring of the data as well as review of the Texas GLO and RRC databases that 36 of the anomalies are associated with oil/gas wells and associated pipelines. This includes two wells (No. 33443 and 1058892) which plot inside the APE as well as Pipelines 33507, 4207639, 4207640, 4207683, and 4207684 which enter into, or traverse, the APE. Only one anomaly, Target M185, is isolated and likely represents a small, single-source object.

Side-scan Sonar

All side-scan sonar data collected within Area B9 was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 50-meter buffer zone (**Appendix F: Sheet 17**). No side-scan sonar targets were documented within the area.

Assessment of Potential Significance

All magnetic anomalies documented within Area B9 were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. All anomalies appear to be associated with oil and gas activities in the area. No side-scan sonar contacts were documented within the area. No additional investigations are warranted for Area B9.

Existing Corpus Christi Ship Channel

The Existing Corpus Christi Ship Channel (CCSC) extends from Harbor Island offshore to just past the 3-mile limit. The APE includes all new cut areas for the CCSC as well as a 100 meter buffer zone. The previously dredged CCSC was not surveyed during the current investigation. The remote sensing survey of the CCSC was conducted during multiple mobilizations during October 2021, February 2022, and June 2022. Water depths averaged less than 5 ft. inshore to 46 ft. offshore.

Magnetometer

Review of the magnetometer data documented a total of 102 magnetic anomalies within the Existing CCSC (**Appendix G: Sheets 1-4**) After contouring of the magnetometer data each target was tabulated including location (easting/northing), peak-to-peak gamma deviation (in nanoteslas [nT]), duration (in feet), type (monopole, dipole, multi-component), association, and any additional notes (**Appendix G**).

Of the 102 magnetic anomalies 27 are isolated and were only recorded on one track line. These anomalies typically represent single-source ferrous metal objects. None of these isolated anomalies retain sufficient deviation, duration, or type indicative of a potentially significant submerged cultural resource. Additional sources of these isolated anomalies include transiting vessels, shoreline structures, and aids to navigation.

Assessment of clustered magnetic anomalies confirms the presence of two historic shipwrecks, the SS *Mary* (41NU252) and *Utina* (41NU264) within the CCSC. For a more detailed discussion of these wreck sites see the Assessment of Significance below.

None of the remaining clustered targets fulfill the criteria established above and are therefore not considered potentially significant submerged cultural resources. Careful review of previous investigations, available databases, background research, and correlated data sets also assisted in this determination

Side-Scan Sonar

All side-scan sonar data collected within the Existing CCSC was processed, analyzed, and mosaiced. The mosaic shows complete coverage of the APE and 100-meter buffer zone (**Appendix F: Sheets 1-4**). A total of 13 side-scan sonar targets were documented within Existing CCSC (See Contact Report in **Appendix F**). Review of the mosaic and contact report indicate the majority are consistent with debris, riprap, shoreline structures, and navigational aids common with an industrial port. All sonar contacts were ultimately cross referenced with the magnetometer data for a complete assessment of potential significance.

Four (4) side-scan sonar contacts are associated with the historic shipwrecks SS *Mary* (41NU252) and *Utina* (41NU264). Contacts 0007, 0009, and 0017 are associated with the SS *Mary* (41NU252) and Contact 0016 is associated with the *Utina* (41NU264).

Assessment of Significance

Review of the correlated remote sensing data as well as historical analysis, background information, previous investigations, available databases (including THC, NOAA AWOIS, etc.) indicate two historic shipwrecks within the Existing CCSC. This includes the SS *Mary* (41NU252) and *Utina* (41NU264). Both sites fulfill the criteria outlined above and are recommended for a 50-meter avoidance margin in accordance with Texas Administrative Code, Title 13, Part 2, Chapter 12, Rule §28.6.

SS *Mary*

For background research and previous investigations on the SS *Mary* refer to Section 3.0 "Overview of Known Cultural Resources in the Project Vicinity" of this report. A total of 8 magnetic anomalies recorded during the current investigation are associated with the SS *Mary* (**Table 8 and Appendix H**).

Table 8. Magnetic Anomalies Associated with the SS *Mary*.

[redacted]

Review of the magnetic contour map identifies a clustered target with high intensity (in nT) and duration as well as a complex contours indicative of a potentially significant submerged cultural resource (**Appendix H**). Recommendation includes a 50-meter avoidance zone around the magnetic anomalies reported in **Table 8** above and **Appendix H**.

Review of the side-scan sonar data also confirms exposed wreckage associated with the SS *Mary* (41NU252) (**Appendix H**). The historic wreck was documented on numerous passes with the side-scan sonar and includes Contact0007, 0009, and 0017 (**Table 9**).

Table 9. Side-scan Sonar Contacts Associated with the SS *Mary* (41NU252).

[redacted]

Publicly accessible multibeam bathymetry details multiple views of the SS *Mary* and its debris field lying roughly perpendicular to the existing CCSC ship channel (**Figures 18 and 19**).

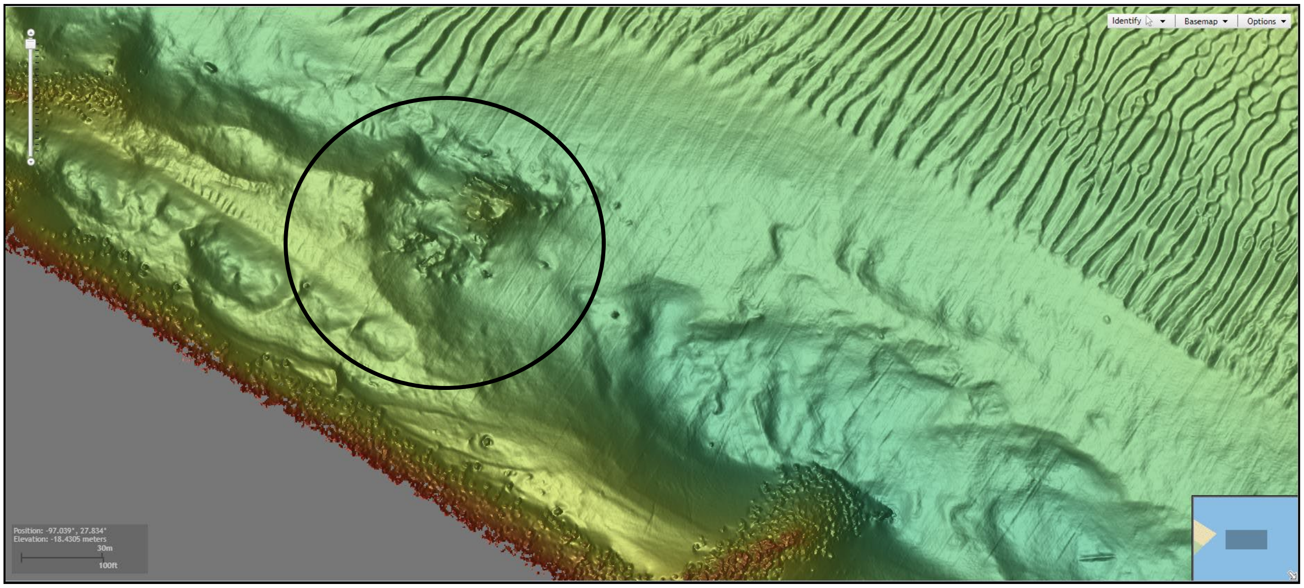

Figure 18. NOAA bathymetry data at *SS Mary* (https://www.ncei.noaa.gov/maps/bathymetry/, accessed 8/18/2022).

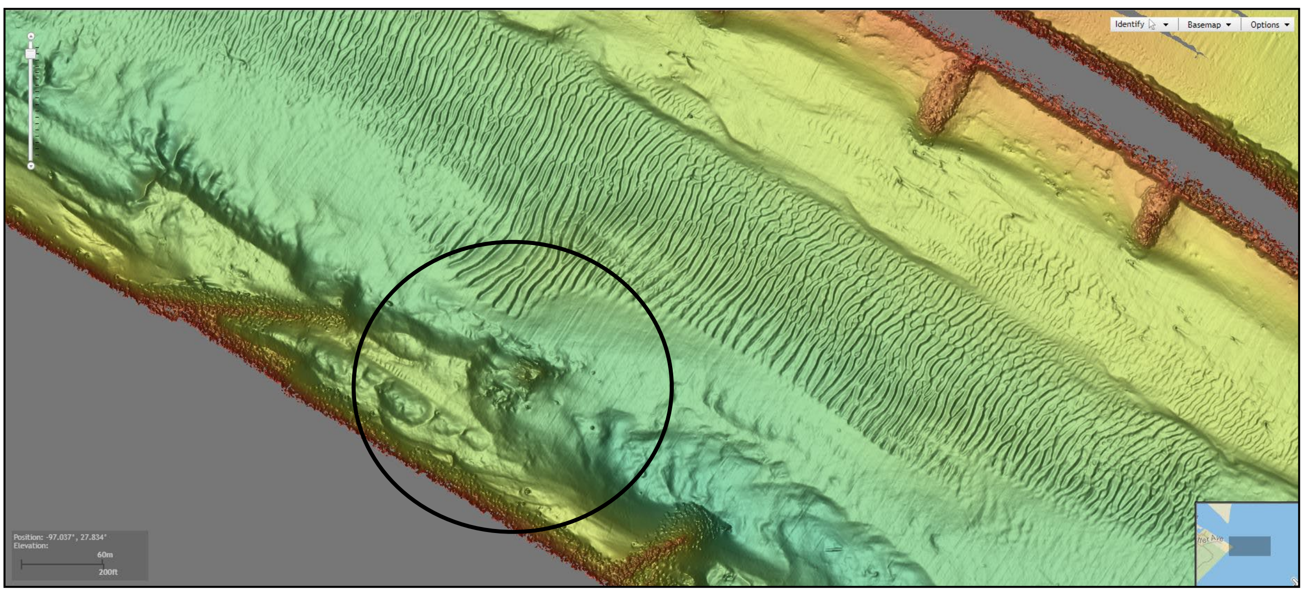

Figure 19. NOAA bathymetry data at *SS Mary* (https://www.ncei.noaa.gov/maps/bathymetry/, accessed 8/18/2022).

Utina

For background research and previous investigations relative to the *Utina* (41NU264) refer to Section 3.0 "Overview of Known Cultural Resources in the Project Vicinity" of this report. A total of four (4) magnetic anomalies are associated with the *Utina* (41NU264) (**Table 10 and Appendix H**).

Table 10. Magnetic Anomalies Associated with the *Utina* (41NU264).

[redacted]

Review of the magnetic contour map identifies a clustered target with high intensity (in nT) and duration as well as a complex contours indicative of a potentially significant submerged cultural resource (**Appendix H**).

One side-scan sonar image (Contact0016) of the *Utina* (41NU264) is presented in the Contact Report in **Appendix H** and **Table 11**. The image shows a large concentration of exposed debris associated with the wreck site (**Figure 20**). The side-scan sonar mosaic of the *Utina* (41NU264) is provided in **Appendix H**.

Table 11. Side-scan Sonar Contact Associated with the *Utina* (41NU264/41NU292).

[redacted]

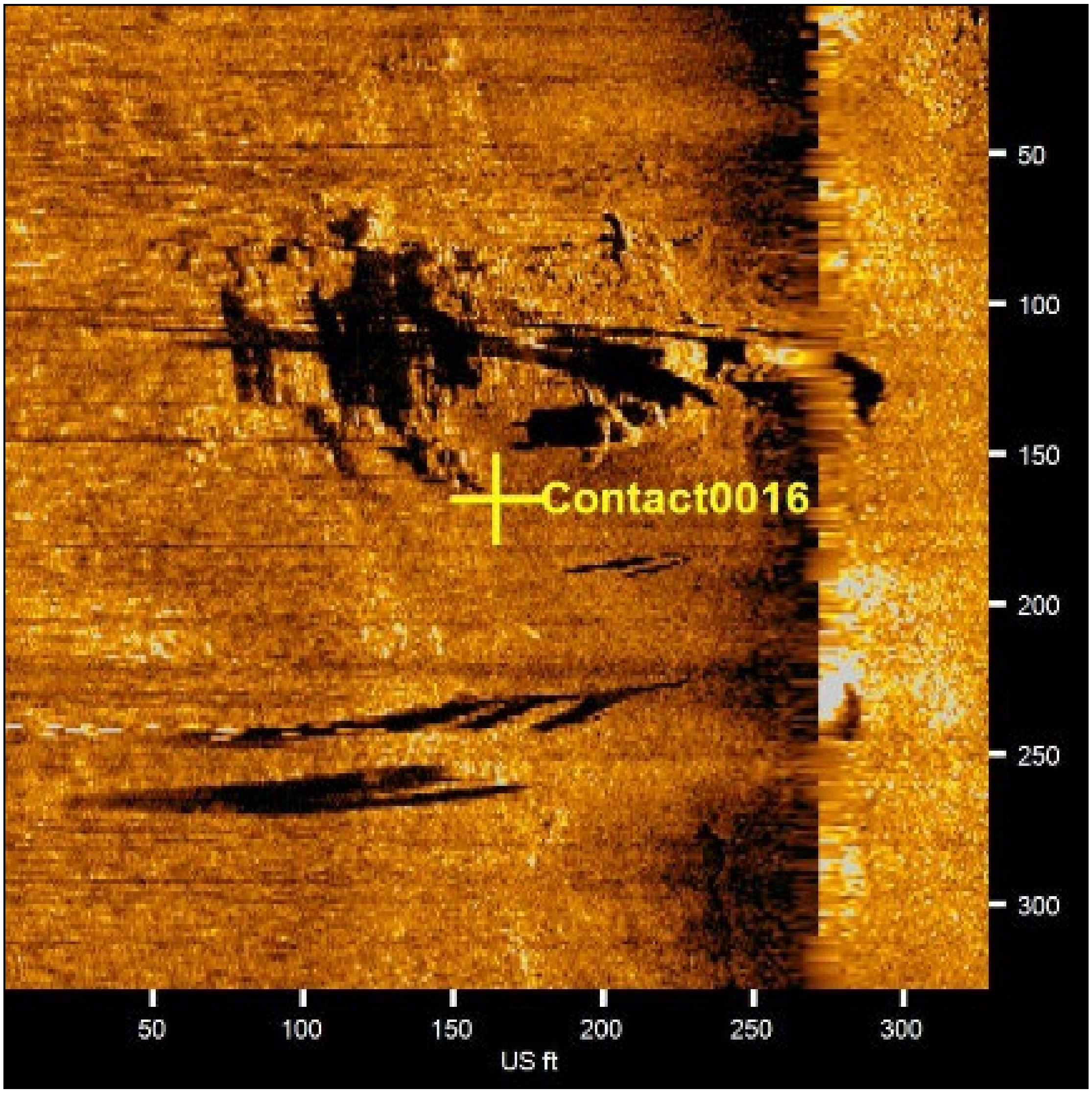

Figure 20. Side-scan sonar Contact0016 represents the remains of the *Utina* (41NU264).

Publicly accessible multibeam bathymetry details the *Utina* Site first identified as 41NU264 (just north of the south jetty) and the subsequent site 41NU292, which lies south of the CCSC APE south of the jetty (**Figure 21**).

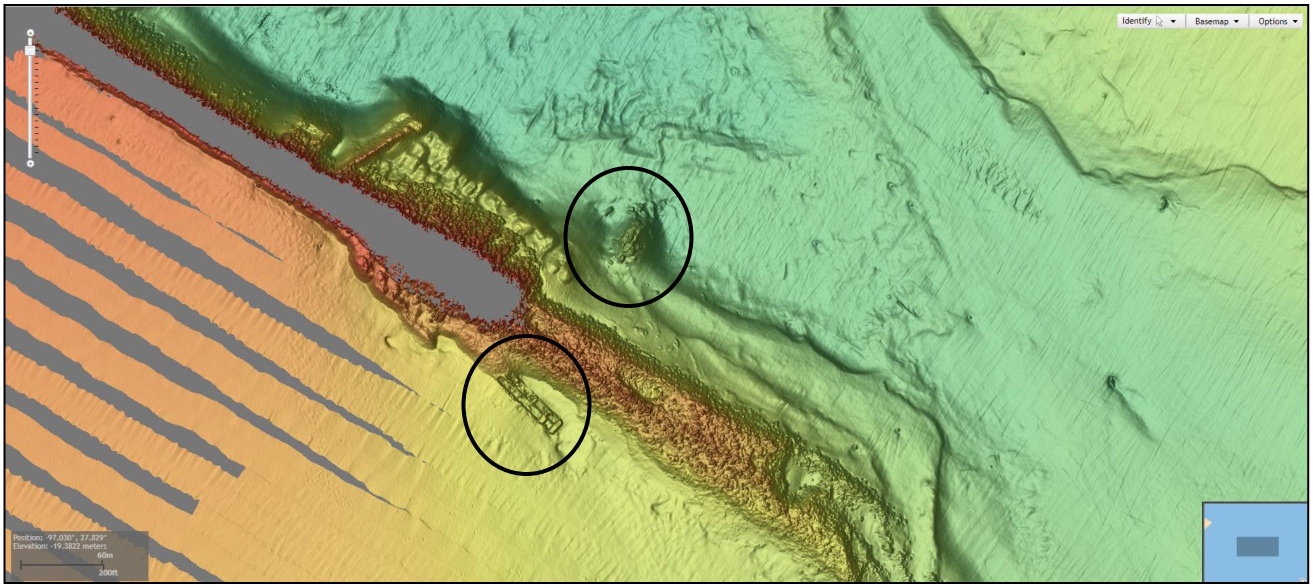

Figure 21. 41NU264 (north) and 41NU292 (south) at the end of the South jetty of the CCSC. (https://www.ncei.noaa.gov/maps/bathymetry/, accessed 8/18/2022).

Historical documentation and previous research list *Utina* at 281.5 feet in length overall with a 45-foot beam. The scatter at 41NU264 measures 134 ½ feet in length by 64 feet in width and was later thought to represent wreck debris from the *Utina*. While 41NU292 visible measurements are 201 ¾ feet in length by 41 feet in width, its shape is perhaps more rectangular than *Utina*'s hull, although only the lower portion of the hull may be visible. More fieldwork/diving would be needed to verify both sites. Therefore, recommendations includes a 50 meter avoidance zone around the magnetic anomalies associated with the *Utina* (41NU264 and 41NU292).

New Cut Area in the Corpus Christi Ship Channel from Station -330+00 to -620+00 offshore including a 200-meter buffer

The New Cut Area extends from the three-mile limit offshore approximately eight (8) miles. The APE includes the new cut for the Corpus Christi Ship Channel (CCSC) from Station -330+00 to -620+00 as well as a 200 meter buffer zone. The remote sensing survey of the New Cut was conducted during multiple mobilizations during October 2021, February 2022, and June 2022.

Magnetometer

Review of the magnetometer data documented a total of 41 magnetic anomalies within the Proposed Extension Channel (**Appendix G: Sheets 4-8**) After contouring of the magnetometer data each target was tabulated including location (easting/northing), peak-to-peak gamma deviation (in nanoteslas [nT]), duration (in feet), type (monopole, dipole, multi-component), status, and description (**Appendix G**).

Assessment of the magnetic anomalies suggests 28 are isolated, indicative of single-source ferrous metal objects. This is not uncommon in an approach to an active navigation channel such as the Corpus Christi Entrance Channel. None of the isolated anomalies are considered potentially significant for the purposes of this investigation.

The remaining 13 magnetic anomalies represent four (4) distinct clustered targets. A clustered target consists of two (2) or more magnetic anomalies recorded on adjacent track lines and have a higher potential to represent potentially significant submerged cultural resources.

Magnetic Targets M7, M200, M263, and M265 form one linear cluster within the proposed New Cut. Review of the magnetic signature(s) of the four anomalies suggests all have relatively low gamma values (the highest being M271 with 18.4 nT). Comparison with the side-scan sonar records indicate these targets may be associated with Contact0004 tentatively identified as fishing gear scour likely caused by commercial trawler activities in the area (**Figure 22**).

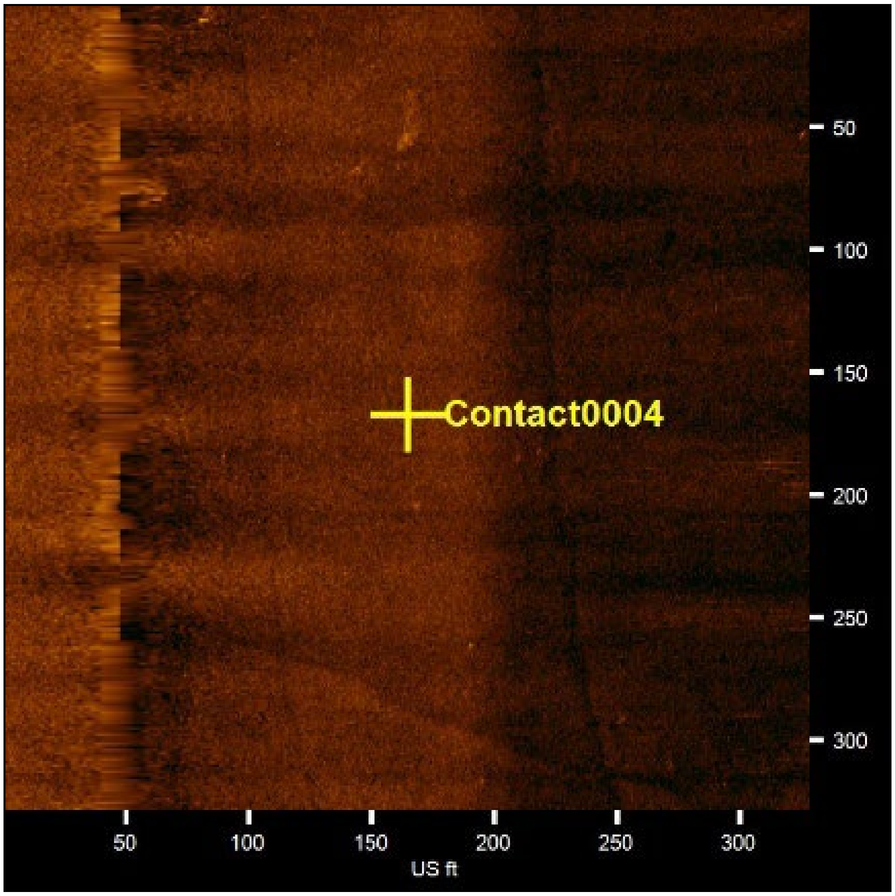

Figure 22. Side-scan sonar Contact0004 appears to be scour from commercial fishing activities in the area.

Review of the magnetic signatures of the four anomalies, the magnetic contours, and correlation with the Side-scan sonar Contact0004 suggest the cluster likely represents a linear object such as a wire rope. This target is not considered potentially significant for the purposes of this investigation.

The next cluster comprises of Magnetic Anomalies M252, M254, M255, and M257. Located near the center of the proposed New Cut this cluster is centered around Magnetic Target M255 which has an intensity of 10.7 nT. With no discernable dipolar signature, no negative (blue) pole, and a low gamma signature, it is likely this target represents a single-source ferrous metal object, likely debris. This target is not considered potentially significant for the purposes of this investigation.

Magnetic Anomalies M8 and M235 comprise of a third clustered target located near the center of the Proposed Extension Channel. Assessment of the target indicates Anomaly M8 has the highest gamma value at 14.3 nT. Review of the magnetic contours does not identify a negative (blue) pole to the north suggesting the target does not fulfill the parameters suggested above for submerged cultural resources.

Comparison of available databases indicates this target correlates with NOAA AWOIS Obstruction No. 4163 reported as two sunken buoys (**Figure 23**). It also should be noted the proximity of these two sunken buoys to the current red channel marker plotted on NOAA Raster Chart #1117A “Galveston to Rio Grande” as well as Magnetic Anomalies M198 and M285 (which plot at the location of the current navigation buoy).

[redacted]

Figure 23. Excerpt from the NOAA AWOIS Obstruction Database describing two sunken buoys at the location of Magnetic Anomalies M8 and M235.

Based on the magnetic signatures of M8 and M235, the magnetic contour map, and association with the NOAA AWOIS Record #4163 this target is not considered potentially significant and no additional work is recommended. Plotting of the side-scan sonar contacts indicates Contact0005 and Contact0018 are also associated with this target (**Figures 24 and 25**).

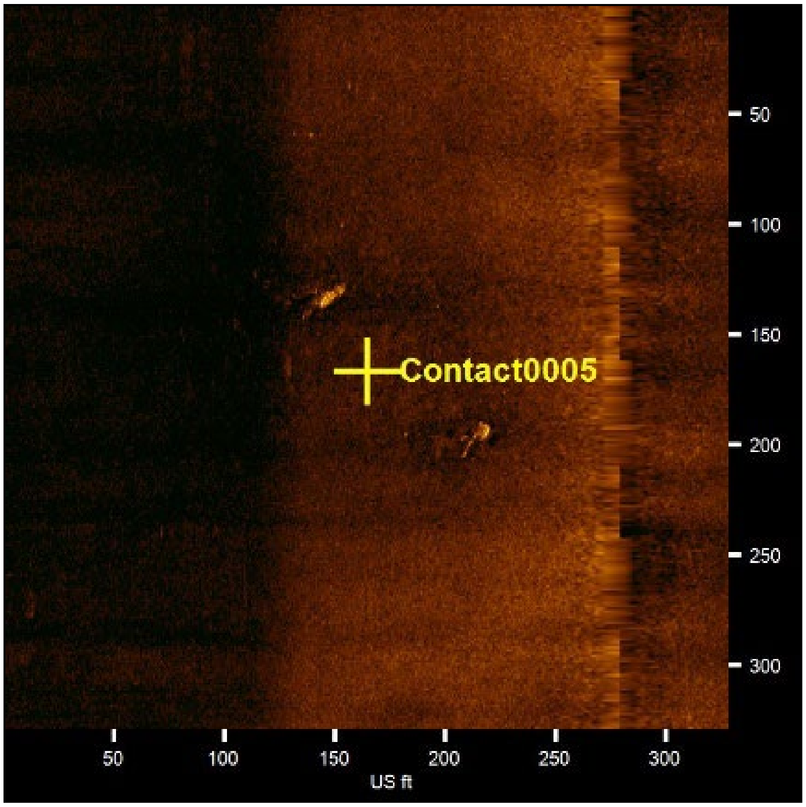

Figure 24. Side-scan sonar Contact0005 show apparent manmade debris consistent with NOAA AWOIS reports.

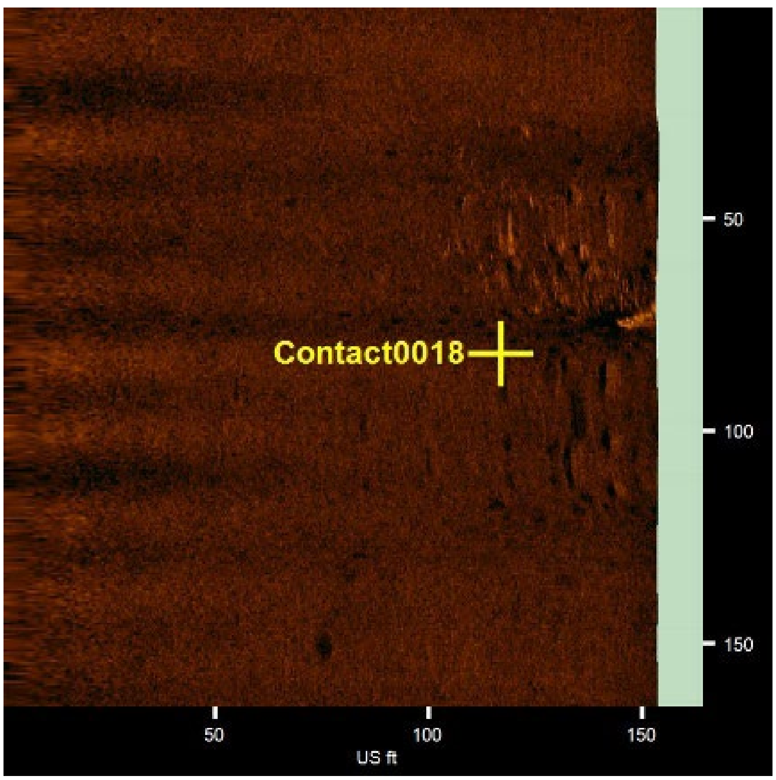

Figure 25. Side-scan sonar Contact00018 also shows debris on the seafloor.

Lastly Magnetic Anomalies M198 and M285 comprise the fourth cluster within the proposed New Cut. Plotting both targets on the current NOAA Raster Chart confirms both are associated with an existing channel marker (red) along the north side of the proposed channel.

<u>Side-scan Sonar</u>
Review of the side-scan sonar records indicate a total of four (4) contacts within the proposed New Cut. This includes Contact0004, 0005, 0018, and 0019. The location of these four contacts are presented in **Appendix F: Sheets 4-8**. Contact004, 0005, and 0018 were discussed above due to their association with magnetic anomalies. Location, description, measurements, and imagery of all side-scan sonar contacts discussed here are presented in **Appendix F**.

Only one contact, 0019, is not associated with a magnetic target indicating it likely has no associated ferrous metal **(Figure 26**).

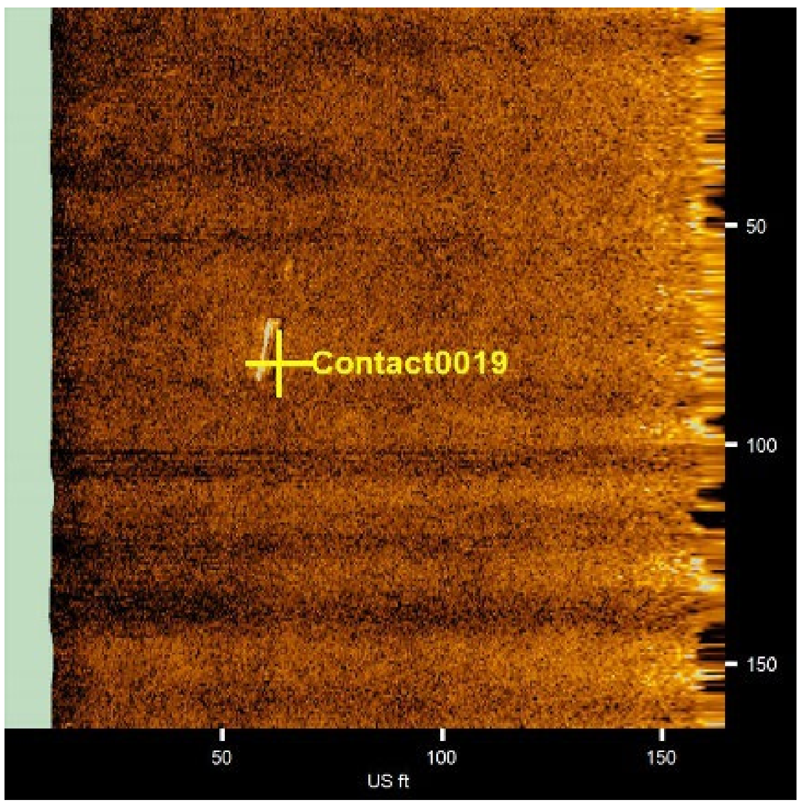

Figure 26. Side-scan sonar Contact0019 has no associated magnetic signature indicating it has no associated ferrous metal.

None of the four side-scan sonar contacts are considered potentially significant for the purposes of this investigation.

Assessment of Potential Significance

All magnetic anomalies and side-scan sonar contacts documented within the proposed New Cut were assessed for potential significance relative to criteria outlined within the Methods Chapter of this report. Review of the magnetic anomalies and analysis of the contour attributes suggest none of the targets are potentially significant. In addition, none of the side-scan sonar contacts documented are considered potentially significant. No additional investigations are warranted for the proposed New Cut.

7.0 Conclusions and Recommendations

The Port of Corpus Christi Authority (PCCA) sponsored marine and terrestrial cultural resources surveys in support of the development of a Draft Environmental Impact Statement (DEIS) for the PCCA's 75-foot Channel Deepening Project. The terrestrial work was conducted by Terracon Consultants, Inc. under Texas Antiquities Permit #30312, while the current marine investigation was conducted by RECON Offshore under Permit #30317. The work was conducted in compliance with Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). Conduct of fieldwork, report preparation, and records curation adhered to the minimum requirements presented in the Texas Administrative Code, Title 13, Part 2, Chapters 26 and 28. The PCCA has requested permit authorization (#SWG-2019-00067) from the US Army Corps of Engineers, Galveston District (USACE) to conduct dredge and fill activities related to the deepening of a portion of the Corpus Christi Ship Channel from Harbor Island into the Gulf of Mexico, covering 13.8 miles. The proposed project also involves the placement of dredged material into nine sand feeder berms offshore as well as on the beach at Mustang, San Jose and Harbor Islands.

Marine survey took place over three deployments due to weather and sea conditions from October 18-22, 2021, February 9-11, 2022 and June 17-21, 2022. The current investigation was conducted in accordance with 13 TAC 28.6. The primary goal of the Antiquities Code is to ensure that activities in Texas' submerged lands avoid damage to historic shipwrecks in said submerged lands and serve to "protect and preserve the cultural resources of Texas" (13 TAC 28.6(a)). The remote sensing survey included a magnetometer, side-scan sonar, single-beam echosounder, and integrated DGPS, and was designed and conducted to ensure coverage of the APE and buffer zones.

The purpose of the remote sensing survey was to determine the presence or absence of submerged cultural resources within the APE (and associated buffer zones). All magnetometer and side-scan sonar data were processed, analyzed, and assessed for potential significance. More specifically, each magnetic target signature was examined individually, including total gamma deviation, duration, type (monopole, dipole, and multicomponent), and correlation with other magnetic anomalies and side-scan sonar returns. All magnetometer data was contoured and compared to a modeling approach outlined in the Methods section above to assess potential significance. All contoured anomalies that correlated with the model were examined more closely for significance. In addition to the magnetometer data, all side-scan sonar data was processed and mosaiced, and individual returns were reviewed for potential significance. This included targets with corresponding linear features, retained height (exposure) off the seafloor, and associated magnetic anomalies.

Two hundred eighty-one (281) magnetic anomalies and nineteen (19) side-scan sonar contacts were documented during the current marine investigation. Of these eight (8) magnetic anomalies and three (3) side-scan sonar contacts are associated with a known wreck site 41NU252, the SS *Mary*, four (4) magnetic anomalies and one (1) side-scan sonar contact are associated with another wreck the *Utina*, 41NU264 and 41NU292 and one (1) side-scan sonar contact buffer is associated with 41AS119 (**Table 12**). Per Texas State Code these anomalies need to be avoided by all project activities by a margin of 50 meters from the outer magnetic contours (see **Appendix H**).

Table 12. Anomalies and Contacts Recommended for Avoidance.

[redacted]

[redacted]

Avoidance buffers for *Mary* and *Utina* have been coordinated in agreements between the Texas Historical Commission, US Army Corps of Engineers, Galveston District and the Port of Corpus Christi Authority. Normal avoidance buffers extend into the existing shipping channel and have been modified not to extend past the top of the channel cut. Avoidance of the potentially significant targets is the preferred method of preservation and should be the primary alternative discussed by applicable agencies. If avoidance is not feasible during the deepening project further documentation would be required to complete National Register of Historic Places (NRHP) eligibility for *Utina* and 41AS119 as *Mary* has already been determined to be eligible for listing on the NRHP and is listed as a State Archaeological Landmark (SAL).

To be considered significant and eligible for nomination to the NRHP the properties must meet one of the four National Register criteria:

A. Be associated with events that have made a significant contribution to the broad pattern of our history; or
B. Be associated with the lives of persons significant in our past; or
C. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D. Yield, or likely to yield, information important in prehistory or history [National Park Service 1985:5-6]

NRHP documentation involves full archival and historical research on both sites to document the vessels from building through wrecking. NRHP nominations could be drafted and submitted through the THC.

A Memorandum of Agreement (MOA), executed in 2018, exists between all parties (THC, USACE and PCCA) that details the next steps for 41NU252 (*SS Mary*) if full avoidance is not possible (**Appendix I**). The MOA includes another remote sensing survey of the site to include further side scan sonar and multibeam echosounder survey, interactive educational materials for children ages 3 to 12, digital educational material, an educational poster and public and professional outreach. A Post-Review Discoveries clause also exists detailing the procedures for artifacts/remains if discovered during dredging activities.

The current investigation's review of the side scan sonar and publicly accessible multibeam echosounder bathymetry data place the visible remains of the *SS Mary* south of the current Corpus Christi ship channel (see **Appendix H**). The magnetic contour map places the center of the dipole anomaly south of the current ship channel as well, suggesting the bulk of the remains lie south of existing channel. There is a possibility of buried remains that are not visible and the avoidance margins will need to be adhered to for any activities at or near 41NU252 that may lie at or near the existing channel.

The site of 41NU264/41NU292, *Utina*, lies south of the proposed project and the site of 41AS119 lies west of any planned activities. Both sites will be avoided by all proposed project activities. If it is determined that any of the sites cannot be avoided by dredging operations a determination of adverse impacts to the sites must be made by applicable agencies followed by additional investigations to mitigate these adverse effects. Additional investigations may include archival research, data recovery in the form of vessel removal, and recordation, archaeological monitoring, conservation and curation of artifacts, disposition of artifacts, followed by a comprehensive report of findings/public outreach.

There are examples of NRHP-eligible vessels deemed unavoidable and subsequently removed. One example includes the U.S.S. *Westfield*. The U.S.S. *Westfield* was a double-ended ferry boat that served as a flagship for the West Gulf Blockading Squadron during the Civil War. The vessel ran aground in 1863 during the Battle of Galveston and was blown up to avoid capture by Confederates. Unable to avoid the wreck the USACE conducted a recovery in 2009 resulting in over 8,000 artifacts being recovered (Borgens et al. 2015: Volume 1-2).

Another example includes the 2001 recordation, recovery, and redeposition of the *Manuela*, an iron-hulled shipwreck site located in the entrance to San Juan Harbor, Puerto Rico. The *Manuela* was scuttled in the entrance to San Juan Harbor during the Spanish-American War. Considered eligible for the NRHP the USACE initiated data recovery of the site to mitigate adverse effects from navigational improvements. Methodologies included utilizing archaeological divers to record and tag exposed portions of the wreckage followed by the removal of and recordation of all hull components and associated artifacts. Recordation on dry land allowed for an immense amount of data recovery in a relatively short period of time. Lastly the hull remains were redeposited offshore and now serve as an artificial reef and as a resource for recreational divers (James et al. 2003).

The C.S.S. *Georgia* is another example of an NRHP-listed shipwreck that was located within the Savannah Harbor Expansion Project and was subsequently removed. Proposed deepening of the Savannah River Channel would adversely affect the C.S.S. *Georgia* so to mitigate the adverse impacts the site was excavated by archaeologists and all vessel remains and artifacts were subsequently recovered (https://www.sas.usace.army.mil/Missions/Civil-Works/Savannah-Harbor-Expansion/CSS-Georgia/, accessed 26 August 2022).

Should unanticipated discoveries occur during the current investigation for any site other than 41NU252 (this work is covered under the MOA in **Appendix I**), work should cease or move until consultation with the PCCA and THC can be conducted under the basic Unanticipated Discoveries Plan included as **Appendix J**. A site revisit form will be submitted for updated positional information for 41NU264/41NU292.

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Appendix A: Texas Antiquities Permit #30317

State of Texas

TEXAS ANTIQUITIES COMMITTEE

Archeology Permit # 30317

This permit is issued by the Texas Historical Commission, hereafter referred to as the Commission, represented herein by and through its duly authorized and empowered representatives.The Commission, under authority of the Texas Natural Resources Code, Title 9, Chapter 191, and subject to the conditions hereinafter set forth, grants this permit for:

Underwater Survey

To be performed on a potential or designated landmark or other public land known as:
Title: Marine Archaeological Investigations Port of Corpus Christi's (PCCA's) Ship Channel 75' Channel Deepening Project
County: Aransas
Location: Aransas Pass, Gulf of Mexico

Owned or Controlled by: (hereafter known as the Permittee):
Texas General Land Office
1700 N. Congress Ave., Ste 935
Austin, TX 78701

Sponsored by (hereafter known as the Sponsor):
Port of Corpus Christi Authority
222 Power Street
Corpus Christi, TX 78401

The Principal Investigator/Investigation Firm representing the Owner or Sponsor is:
Jason Burns
RECON Offshore
3240 rothschild drive
pensacola, FL 32503

This permit is to be in effect for a period of:
0 Years and 12 Months

And will expire on:
9/15/2022

During the preservation, analysis, and preparation of a final report or until further notice by the Commission, artifacts, field notes, and other data gathered during the investigation will be kept temporarily at:
Terracon Consultants, Inc.

Upon completion of the final permit report, the same artifacts, field notes, and other data will be placed in a permanent curatorial repository at:
Center for Archaeological Research

Scope of Work under this permit shall consist of:
An underwater archeological survey that meets or exceeds requirements in the Texas Administrative Code, Title 13, Chapter 28, Rule §28.6. Instrumentation for underwater geophysical remote-sensing surveys includes, but is not limited to, a marine magnetometer, side-scan sonar, recording fathometer, and positioning systems. Underwater survey permits may include ground-truthing of archeological sites and remote-sensing targets through diver examination and probing of buried cultural resources. Limited removal of sediment overburden to expose a small section of a buried object is permissible. For details, see scope of work submitted with permit application.

This permit is granted on the following terms and conditions:

1. This project must be carried out in such a manner that the maximum amount of historic, scientific, archeological, and educational information will be recovered and preserved and must include the scientific, techniques for recovery, recording, preservation and analysis commonly used in archeological investigations.All survey level investigations must follow the state survey standards and the THC survey requirements established with the projects sponsor(s).
2. The Principal Investigator / Investigation Firm, serving for the Owner/ Permittee and / or the Project Sponsor, is responsible for insuring that specimens, samples, artifacts, materials and records that are collected as a result of this permit are appropriately cleaned, and cataloged for curation.These tasks will be accomplished at no charge to the Commission, and all specimens, artifacts, materials, samples, and original field notes, maps, drawings, and photographs resulting from the investigations remain the property of the State of Texas, or its political subdivision, and must be curated at a certified repository.Verification of curation by the repository is also required, and duplicate copies of any requested records shall be furnished to the Commission before any permit will be considered complete.
3. The Principal Investigator / Investigation Firm serving for the Owner/ Permittee, and / or the Project Sponsor is responsible for the publication of results of the investigations in a thorough technical report containing relevant descriptions, maps, documents, drawings, and photographs.A draft copy of the report must be submitted to the Commission for review and approval.Any changes to the draft report requested by the Commission must be made or addressed in the report, or under separate written response to the Commission.Once a draft has been approved by the Commission, one(1) printed, unbound copy of the final report containing at least one map with the plotted location of any and all sites recorded and two copies of the report in tagged PDF format on an archival quality CD or DVD shall be furnished to the commission.One copy must include the plotted location of any and all sites recorded and the other should not include the site location data.A paper copy and an electronic copy of the completed Abstracts in Texas Contract Archeology Summary Form must also be submitted with the final report to the Commission. (Printed copies of forms are available from the Commission or also online at www.thc.state.tx.us.)
4. If the Owner / Permittee, Project Sponsor or Principal Investigator / Investigation Firm fails to comply with any of the Commission's Rules of Practice and Procedure or with any of the specific terms of this permit, or fails to properly conduct or complete this project within the allotted time, the permit will fall into default status.A notification of Default status shall be sent to the Principal Investigator/ Investigation Firm, and the Principal Investigator will not be eligible to be issued any new permits until such time that the conditions of this permit are complete or, if applicable, extended.
5. The Owner/ Permittee, Project Sponsor, and Principal Investigator/ Investigation Firm, in the conduct of the activities hereby authorizes, must comply with all laws, ordinances and regulations of the State of Texas and of its political subdivisions including, but not limited to, the Antiquities Code of Texas; they must conduct the investigation in such a manner as to afford protection to the rights of any and all lessees or easement holders or other persons having an interest in the property and they must return the property to its original condition insofar as possible, to leave it in a state which will not create hazard to life nor contribute to the deterioration of the site or adjacent lands by natural forces.
6. Any duly authorized and empowered representative of the Commission may, at any time, visit the site to inspect the fieldwork as well as the field records, materials, and specimens being recovered.
7. For reasons of site security associated with historical resources, the Project Sponsor(if not the Owner/ Permittee), Principal Investigator, Owner, and Investigation Firm shall not issue any press releases, or divulge to the news media, either directly or indirectly, information regarding the specific location of, or other information that might endanger those resources, or their associated artifacts without first consulting with the Commission, and the State agency or political subdivision of the State that owns or controls the land where the resource has been discovered.
8. This permit may not be assigned by the Principal Investigator/ Investigation Firm, Owner / Permittee, or Project Sponsor in whole, or in part to any other individual, organization, or corporation not specifically mentioned in this permit without the written consent of the Commission.
9. Hold Harmless: The Owner/ Permittee hereby expressly releases the State and agrees that Owner / Permittee will hold harmless, indemnify, and defend(including reasonable attorney's fees and cost of litigation) the State, its officers, agents, and employees in their official and/or individual capacities from every liability, loss, or claim for damages to persons or property, direct or indirect of whatsoever nature arising out of, or in any way connected with, any of the activities covered under this permit.The provisions of this paragraph are solely for the benefit of the State and the Texas Historical Commission and are not intended to create or grant any rights, contractual or otherwise, to any other person or entity.
10. Addendum: The Owner/Permittee, Project Sponsor and Principal Investigator/Investigation Firm must abide by any addenda hereto attached.

Upon a finding that it is in the best interest of the State, this permit is issued on 9/15/2021

Mark Wolfe

Brad Jones,
Archeology Division Director

Mark Wolfe,
Executive Director

Appendix B: NOAA AWOIS/NOAA ENC

AWOIS/ENC

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent	Position Quality	Position Source	History
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AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
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AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
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AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
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AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
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AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent	Position Quality	Position Source	History

[redacted]

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent (<250 m))	Position Quality	Position Source	History
[redacted]							

AWOIS Record	Type	Latitude (decimal degrees)	Longitude (decimal degrees)	Proximity to APE (Within APE, Adjacent	Position Quality	Position Source	History

[redacted]

Appendix C: Port of Corpus Christi Scope of Work – Marine Survey

G. **Assumptions**

- The client will secure all necessary rights-of-entry for the field surveys. CONTRACTOR requests copies of request for access letters and a list of property owners.

- No coordination with Federally recognized Tribes will be performed as part of this scope.

- No deep mechanical trenching (e.g., backhoe trenching) will be required.

- Any additional cultural resource investigations that may be required by the THC, including but not limited to additional survey, deep mechanical testing, site testing, data recovery, or monitoring, are not covered by this work plan but can be provided as an additional service under a separate scope ofwork

- No artifacts would be collected; only records will require curation.

7.02 Scope of Work – MARINE SURVEY

Phase I Maritime Archaeological Survey for the Port of Corpus Christi Authority's Ship Channel Improvement Project and Entrance Channel Extension Aransas and Nueces Counties, Texas.

A. **Project Description**

The Port of Corpus Christi Authority (PCCA) is proposing to conduct dredge and fill activities related to deepening a portion of the existing Corpus Christi Ship Channel (CCSC) in Nueces County, Texas (Figure 1).The PCCA is requesting that the U.S. Army Corps of Engineers (USACE) – Galveston District authorize this activity by issuing a permit to dredge along a roughly 13.8-mile corridor from Harbor Island into the Gulf of Mexico (Station 110+00—Station 620+00). If the project is approved, the dredged fill would be placed in beneficial use areas in the vicinity. This Phase I Marine Archaeological Scope of Work (SOW) is being submitted as part of the PCCA's permitting process. The USACE currently authorizes the CCSC to project depths of –54 feet and –56 feet mean lower low water (MLLW) from Station 110+00 to Station –330+00 as part of the Corpus Christi Ship Channel Improvement Project (CCSCIP).

The CCSC's current authorized width is 600 feet inside the jetties and 700 feet in the entrance channel. The proposed project would deepen the channel from Station 110+00 to Station –72+50 to a maximum depth of –79 feet MLLW (–75 feet MLLW plus two feet of advanced maintenance and two feet of allowable over dredge), and from Station -72+50 to Station –330+00, the channel would be deepened to a maximumdepth of –81 feet MLLW (–77 feet MLLW plus two feet of advanced maintenance and two feet of allowable over dredge). The proposed project includes a 29,000-foot extension of the CCSC from Station –330+00 to Station –620+00 to a maximum depth of –81 MLLW (–77 feet MLLW plus two feet of advancedmaintenance and two feet of allowable over dredge) to reach the

–80-foot MLLW bathymetric contour in the Gulf of Mexico. The deepening activities will be completed within the footprint of the authorized CCSC channel width (Figure 1). The proposed project does not include widening the channel; however, some minor incidental widening of the channel slopes is expected to meet side slope requirements and to maintain channel stability.

This work plan addresses the enumerated survey areas (Figure 1), that consist of:

- Beach Nourishment areas located along San José Island and Mustang Island (SJI and MI),
- Feeder Berms (B1 – B9),
- All new cut areas in the CCSC from station –330+00 to –620+00,
- All existing CCSC including a 100-meter (328-foot) buffer within the 3-mile limit (regardless of previous survey coverage), and
- All existing CCSC including a 200-meter (656-foot) buffer, outside the 3-mile limit that have not been previously archaeologically surveyed.

The USACE-Galveston District is permitting this project through Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. As such, the project is subject to review under Section 106 of the National Historic Preservation Act of 1966, as amended. Additionally, the project includes dredging and other impacts on submerged tracts owned by a political subdivision of the State of Texas (the Texas General Land Office [GLO]), making it subject to state-level archeological resource regulatory oversight outlined in the Antiquities Code of Texas (ACT).

The survey approach outlined in this Work Plan is designed to assure that the CCSC complies with Section 106 of the National Historic Preservation Act of 1966 (PL 89-665, 54 U.S.C. 300101 et seq.), as amended; the Archaeological and Historic Preservation Act of 1974 (PL 93- 291), as amended; the Abandoned Shipwreck Act of 1987; and implementing regulations Title 36 Code of Federal Regulations, Parts 60-66 and 800, as appropriate. The survey approach has also been designed for ACT compliance under Texas Administrative Code (TAC) Title 13 Part 2 Chapter 28 Rule §28.6 Conduct of Activities (Rule §28.6).

B. Methodology

This survey is comprised of 17 discrete nearshore and offshore seafloor segments with fieldwork designed to comply with Rule §28.6, including equipment used and survey transect spacing. In addition, the Corps of Engineers' Standards for Hydrographic Surveying will be followed where appropriate. The survey will follow "Other General Surveys and Studies (Coastal Engineering Surveys)" specifications according to USACOE manual No. 1110-2-1003. Quality control and quality assurance (QA/QC) procedures as presented in the manual are followed where applicable. Upon the completion of the basic survey transects, if deemed necessary, surveyors will return to target locations of interest to collect higher- resolution and higher precision compositional and locational information through supplemental close- order survey transects.

The remote sensing work proposed for this project will be conducted under the supervision of a marine archaeologist that meets the Secretary of Interior's professional qualifications as promulgated in the Code of Federal Regulations, 36 CFR Part 61.

C. **Background Review**

Prior to any fieldwork, CONTRACTOR will perform an online search of site files, records, and maps available on the THC's Texas Archeological Sites Atlas and Texas Historic Sites Atlas. These databases will be consulted in order to obtain all available information regarding previous surveys, previously recorded archaeological sites, shipwrecks, National Register of Historic Places (NRHP) properties, State AntiquitiesLandmarks (SALs), Historical Markers, Registered Texas Historic Landmarks, and cemeteries within 1,000 meters (3,280 feet) of the APE. Additionally, prior disturbances and the natural geologic and pedologic conditions will be evaluated for their potential to affect the integrity of any archaeological sites that maybe present within the APE.

D. **Antiquities Permit Application**

The investigations proposed herein will require a Texas Antiquities Permit issued by the THC.

Upon Notice to Proceed (NTP), a Texas Antiquities Permit application and research design will be prepared and submitted to the THC in order to obtain an Antiquities Permit so that field investigations may be conducted. All field investigations will be conducted under the supervision.

E. **Marine Archaeological Cultural Resource Survey Methodology**

Once an Antiquities Permit has been issued, the CONTRACTOR will begin field survey. Survey crews will simultaneously collect side scan sonar, magnetometer, and single-beam echosounder datasets along linear transects within 100% of the areas defined above. Within three nautical miles of the shoreline, survey transects will be spaced 20 meters apart. Transects will be 30 meters apart beyond that three- nautical-mile line. Survey methodology specifics are summarized below.

F. **Control**

Horizontal control will be obtained using Differential Global Positioning Systems (DGPS) where appropriate. Surveys near shore or in the vicinity of structures may be supplemented with Real-Time Kinematic GPS (GPS-RTK). Vertical control will be verified using GPS-RTK or static methods. All checks arecompleted using published National Oceanographic and Atmospheric Administration National Geodetic Survey (NOAA-NGS) control points and/or USACE's local control points. Horizontal Datum for this project is North American Datum of 1983 (NAD), projection is Texas South Zone (4205).

G. **Tides and Tidal Datums**

Tides will be monitored using local NOAA tide gauges, specific site gauges, and GPS-RTK where appropriate. When GPS-RTK tides are utilized a local base will be established near the site. The referencedatum for this project is NAVD88 and MLLW (Mean Lower Low Water). Collected GPS data will populate transect lines to be depicted (as needed) on dataset results maps.

H. **Magnetic Survey**

A magnetometer will be utilized to identify the horizontal location and magnetic signature of contacts in the area. Transect spacing is set to comply with Title 13 Part 2 Chapter 28 Rule §28.6. The magnetometerwill be towed behind the survey vessel at a minimum of 100 feet (30 meters) to eliminate magnetic interference from the vessel. The data will be processed for a gamma contour map and anomaly report. The magnetometer will be towed within 20 feet of the sea floor at all times during the survey. Magnetometer data will be collected to a depth of –2.0 feet NAVD 88 in inshore areas. In offshore areas,magnetometer data will be collected to the back of the surf zone. Work in the surf zone is not part of thisSOW. No terrestrial magnetometer work is proposed for the emergent portions of the project.

I. **Side Scan Sonar**

A side scan sonar survey will provide complete acoustic coverage in the survey area. Transect lines will beestablished to provide 200% bottom coverage and run with a range setting to provide overlap of the adjacent line's nadir. Data collected will be processed using Chesapeake Software and a geo-referenced tiff format image produced. A report will be produced listing close up images and the sizes of contacts. Side scan sonar data will be collected to a depth of –2.0 feet NAVD 88 in inshore areas. In offshore areas,side scan sonar data will be collected to the back of the surf zone. Work in the surf zone is not part of this SOW.

J. **Single-beam Bathymetry**

A single-beam echo sounder is utilized to measure precise depths throughout the area. Transects are setto coincide with side scan sonar and magnetometer surveys. The speed of sound in water will be calculatedor measured and the echo sounder calibration, including bar check, will be verified using manual lead-line measurements on site. The data will be reduced to a spacing of 10 feet along transects. When GPS-RTK isutilized for positioning, tide, and/or heave, surveyors will calculate positional corrections using a local basestation established near the site. No RTK topographic surveys are proposed for this survey. It is anticipatedthat in inshore survey areas the survey vessel will record bathymetry to wading depth (approximately –2.0 feet NAVD 88). In areas such as M4, the airboat will collect bathymetry to –0.5 feet NAVD 88. In offshore survey areas, bathymetry will be collected to the back of the surf zone. Work in the surf zone is not part of this SOW.

K. **Proposed Equipment**

The equipment array will consist of the following instruments:

GPS-RTK – Hemisphere S320,Trimble R8, R10, or Emlid Reach RS2

DGPS – Trimble R8, Hemisphere V111, V131

Echo Sounder – Knudsen, Odom, or equivalent at 200kHz

Side Scan Sonar – Edgetech 4200 100/400 kHz or equivalent

Magnetometer – Geometrics G882 or equivalent

All settings, ranges, and recordings will comport with Title 13 Part 2 Chapter 28 Rule §28.6.

L. **ANALYSIS AND REPORTING**

Archaeologists will review, process, interpret, and present magnetic and acoustic data in accordance with Texas Administrative Code (Rule §28.9), governing analysis and presentation of data. In addition, archeologists will assess the significance of any identified cultural resources. This will include an assessment of a resource's eligibility for listing on the National Register of Historic Places (NRHP) or as a State Antiquities Landmark (SAL) to the extent possible through standard and/or close-order field surveyalone. Following survey, archaeologists will write a draft report that presents the background, methods, and results of this investigation and it will contain appendices that will include an inventory of remote sensing anomalies, and project correspondence with review agencies.

M. **CURATION**

No material culture will be collected during the Phase I marine cultural resource survey and permanent project curation is not proposed.

N. **ASSUMPTIONS**

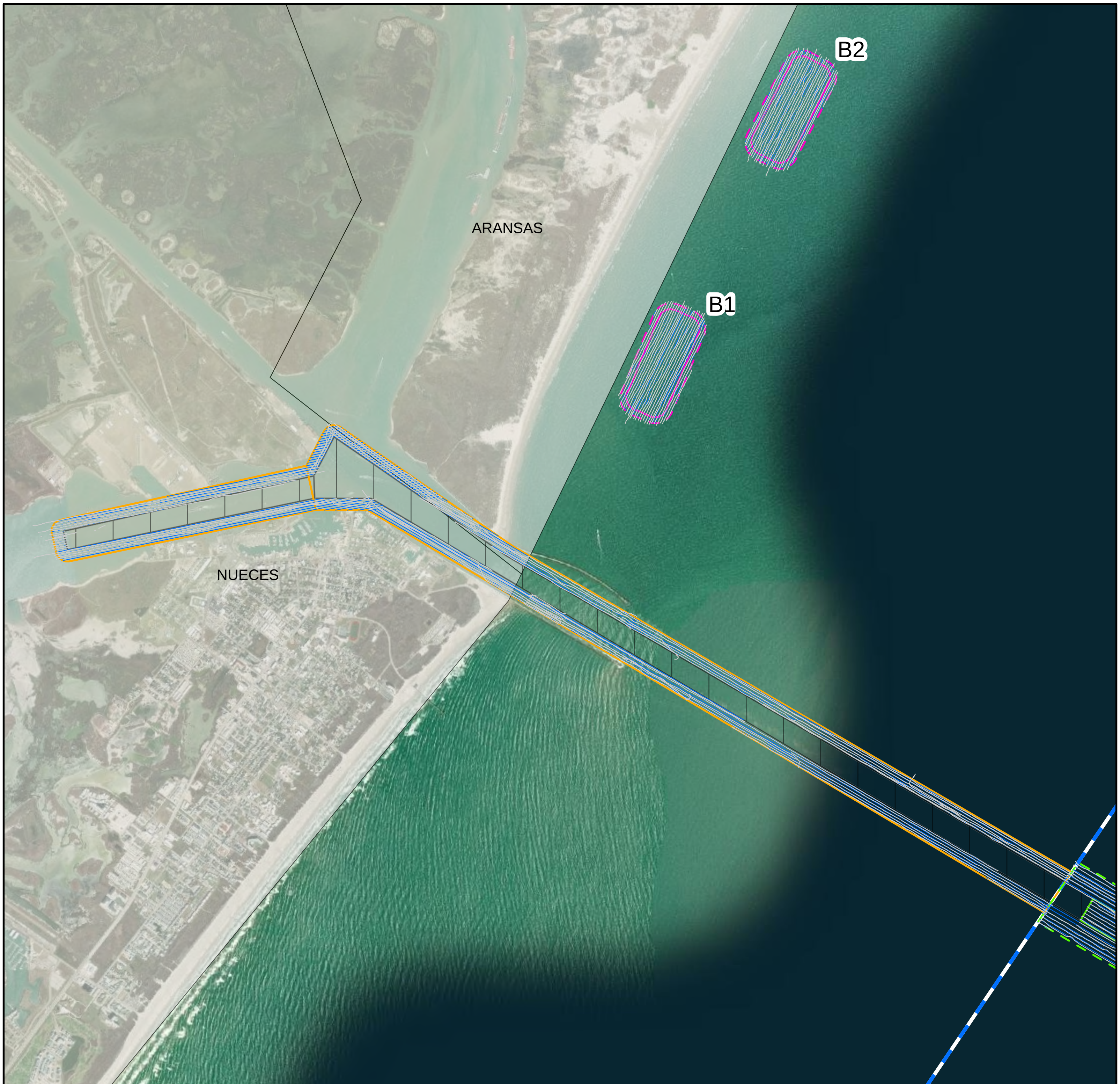
- No coordination with federally recognized Tribes will be performed as part of this scope.
- Any additional cultural resource investigations that may be required by the THC, including diverassessments, data recovery investigations, etc.

are not covered by this work plan but can be provided as an additional service under a separate scope of work.

- No artifacts will be collected; no curation will be completed

End of Section

Appendix D: Planned and Run Survey Lines



Port of Corpus Christi Authority 75' Channel Deepening Project
Nueces and Aransas Counties, Texas
Corpus Christi Ship Channel (CCSC) Area A to Area D, B1 and B2
Planned Line and Track Line

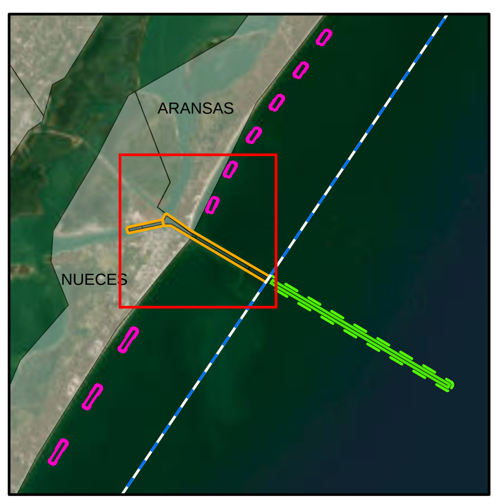
Area of Potential Effects
New Cut CCSC
Beneficial Use Site

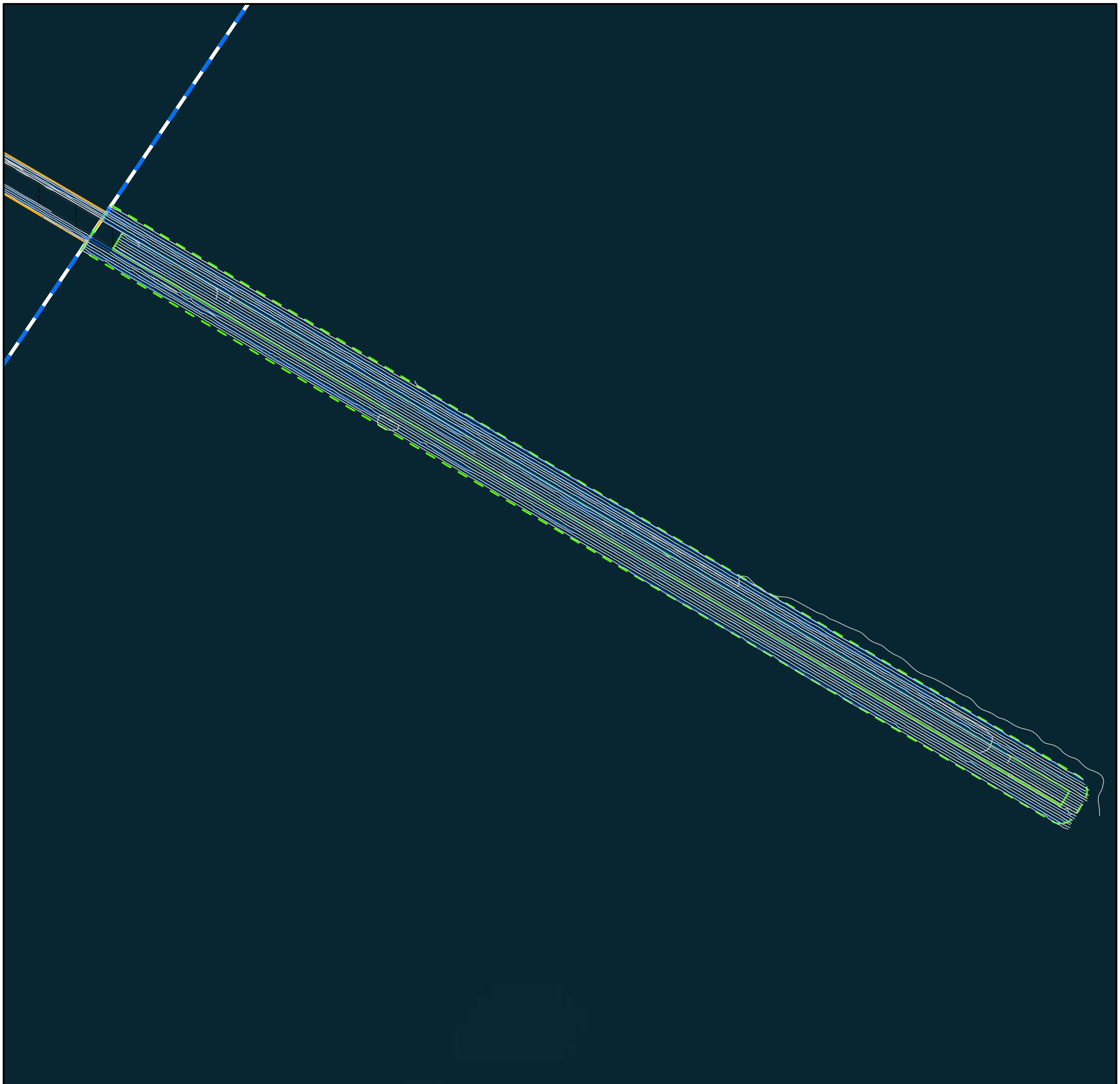
Survey Buffers
No Survey
New Cut CCSC (200m)
Existing CCSC (100m)
Beneficial Use Site (50m)

Track Line
Planned Line
3 Nautical Miles Offshore
County

0 4 Kilometers
0 2 Miles

NAD 1983 (2011) State Plane Texas South FIPS 4205 (US Feet)





Port of Corpus Christi Authority 75' Channel Deepening Project
Nueces and Aransas Counties, Texas
Corpus Christi Ship Channel (CCSC) Area D to Area H
Planned Line and Track Line

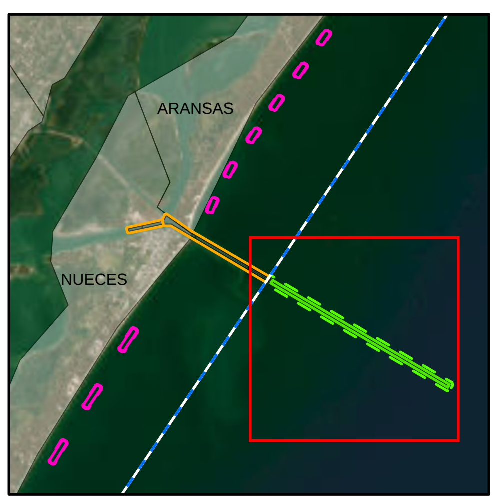
Area of Potential Effects
New Cut CCSC
Beneficial Use Site

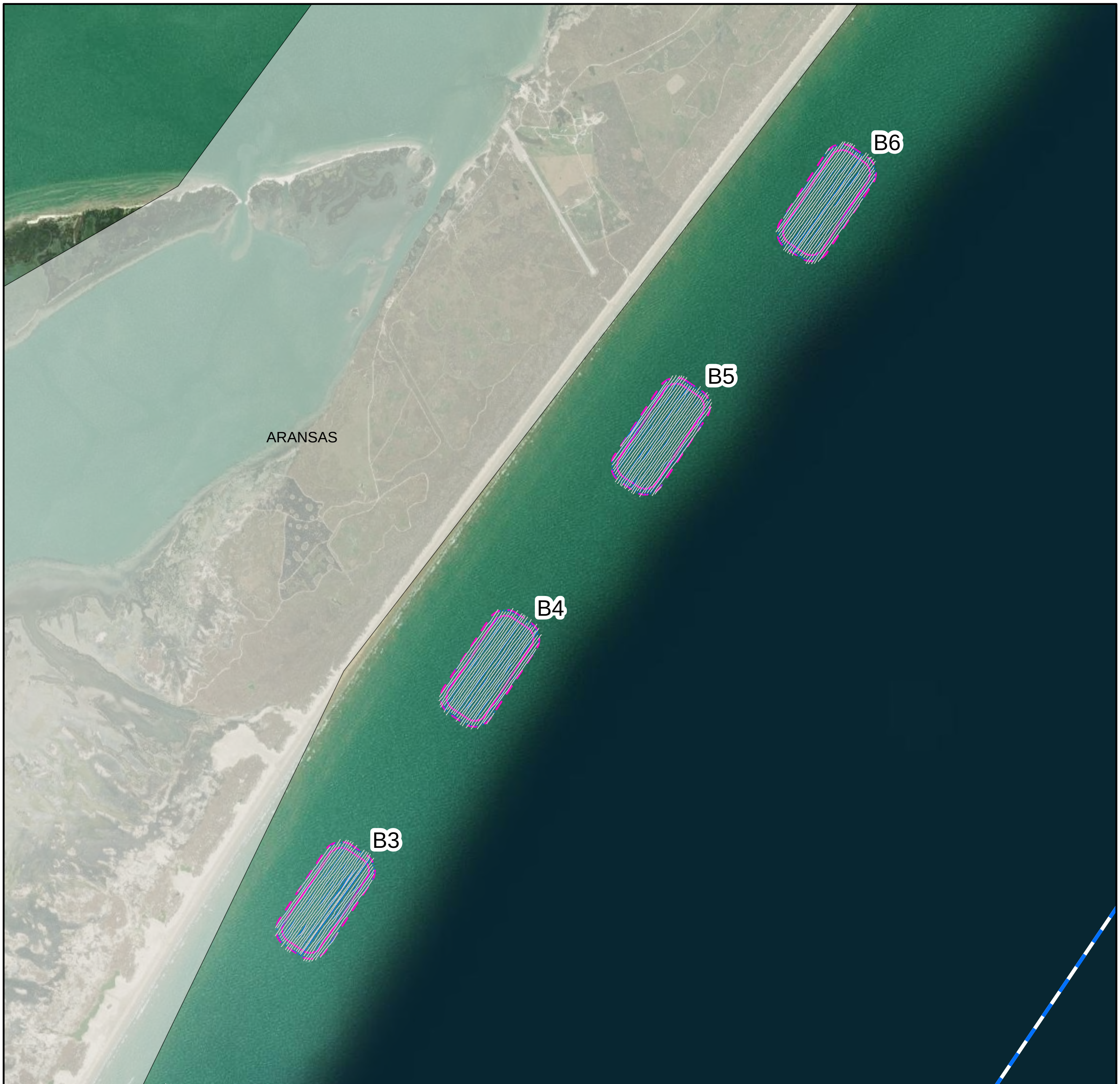
Survey Buffers
No Survey
New Cut CCSC (200m)
Existing CCSC (100m)

Track Line
Planned Line
3 Nautical Miles Offshore
County

0 4 Kilometers
0 2 Miles

NAD 1983 (2011) State Plane Texas South FIPS 4205 (US Feet)





Port of Corpus Christi Authority 75' Channel Deepening Project
Nueces and Aransas Counties, Texas
Corpus Christi Ship Channel (CCSC) B3 to B6
Planned Line and Track Line

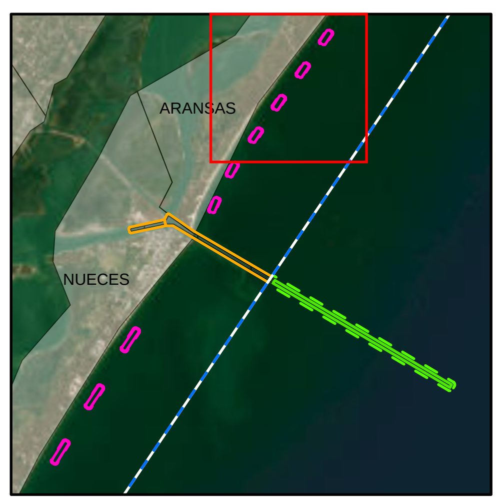
Area of Potential Effects
New Cut CCSC
Beneficial Use Site

Survey Buffers
Beneficial Use Site (50m)

Track Line
Planned Line
3 Nautical Miles Offshore
County

0 — 4 Kilometers
0 — 2 Miles

NAD 1983 (2011) State Plane Texas South FIPS 4205 (US Feet)



Port of Corpus Christi Authority 75' Channel Deepening Project
Nueces and Aransas Counties, Texas
Corpus Christi Ship Channel (CCSC) B7 to B9
Planned Line and Track Line

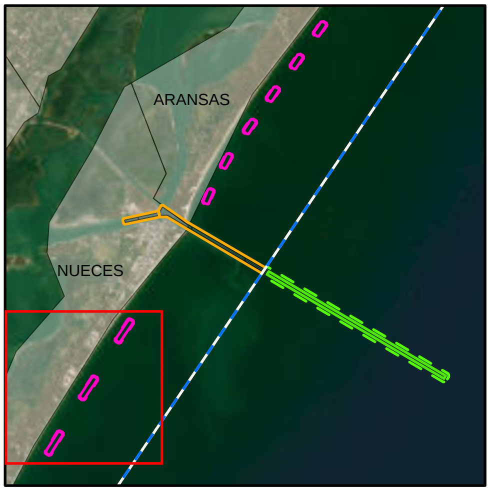
Area of Potential Effects
New Cut CCSC
Beneficial Use Site

Survey Buffers
Beneficial Use Site (50m)

Track Line
Planned Line
3 Nautical Miles Offshore
County

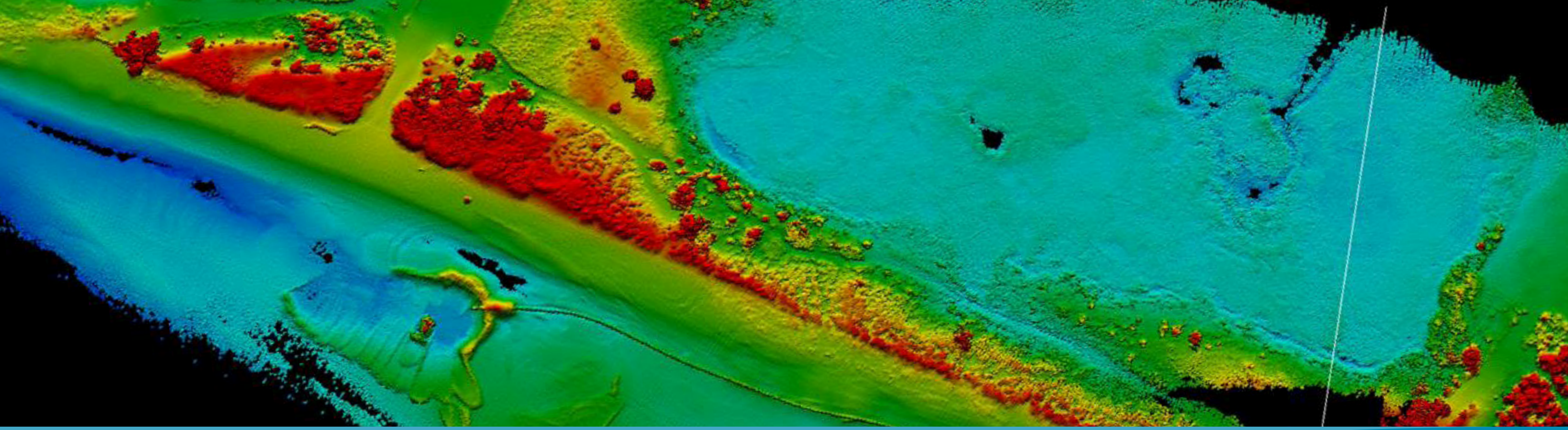
0 4 Kilometers
0 2 Miles

NAD 1983 (2011) State Plane Texas South FIPS 4205 (US Feet)



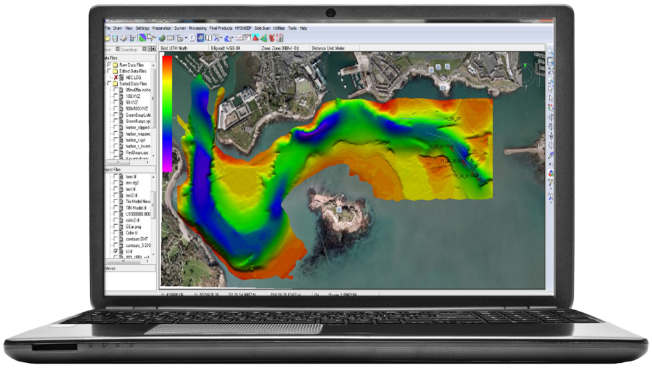
Appendix E: Equipment Specifications

Equipment Specifications (*Ms. Kendle*)



HYPACK®

SOFTWARE FOR HYDROGRAPHIC DATA COLLECTION, PROCESSING AND FINAL PRODUCTS



About HYPACK®

HYPACK® is one of the most widely used hydrographic software packages in use today. It is designed to assist you in all of the hydrographic operations, with software that is straightforward and simple to use. The software package provides the tools needed to design, acquire and process your survey data, and create the final products needed. Tools for creating contours, computing volumes, creating sidescan mosaic and create electronic charts (ENC) are part of the package. Over two hundred sensor inputs provide the connection for all types of GPS, Inertial systems, echo sounders, sidescan and sub bottom, magnatometers, velocity sensors and more. HYPACK® is more than a navigation software; it's your complete hydrographic package from planning to deliverable.

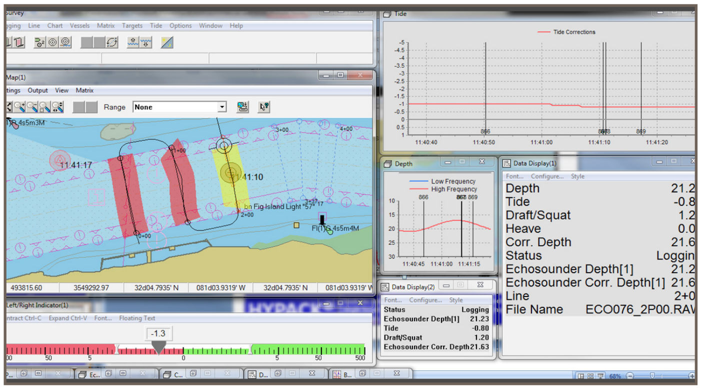
Benefits

- HYPACK® is a standard package for many hydrographic organizations
- Effective solution to meet your survey needs
- Online and phone support provided by our experienced support team
- It is easy to set-up, user configurable, and allows you to connect to virtually any sensor on the market today

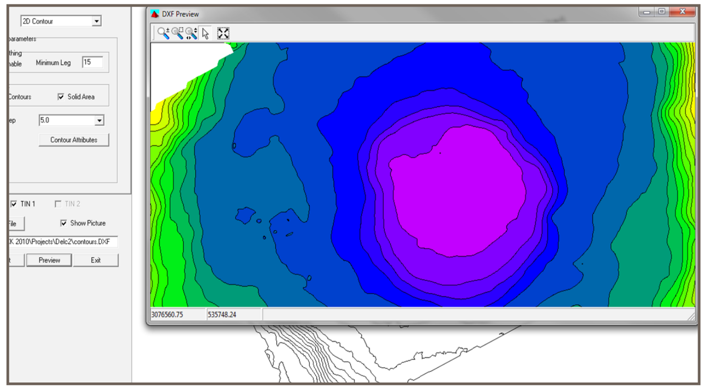
Features

- Simple to use survey planning for line creation, with support for worldwide geodesy models
- Real time navigation display, support for remote helmsman and survey view
- Processing tools allow for simple to use data cleaning, with both manual and automatic filters
- HYPACK® data files are easily exported to XYZ, CAD, DXF and dozens of other formats

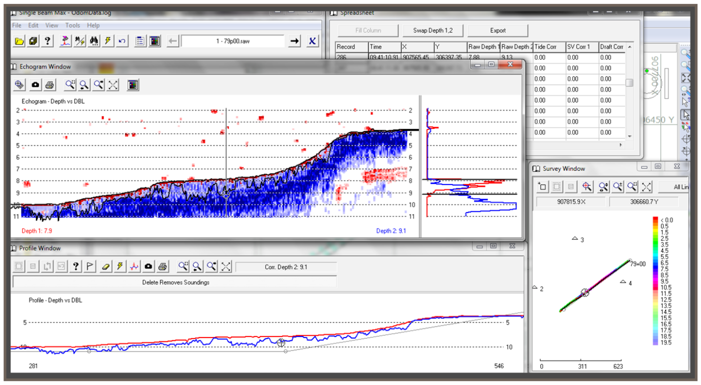
Included in HYPACK®



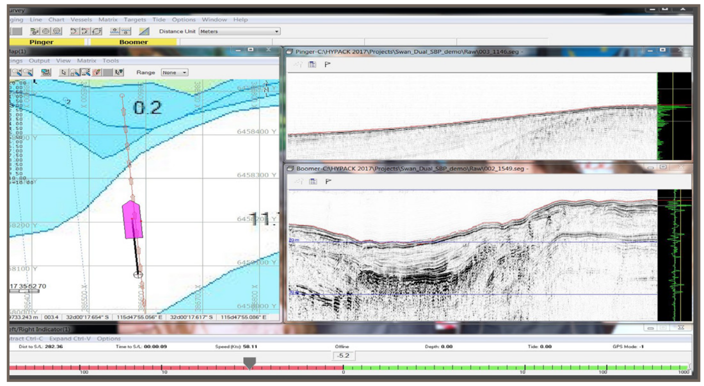
The HYPACK® SURVEY program provides you with the visual feedback needed to get your survey job done right.



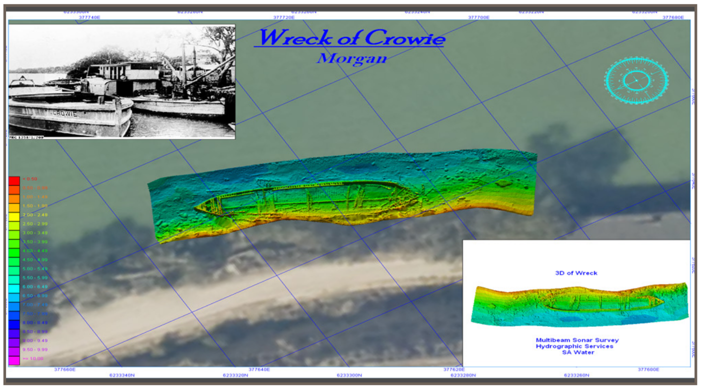
The TIN MODEL program creates surface models, generates DXF contours and computes volume quantities. Export gridded XYZ or BAG surfaces.



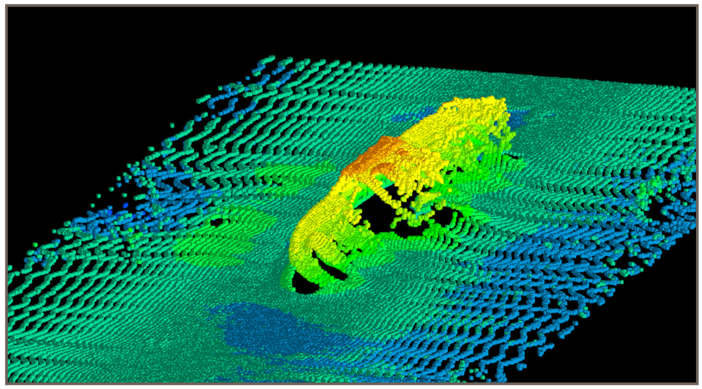
The SURVEY program handles input from over 200 devices: GPS, inertial systems, sub-bottom systems, single and dual frequency echosounders and magnetometers.



HYPACK® supports both analog and digital sub-bottom systems. It saves your data to industry standard SEG-Y. It's a standard feature in HYPACK®.



HYPLOT lets you output smooth sheets to your printer or plotter, or save them to PDF or DXF. Choose from an array of borders and sheet options. Design your own title block.



The CLOUD program can be used for data review. It accepts HYPACK® data, XYZ data, or LAS files.

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Professional Heading and Positioning Receiver

VS100™

Powered by Crescent

Precise applications demand the heading and positioning performance of the VS100™ Series GPS Compass. Ideal for professional machine control and navigation applications, the VS100 delivers reliable accuracy at significantly less cost than competitors products or traditional methods.

The VS100 Series Receiver, with its display and user interface, can be conveniently installed near the operator. The two antennas are mounted separately and with a distance between them to meet the desired accuracy.

Key VS100 Series Advantages

- Affordable solution delivers 2D GPS heading accuracy better than 0.1 degree rms
- Differential positioning accuracy of less than 60 cm, 95% of the time
- Integrated gyro and tilt sensor deliver fast start-up times and provide heading updates during temporary loss of GPS
- Fast heading and positioning output rates up to 20 Hz
- Differential options including SBAS (WAAS, EGNOS, etc.) and optional beacon differential
- COAST™ technology maintains accurate solutions for 40 minutes or more after loss of differential signal
- The status lights and menu system make the VS100 series easy to monitor and configure

VS100 Series GPS Compass

GPS Sensor Specifications

Receiver Type:	L1, C/A code, with carrier phase smoothing
Channels:	Two 12-channel, parallel tracking (Two 10-channel when tracking SBAS)
Update Rate:	Standard 10 Hz, optional 20 Hz (position and heading)
Horizontal Accuracy:	< 0.6 m 95% confidence (DGPS)* < 2.5 m 95% confidence (autonomous, no SA)**
Heading Accuracy:	< 0.30° rms @ 0.5 m antenna separation < 0.15° rms @ 1.0 m antenna separation < 0.10° rms @ 2.0 m antenna separation
Pitch / Roll Accuracy:	< 1° rms @ 0.5 m antenna separation
Rate of Turn:	90°/s max
Cold Start:	60s (No almanac or RTC)
Heading Fix:	< 20s
Satellite Reacquisition:	< 1s
Antenna Input Impedance:	50Ω

Beacon Sensor Specifications (VS110 version)

Channels:	2-channel, parallel tracking
Frequency Range:	283.5 to 325 kHz
Operating Modes:	Automatic (signal strength), Database and Manual
Compliance:	IEC 61108-4 beacon standard

Communications

Serial ports:	2 full duplex
Interface Level:	RS-232C
Baud Rates:	4800 - 57600
Correction I/O Protocol:	RTCM SC-104, L-Dif (Hemisphere GPS proprietary)
Data I/O Protocol:	NMEA 0183, Crescent binary, L-Dif (Hemisphere GPS proprietary)
Timing Output:	1 PPS (HCMOS, active high, rising edge sync, 10 kΩ, 10 pF load)
1 PPS Accuracy:	50 ns

Power

Input Voltage:	9 to 36 VDC
Power Consumption:	< 5 W
Current Consumption:	< 360 mA @ 12 VDC
Antenna Voltage Output:	5 VDC
Antenna Short Circuit Protection:	Yes

Environmental

Operating Temperature:	-32°C to +74°C (-25°F to +165°F)
Storage Temperature:	-40°C to +85°C (-40°F to +185°F)
Humidity:	95% non-condensing
Shock and Vibration:	EP 455
EMC:	FCC Part 15, Subpart B, Class B, CISPR22, CE

Mechanical

Dimensions:	189 mm L x 114 mm W x 71 mm H (7.4” L x 4.5” W x 2.8” H)
Weight:	0.86 kg (1.9 lb)
Status Indication:	Power, primary GPS lock, secondary GPS lock, differential lock, and heading lock
Power Switch:	Miniature push-button
Power Connector:	2-pin, micro-Conxall
Data Connectors:	DB9-female x2
Antenna Connectors:	TNC-female x2

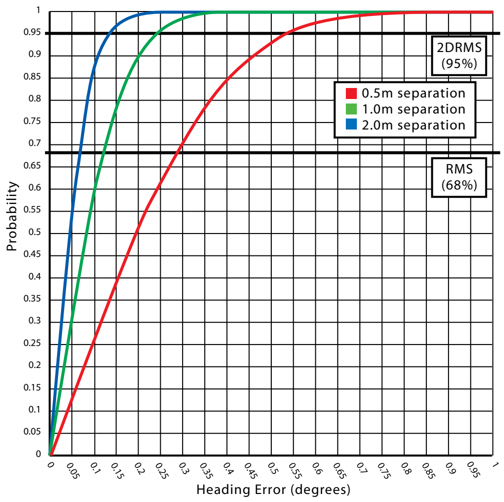
Aiding Devices

Gyro:	Single axis gyro provides reliable <1° heading for periods up to 3 minutes when loss of GPS lock has occurred
Tilt Sensor:	Assists in fast start up of RTK solution

* Depends on multipath environment, number of satellites in view, satellite geometry, baseline length (for local services), and ionospheric activity

** Depends on multipath environment, number of satellites in view, and satellite geometry

VS100 Series Heading Performance vs. Antenna Separation



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4125i

SIDE SCAN SONAR SYSTEM

FEATURES

- Ultra high resolution images
- Lightweight for one person deployment
- Standard heading, pitch, roll & pressure sensors
- Choice of dual simultaneous frequencies
- Runs on AC or DC
- Pole mount option for shallow water use

APPLICATIONS

- Hydrographic Surveys
- Geological Surveys
- Search & Recovery
- Channel/Clearance Surveys
- Bridge/Pier/Harbor Wall Inspection
- Hull Inspections

EdgeTech's 4125i Side Scan Sonar System was designed with both the Search & Recovery (SAR) and shallow water survey communities in mind. The 4125i utilizes EdgeTech's Full Spectrum® CHIRP technology, which provides higher resolution imagery at ranges up to 50% greater than non-CHIRP systems operating at the same frequency. This translates into more accurate results and faster surveys, thus cutting down on costs.

Two dual simultaneous frequency sets are available for the 4125i depending on the application. The 400/900 kHz set is the perfect tool for shallow water survey applications, providing an ideal combination of range and resolution. The 600/1600 kHz set is ideally suited for customers that require ultra high resolution imagery in order to detect very small targets (SAR).

The 4125i system can be powered by both AC and DC for added versatility and is delivered in portable rugged cases for ease of transport from site-to-site. As is standard with all of EdgeTech's towed side scan systems, the 4125i comes with a safety recovery system which will prevent the loss of a towfish if it becomes snagged on an obstacle during a survey.

A standard 4125i System comes with a rugged stainless steel towfish and a portable water resistant topside processor including a laptop computer (Optional: Splash Proof/Ruggedized Laptop). A 50 meter Kevlar tow cable is included as standard with customer-specified lengths also available. Multiple options are available such as a v-fin depressor, keel weight, pole mount and hull scan bracket for added versatility.

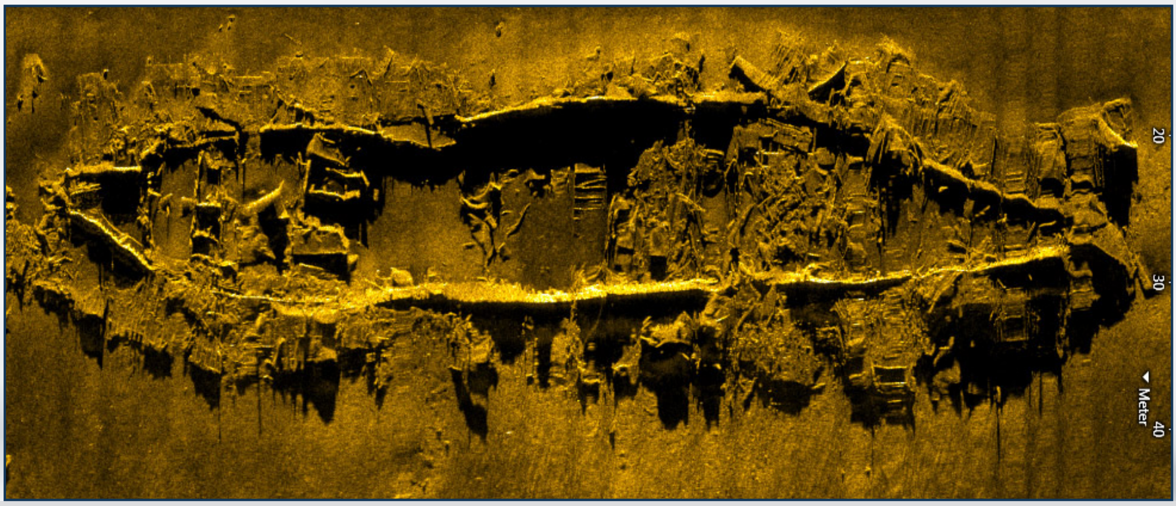
info@EdgeTech.com | USA 1.508.291.0057

4125i

SIDE SCAN SONAR SYSTEM

KEY SPECIFICATIONS

SONAR	
Frequencies (Dual Simultaneous)	Choice of either a 400/900 kHz or 600/1600 kHz towfish
Pulse Type	EdgeTech's Full Spectrum® CHIRP
Operating Range	200m @ 400 kHz, 75m @ 900 kHz; 120m @ 600 kHz, 35m @ 1600 kHz
Horizontal Beam Width	0.46° @ 400 kHz, 0.28° @ 900 kHz; 0.33° @ 600 kHz, 0.20° @ 1600 kHz
Vertical Beam Width	50°
Resolution Across Track	400 kHz: 2.3 cm, 900 kHz: 1.0 cm, 600 kHz: 1.5 cm, 1600 kHz: 0.6 cm
TOWFISH	
Diameter	9.5 cm (3.75 inches)
Length	112 cm (44 inches)
Weight in Air	20 kg (44 pounds)
Tow Cable Type	Coaxial up to 600m max length (will provide a typical operational depth down to 200m)
Max Depth Rating of Towfish	200m
Material	Stainless Steel
Standard Sensors	Heading, Pitch, Roll, Pressure (Depth)
TOPSIDE PROCESSOR	
Power Input	12-24 VDC or 115/230 VAC, 50/60 Hz
Connections	AC, DC, Ethernet (to laptop), Towfish
Hardware	Laptop Computer (Optional: Splash Proof/Ruggedized Laptop)
Operating System	Windows® 7 & Windows® 10
Acquisition Software	EdgeTech DISCOVER
SYSTEM OPTIONS	
	Keel weight, v-fin depressor wing, pole mount, quick change hull scan bracket



For more information please visit EdgeTech.com

Teledyne Odom Hydrographic

ECHOTRAC E20

Hydrographic Echosounder for demanding 24/7 use

The new ECHOTRAC E20 is the result of more than 40 years of experience in precise echosounding and market leading sonar technology.

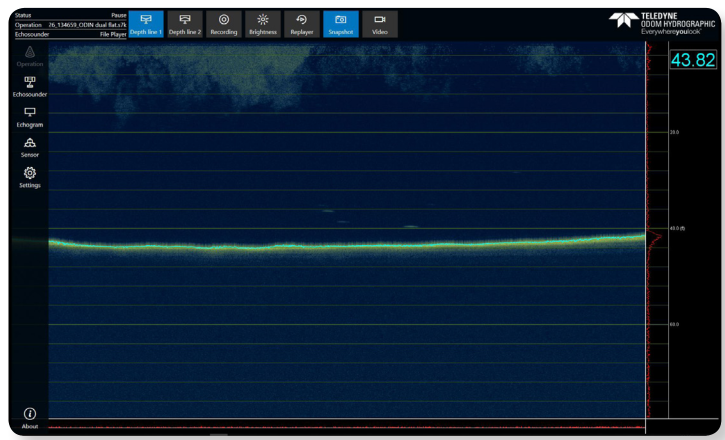
A portable, compact and robust echosounder designed for survey in all environments allowing you to maximize your utilization of the equipment and reducing your costs by having one unit for all applications.

Easy to use and fast to mobilize, the E20 allows you to begin your survey rapidly, delivering accurate results first time, every time. The E20 saves time and enables you to get results faster.

The ECHOTRAC E20 completes our portfolio of sonar solutions introducing yet another groundbreaking innovation into the day-to-day work life of our customers.

E20 PRODUCT FEATURES

- 1 or 2 frequency agile channels from 10 to 250kHz
- 0.5 to 6,000m depth range
- Ruggedized and shock-proof, water resistant IP67



The new SBES UI operator software is being used to operate the ECHOTRAC

BENEFITS

- Precise and reliable survey data for shorter data processing time, enabling you to complete your project faster.
- Dual channel survey echosounder from very shallow to deep sea, from 10 kHz to 250 kHz – giving you the flexibility for all your survey projects, maximizing utilization of your investment.
- The compact system with minimal interfacing effort, allows for fast mobilization, and extremely low space to go anywhere, enabling you to start work immediately.
- Intuitive user interface, easy to use, so you can focus on the job at hand.
- The ECHOTRAC E20 is compatible with a broad range of transducers with straightforward transducer interfacing.

A Teledyne Marine Company

TELEDYNE ODOM HYDROGRAPHIC
Everywhereyoulook™

ECHOTRAC E20

TECHNICAL SPECIFICATIONS

	Single channel	Dual channel	Dual channel Extended Range
Operating frequency	HF channel 10 to 250Khz, optimized for 50-250kHz LF channel 10 to 250khz, optimized for 10-50kHz		
Channels	Single[1]	Dual	Dual
Accuracy and Resolution			
200kHz	1cm resolution and 2cm +/- 0.1% of depth accuracy		
33kHz	5cm resolution and 10cm +/- 0.1% of depth accuracy		
12kHz	15cm resolution and 15cm +/- 0.1% of depth accuracy		
Depth Range[2]			
200kHz	0.5 to 250m		0.5 to 400m
33kHz	1.0 to 1,000m		1.0 to 3,000m
12kHz	3.0 to 1,000m		3.0 to 6,000m
Max ping rate	50Hz		
Pulse type	CW	CW	CW and FM (chirp)
Output power	Typically max output power varies between 1 and 3kW, depending on transducer		
Input power	10-30VDC, 100-230VAC[3] , max 100W		
Data output	Via LAN interface: For each channel the measured depth and full amplitude-time echogram, passed through auxiliary sensor data, s7k data protocol. Via serial port: For each channel the measured depth		
Transducer interfaces	Impedance: minimum 50 Ohm, Max power: 15W per channel RMS • Single-connector TX1 for dual transducer • Two separate connectors TX1 and TX2 for separate transducer cables		
Interfaces	3 serial connectors (RS-232): • Input: GPS position and time, heave, motion, heading • Output: depth 1 Ethernet LAN connector 1 sync connector		
Dimensions H x W x D	83.0mm x 300.0mm x 221.0mm		
Weight	5.7kg (excl. external cables and transducers)		
Environmental conditions and ingress protection	Temperature Operation (Storage): -20°C to +55°C (-30°C to +70°C) IP67, Vibration, Drop: Complies with standard EN 60945 §8.7 and §8.6		

[1]The E20 SC single channel can utilize both channels, but not at the same time.
[2]The depth values are based on the performance of TC2122 for 200 and 33kHz, and HM210/12-8/20 for 12kHz. Stated depth ranges may be impacted by environmental conditions, vessel installation, and motion
[3]External AC power supply is included and intended for dry installation (not IP67 compliant).

TELEDYNE
ODOM HYDROGRAPHIC
Everywhereyoulook™

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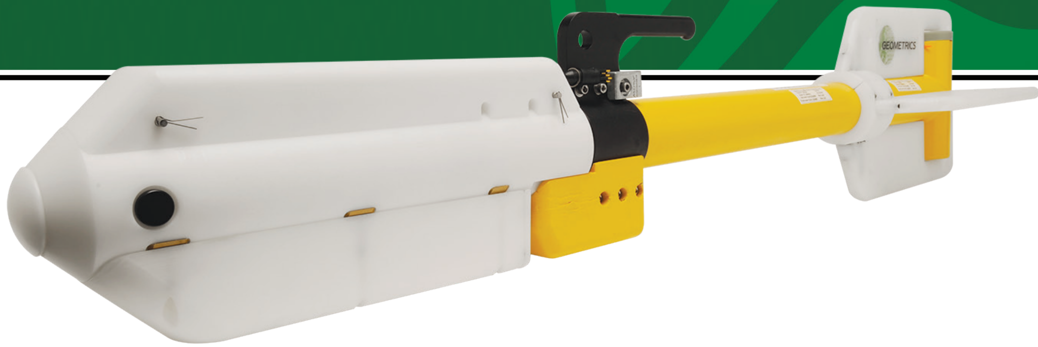
PLD19162-2

G-882
Cesium Marine Magnetometer

GEOMETRICS
Innovation • Experience • Results



Geometrics' G-882 Marine Magnetometer is the leading marine system in the industry with over 1,000 systems sold! The G-882 is the only system that meets the standards for UXO clearance in the North Sea.

This very high-resolution Cesium vapor marine magnetometer is low in cost, small in size, and offers flexibility for professional surveys in shallow or deep water. Use your personal computer with our MagLog™ software to log, display and print GPS position and magnetic field data.

The system directly interfaces to all major side-scan manufacturers for tandem tow configurations. Being small and lightweight, it is easily deployed and operated by one person. But add several streamlined weight collars and the system can quickly weigh more than 100 lbs for deep-tow applications.

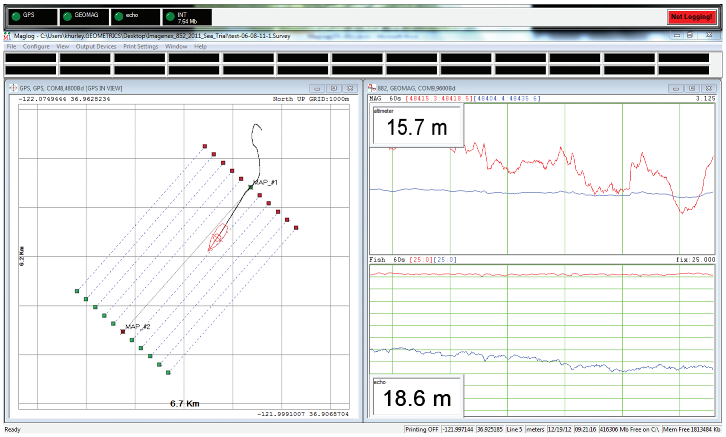
This marine magnetometer system is particularly well-suited for the detection and mapping of all sizes of ferrous objects. This includes anchors, chains, cables, pipelines, ballast stones and other scattered shipwreck debris, munitions of all sizes (UXO), aircraft, engines and any other object with a magnetic expression. The G-882 is also perfect for geological studies. Its high sensitivity and high sample rates are maintained for all applications.

Objects as small as a 5-inch screwdriver are readily detected provided that the sensor is close to the seafloor and within practical detection range (refer to table on back).

FEATURES & BENEFITS

- **Cesium Vapor High Performance** – Highest detection range and high probability of detecting all sized ferrous targets.
- **Streamlined Design for Tow Safety** – Low probability of fouling in fishing lines or rocks. Rugged fiber-wound fiberglass housing.
- **Sample at up to 20Hz** – Unparalleled data density while also covering larger areas per day.
- **Sensor can be Rotated for Optimal Signal** – Can be used worldwide.
- **Easy Portability and Handling** – No winch required. Built-in easy-carry handle. Operable by a single man; only 44 lb with 200 ft cable.
- **Combine Multiple Systems for Increased Coverage** – Internal CM-221 Mini-counter provides multi-sensor sync and data concatenation, allowing side-by-side coverage which maximizes detection of small targets and reduces noise.
- **Export Version Available** – Use anywhere in the world without need for an export license (except embargoed countries). See specifications.

SPECIFICATIONS | G-882 Cesium Marine Magnetometer



MagLogLite™ Data Logging software is included with each magnetometer and allows recording and display of data and position with automatic anomaly detection. Additional software options include: MagLog Pro™, advanced logging software; MagMap™, a plotting and contouring package; and MagPick™ post-acquisition processing software.

MAGNETOMETER / ELECTRONICS

Operating Principle: Self-oscillating split-beam Cesium vapor (non-radioactive).

Operating Range: 20,000 to 100,000 nT.

Operating Zones: The earth's field vector should be at an angle greater than 10° from the sensor's equator and greater than 6° away from the sensor's long axis. Automatic hemisphere switching.

Noise: <0.004 nT/$\sqrt{Hz}_{rms}$. (SX (export) version: <0.02 nT/$\sqrt{Hz}_{rms}$).

Max Sample Rate: 20 Hz.

Heading Error: < 1 nT (over entire 360° spin).

Output: RS-232 at 1,200 to 19,200 Baud.

Power: 24 to 32 VDC, 0.75 A at power-on and 0.5 A thereafter.

MECHANICAL

Sensor Fish

DIA: 7 cm; L: 137 cm (2.75x54 in) (with fin assembly).
Weight: 18 kg (40 lb).

Includes sensor and electronics and 1 main weight. Additional collar weights are 6.4 kg (14 lb) each; total of 5 capable.

Tow Cable

DIA: 12 mm; L: 800 m (0.47 in x 2,625 ft).
Weight: 7.7 kg (17 lb) with terminations.
Break strength: 1,630 kg (3,600 lb)
Bend diameter: 30 cm (12 in).

Typical Detection Range for Common Objects

1.	Ship: 1000 tons	0.5 to 1 nT at 800 ft (244 m)
2.	Anchor: 20 tons	0.8 to 1.25 nT at 400 ft (120 m)
3.	Automobile	1 to 2 nT at 100 ft (30 m)
4.	Light Aircraft	0.5 to 2 nT at 40 ft (12 m)
5.	Pipeline (12 inch)	1 to 2 nT at 200 ft (60 m)
6.	Pipeline (6 inch)	1 to 2 nT at 100 ft (30 m)
7.	Iron: 100 kg	1 to 2 nT at 50 ft (15 m)
8.	Iron: 100 lb	0.5 to 1 nT at 30 ft (9 m)
9.	Iron: 10 lb	0.5 to 1 nT at 20 ft (6 m)
10.	Iron: 1 lb	0.5 to 1 nT at 10 ft (3 m)
11.	Screwdriver: 5-inch	0.5 to 2 nT at 12 ft (4 m)
12.	Bomb: 1000 lb	1 to 5 nT at 100 ft (30 m)
13.	Bomb: 500 lb	0.5 to 5 nT at 50 ft (16 m)
14.	Grenade	0.5 to 2 nT at 10 ft (3 m)
15.	Shell: 20 mm	0.5 to 2 nT at 5 ft (1.8 m)

ENVIRONMENTAL

Operating Temperature: -35°C to +50°C (-30°F to +122°F).

Storage Temperature: -45°C to +70°C (-48°F to +158°F).

Altitude: 9,000 m (30,000 ft).

Depth: 4,000 psi (2,730 m; 8956 ft).

Water Tight: O-Ring sealed for up to 4,000 psi depth operation.

ACCESSORIES

Standard: Operation manual, shipping/storage container, ship kit with tools and hardware, power supply, MagLogLite™, MagMap™ and MagPick™ processing software, depth transducer, altimeter.

Optional: Steel tow cable to 6,000 m (19,600 ft) with telemetry, longitudinal or transverse gradiometer, plastic Pelican® case, MagLogPro™, collar weights.

Specifications subject to change without notice. G-882_v1 (0118)

GEOMETRICS
Innovation • Experience • Results

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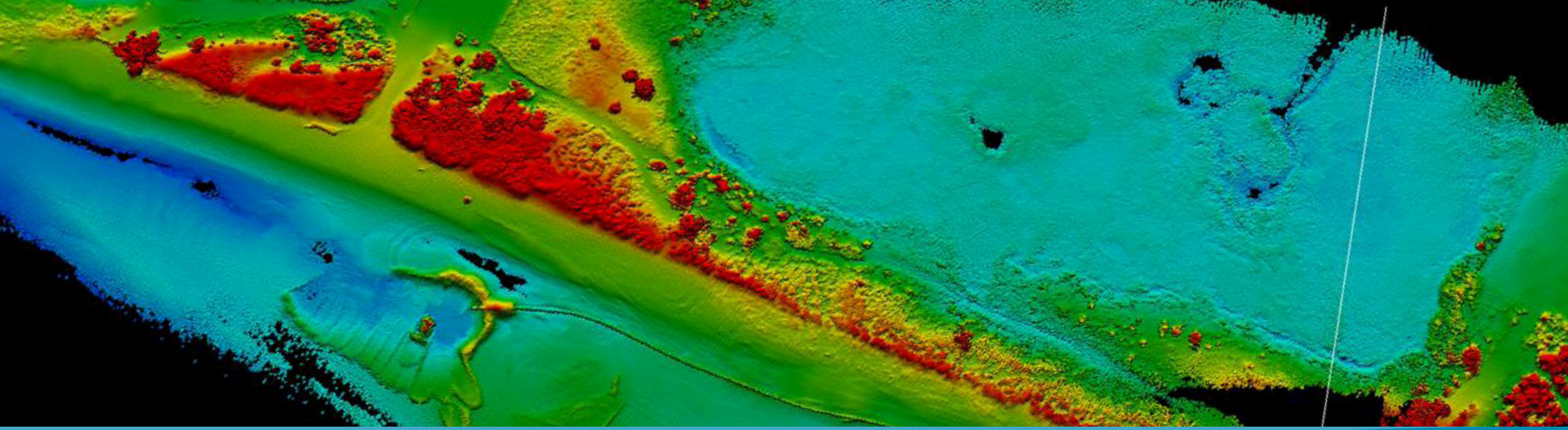
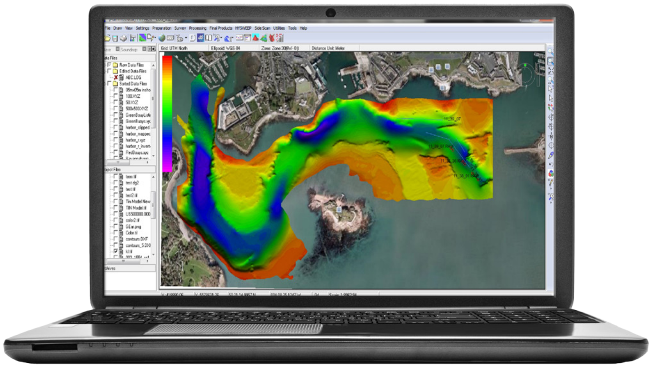
Equipment Specifications (MREC Survey Vessel)



HYPACK®

SOFTWARE FOR HYDROGRAPHIC DATA COLLECTION, PROCESSING AND FINAL PRODUCTS



About HYPACK®

HYPACK® is one of the most widely used hydrographic software packages in use today. It is designed to assist you in all of the hydrographic operations, with software that is straightforward and simple to use. The software package provides the tools needed to design, acquire and process your survey data, and create the final products needed. Tools for creating contours, computing volumes, creating sidescan mosaic and create electronic charts (ENC) are part of the package. Over two hundred sensor inputs provide the connection for all types of GPS, Inertial systems, echo sounders, sidescan and sub bottom, magnatometers, velocity sensors and more. HYPACK® is more than a navigation software; it's your complete hydrographic package from planning to deliverable.

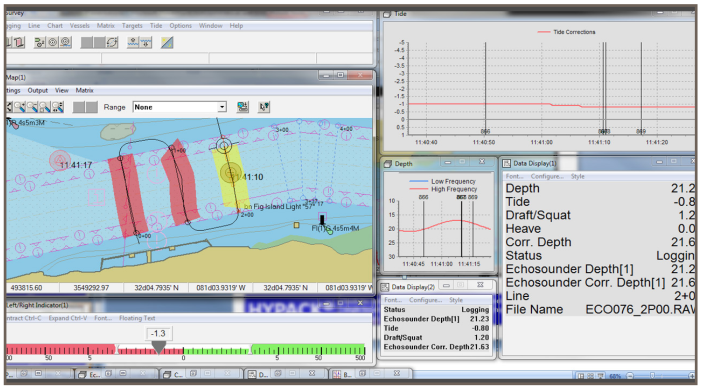
Benefits

- HYPACK® is a standard package for many hydrographic organizations
- Effective solution to meet your survey needs
- Online and phone support provided by our experienced support team
- It is easy to set-up, user configurable, and allows you to connect to virtually any sensor on the market today

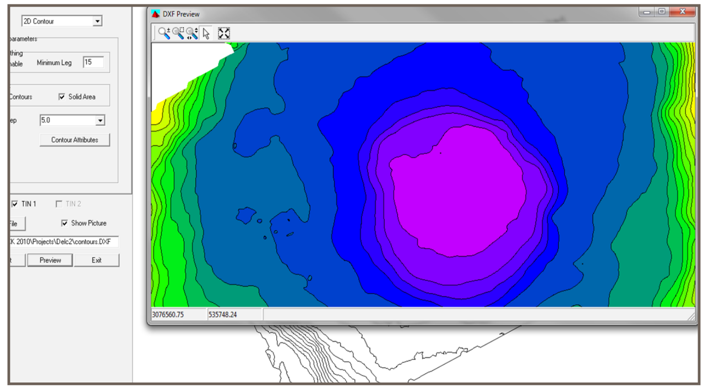
Features

- Simple to use survey planning for line creation, with support for worldwide geodesy models
- Real time navigation display, support for remote helmsman and survey view
- Processing tools allow for simple to use data cleaning, with both manual and automatic filters
- HYPACK® data files are easily exported to XYZ, CAD, DXF and dozens of other formats

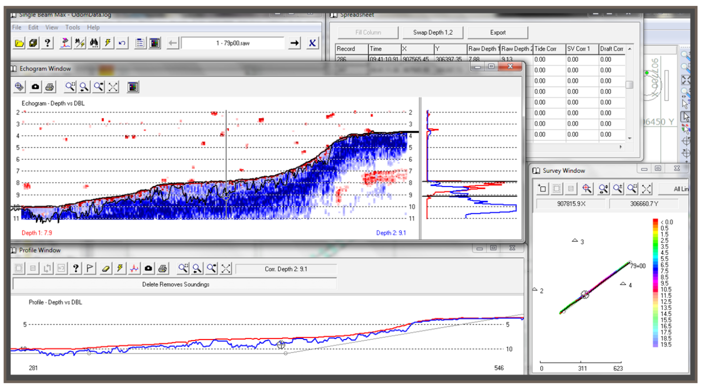
Included in HYPACK®



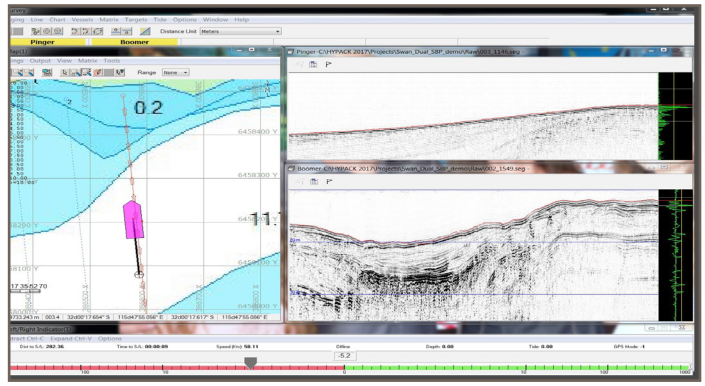
The HYPACK® SURVEY program provides you with the visual feedback needed to get your survey job done right.



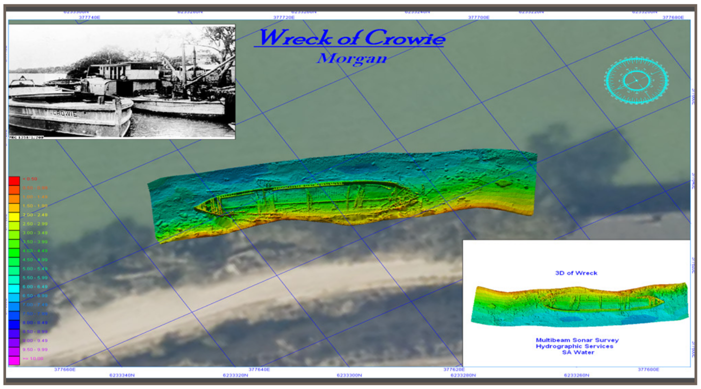
The TIN MODEL program creates surface models, generates DXF contours and computes volume quantities. Export gridded XYZ or BAG surfaces.



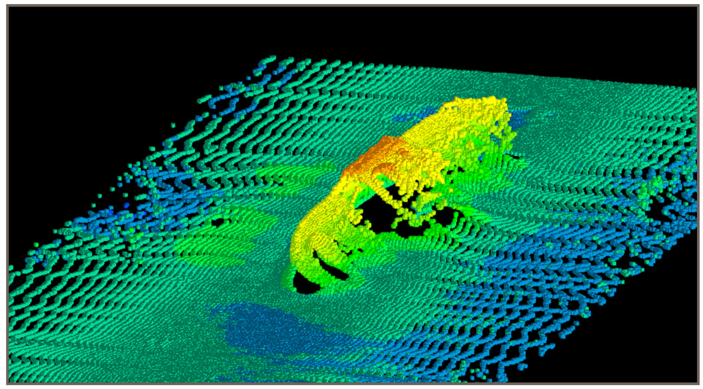
The SURVEY program handles input from over 200 devices: GPS, inertial systems, sub-bottom systems, single and dual frequency echosounders and magnetometers.



HYPACK® supports both analog and digital sub-bottom systems. It saves your data to industry standard SEG-Y. It's a standard feature in HYPACK®.



HYPLOT lets you output smooth sheets to your printer or plotter, or save them to PDF or DXF. Choose from an array of borders and sheet options. Design your own title block.



The CLOUD program can be used for data review. It accepts HYPACK® data, XYZ data, or LAS files.

HYPACK
a xylem brand

HYPACK
56 Bradley Street
Middletown, CT 45387

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DATASHEET

Trimble MPS865

MARINE POSITIONING SYSTEM GNSS RECEIVER

The Trimble® MPS865 Marine Positioning System GNSS Receiver is a highly versatile, rugged and reliable Global Navigation Satellite System (GNSS) positioning and heading solution for a wide variety of real-time and post-processing applications for marine survey and construction.

With a modular form factor, the MPS865 GNSS Receiver is flexible and can be used as an integrated on-board rover receiver, onshore land rover, a base station, or a continuously operating reference station. The MPS865 allows the connection of two GNSS antennas for precise heading.

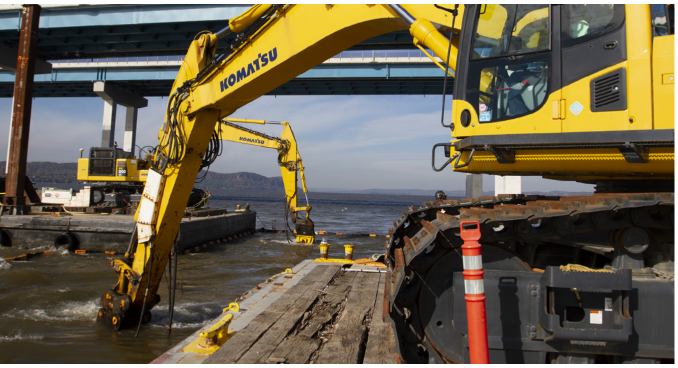
The multi-constellation option maintains productivity in marine sites or when antennas/satellites are partly obstructed. It always delivers precise heading even when no GNSS corrections are received.

The MPS865 has cellular inside—it is now easier to use base-station-free VRS onsite as well as communicate with the receiver via the internet and SMS messages. The receiver can also be used as a data access point on the vessel to download design files or for immediate remote support.

Key Features

- Rugged design built for marine environments
- Bluetooth® and Wi-Fi® communication
- Patented GNSS technology
- 480-channel tracking
- Dual GNSS antenna inputs for heading
- 1 PPS output for sonar synchronization
- OLED display, keyboard, and Web UI
- Optional internal transmit and receive 450 MHz UHF radio
- LTE(4G) cellular modem
- SMS and email alerts
- Anti-theft technology
- Backup RTK - Hot Standby
- RTK bridge to rebroadcast corrections
- 2 MSS L-band channels
- GSM/GPRS/EDGE Quad bands 850/900/1800/1900MHz for 2G
- UMTS/HSDPA Cat 8 /HSUPA Cat 6: Seven bands 1,2,4,5,8,9,19 for 3G
- LTE Cat 1 Twelve bands 1,2,3,4,5,7,8,12,18,19,20,28 for 4G

Trimble MPS865 GNSS RECEIVER



MARINE APPLICATIONS

MPS865 and Trimble Marine Constructon Software

As a key component of Trimble Marine Construction Systems, the MPS865 provides precise position and heading directly into Trimble Marine Construction Software for dredging operations.

Utilize the MPS865 and Trimble Marine Construction software in a range of marine construction applications:

- Hydrographic and land-based pre-construction as-built surveying
- Machine guidance and positioning
- Progress volumes and reporting
- Post-construction as-built inspections

MPS865 and Trimble Siteworks for Construction Surveyors

The Trimble Siteworks Positioning System enables surveyors to work with complex 3D models, collect large data sets faster, visualize complex 3D models more easily and work day or night efficiently.

With Siteworks, the same MPS865 can be used on site and on the vessel for both field rover measure up and topographic mapping. Contractors can more efficiently accomplish surveying tasks such as:

- GNSS base station setup
- Construction stakeout and as-built
- SonarMite echosounder integration for small scale bathymetric surveys
- Single beam echosounder surveys
- Measure on-land features such as beach profiles
- Quickly collect data when measuring up for beach reclamation and surveying port features

Bluetooth® FC CE

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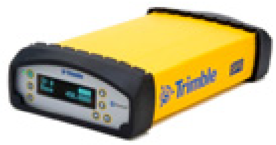
Specifications

Trimble SPS461
Modular GPS Heading Receiver



Receiver Name	**SPS461 GPS Heading Receiver**
Configuration Option	**DGPS**
Type	Modular
Base and rover interchangeability	No, rover only
Base operation	NA
Rover operation	All models
Heading operation	All models[5]
Rover position update rate	1 Hz, 2 Hz, 5 Hz, 10 Hz, 20Hz
Rover maximum range from base	Unlimited
Rover operation within a VRS™ network	Yes
Factory options	Location RTK, OmniSTAR HP/XP, Precise Vertical, Precision RTK
General	
Keyboard and display	VFD display 16 characters by 2 rows On/Off key for one-button startup Escape and Enter keys for menu navigation 4 arrow keys (up, down, left, right) for option scrolls and data entry
Dimensions (L × W × D)	24 cm (9.4 in) × 12 cm (4.7 in) × 5 cm (1.9 in) including connectors
Weight	1.22 kg (2.70 lb) receiver only 1.37 kg (3.00 lb) receiver with internal radio
Antenna Options	
GA510	L1/L2 GPS, SBAS, and OmniSTAR (optimized for OmniSTAR)
GA530	L1/L2 GPS, MSK Beacon, SBAS, and OmniSTAR
L1/Beacon, DSM 232	Not supported
Zephyr™ Model 2	L1/L2 GPS, SBAS, and OmniSTAR
Zephyr Geodetic™ Model 2	L1/L2 GPS, SBAS, and OmniSTAR
Zephyr Model 2 Rugged	L1/L2 GPS, SBAS, and OmniSTAR
Zephyr, Zephyr Geodetic, Z-Plus, Micro-Centered™	Refer to antenna specification
Temperature	
Operating	–40 °C to +65 °C –40 °F to +149 °F)[1]
Storage	–40 °C to +80 °C (–40 °F to +176 °F)
Humidity	MIL-STD 810F, Method 507.4
Waterproof	IP67 for submersion to depth of 1 m (3.3 ft), dustproof
Shock and Vibration	
Drop	Designed to survive a 1 m (3.3 ft) pole drop onto a hard surface
Shock – Non-operating	To 75 g, 6 ms
Shock – Operating	To 40 g, 10 ms, saw-tooth
Vibration	Tested to Trimble ATV profile (4.5 g RMS): 10 Hz to 300 Hz: 0.04 g/Hz;[2] 300 Hz to 1,000 Hz; –6 dB/octave

Trimble

Specifications

Trimble SPS461
Modular GPS Heading Receiver

Measurements	
	Advanced Trimble Maxwell™ 5 Custom GPS Chip
	High-precision multiple correlator for L1/L2 pseudo-range measurements
	Unfiltered, unsmoothed pseudo-range measurements data for low noise, low multipath error, low-time domain correlation, and high-dynamic response
	Very low noise carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
	L1/L2 signal-to-noise ratios reported in dB-Hz
	Proven Trimble low elevation tracking technology
	72-channel L1 C/A code, L1/L2 Full Cycle Carrier
	Trimble EVEREST™ multipath signal rejection
	2-channel MSK Beacon (Optional)
	4-channel SBAS (WAAS/EGNOS/MSAS)
Code Differential GPS Positioning[2]	
Correction type	DGPS RTCM 2.x
Correction source	DGPS Base via radio or Internet
Horizontal accuracy	±(0.25m + 1 ppm) RMS ±(0.8 ft + 1 ppm)
Vertical accuracy	±(0.50m + 1 ppm) RMS ±(1.6 ft + 1 ppm)
SBAS (WAAS/EGNOS/MSAS) Positioning[3]	
Horizontal accuracy	Typically <1 m (3.3 ft)
Vertical accuracy	Typically <5 m (16.4 ft)
OmniSTAR Positioning	
VBS service accuracy	Horizontal <1 m (3.3 ft)
XP service accuracy	NA
HP service accuracy	NA
Location RTK Positioning[2]	
Horizontal accuracy	NA
Vertical accuracy	NA
Precise Heading	
Heading accuracy	
2 m antenna separation	0.09° RMS
10 m antenna separation	0.05° RMS
Power	
Internal	NA
External	Power input on the 26-pin D-sub connector is optimized for Trimble lithium-ion battery input with a cut-off threshold of 9.5 V
	9.5 V DC to 28 V DC external power input with over-voltage protection
	Receiver automatically turns on when connected to external power
Power over Ethernet (PoE)	44 V DC to 57 V DC, IEEE802.3af compliant device
Power consumption	6.0 W in rover mode with internal receive radio

Specifications

Trimble SPS461
Modular GPS Heading Receiver

Operation Time on Internal Battery

Rover	NA
Base station	NA
450 MHz systems	

Regulatory Approvals

FCC: Part 15 Subpart B (Class B Device) and Subpart C, Part 90
Industry Canada: ICES-003 (Class B Device), RSS-210, RSS-Gen, RSS-310, RSS-119
R&TTE Directive: EN 301 489-1/-5/-17, EN 300 440, EN 300 328, EN 300 113, EN 60950, EN 50371
ACMA: AS/NZS 4295 approval
CE mark compliance
C-tick mark compliance
RoHS compliant
WEEE compliant

Communications

Lemo (Serial)	NA
Modem 1 (Serial)	26-pin D-sub, Serial 2, Full 9-wire RS232, using adaptor cable
Modem 2 (Serial)	26-pin D-sub, Serial 3, 3 wire RS-232, using adaptor cable
1PPS (1 pulse-per-second)	Available
Ethernet	Through a multi-port adaptor
Bluetooth® wireless technology	Fully-integrated, fully-sealed 2.4 GHz Bluetooth module[4]
Integrated radios (optional)	Fully-integrated, fully-sealed internal MSK Beacon and 450 MHz (UHF) Rx only, Internal MSK Beacon only or Internal 900 MHz Rx only
Channel spacing (450 MHz)	12.5 kHz or 25 kHz spacing available
450 MHz output power	NA
900 MHz output power	NA
Frequency approvals (900 MHz)	NA
External GSM/GPRS, cell phone support	Supported for direct-dial and Internet-based correction streams
Internal MSK Beacon receiver	If internal MSK Beacon Radio is installed[6] Frequency range 283.5–325.0 kHz Channel spacing 500 Hz MSK bit rate 50, 100, and 200 bps Demodulation minimum shift key (MSK)
Correction data input	RTCM 2.x
Correction data output	Repeat DGPS RTCM from MSK Beacon or OmniSTAR VBS source
Data outputs	NMEA, GSOF, 1PPS Time Tags

Specifications

Trimble SPS461
Modular GPS Heading Receiver

Receiver Upgrades	
	Location RTK OmniSTAR, Location RTK PV, Precise RTK
Notes	*1 Receiver will operate normally to –40 °C.*
	2 Accuracy and reliability may be subject to anomalies such as multipath, obstructions, satellite geometry, and atmospheric conditions. Always follow recommended practices.
	3 Depends on SBAS system performance.
	4 Bluetooth type approvals are country specific. For more information, contact your local Trimble office or representative.
	5 Two of the supported antennas (See Antenna Options) must be connected for heading.
	6 One of the antennas must be a GA530 for MSK Beacon signal reception.
Specifications subject to change without notice.	

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Trimble Authorized Distribution Partner

4125i

SIDE SCAN SONAR SYSTEM

FEATURES

- Ultra high resolution images
- Lightweight for one person deployment
- Standard heading, pitch, roll & pressure sensors
- Choice of dual simultaneous frequencies
- Runs on AC or DC
- Pole mount option for shallow water use

APPLICATIONS

- Hydrographic Surveys
- Geological Surveys
- Search & Recovery
- Channel/Clearance Surveys
- Bridge/Pier/Harbor Wall Inspection
- Hull Inspections

EdgeTech's 4125i Side Scan Sonar System was designed with both the Search & Recovery (SAR) and shallow water survey communities in mind. The 4125i utilizes EdgeTech's Full Spectrum® CHIRP technology, which provides higher resolution imagery at ranges up to 50% greater than non-CHIRP systems operating at the same frequency. This translates into more accurate results and faster surveys, thus cutting down on costs.

Two dual simultaneous frequency sets are available for the 4125i depending on the application. The 400/900 kHz set is the perfect tool for shallow water survey applications, providing an ideal combination of range and resolution. The 600/1600 kHz set is ideally suited for customers that require ultra high resolution imagery in order to detect very small targets (SAR).

The 4125i system can be powered by both AC and DC for added versatility and is delivered in portable rugged cases for ease of transport from site-to-site. As is standard with all of EdgeTech's towed side scan systems, the 4125i comes with a safety recovery system which will prevent the loss of a towfish if it becomes snagged on an obstacle during a survey.

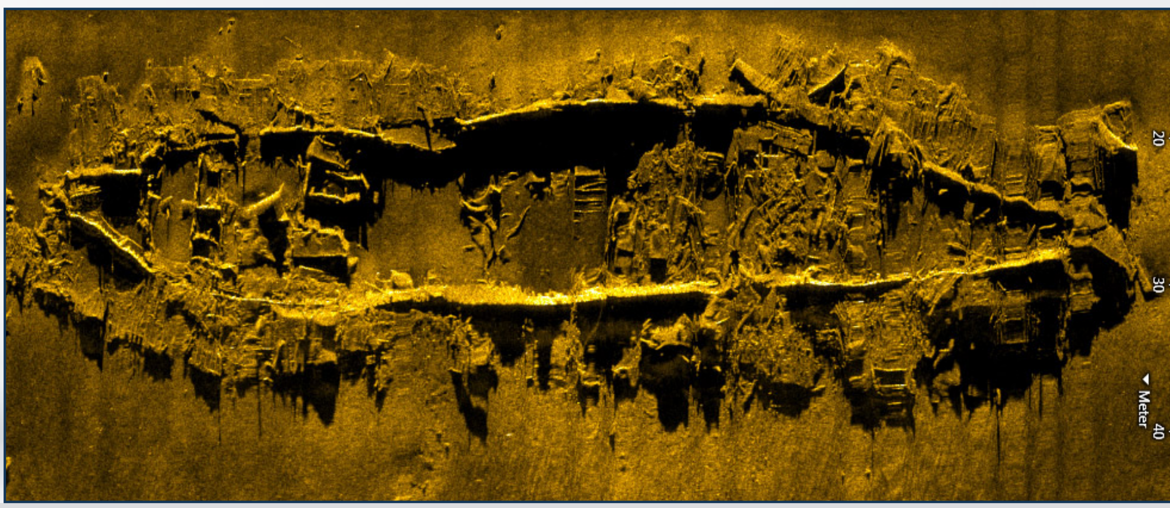
A standard 4125i System comes with a rugged stainless steel towfish and a portable water resistant topside processor including a laptop computer (Optional: Splash Proof/Ruggedized Laptop). A 50 meter Kevlar tow cable is included as standard with customer-specified lengths also available. Multiple options are available such as a v-fin depressor, keel weight, pole mount and hull scan bracket for added versatility.

4125i

SIDE SCAN SONAR SYSTEM

KEY SPECIFICATIONS

SONAR	
Frequencies (Dual Simultaneous)	Choice of either a 400/900 kHz or 600/1600 kHz towfish
Pulse Type	EdgeTech's Full Spectrum® CHIRP
Operating Range	200m @ 400 kHz, 75m @ 900 kHz; 120m @ 600 kHz, 35m @ 1600 kHz
Horizontal Beam Width	0.46° @ 400 kHz, 0.28° @ 900 kHz; 0.33° @ 600 kHz, 0.20° @ 1600 kHz
Vertical Beam Width	50°
Resolution Across Track	400 kHz: 2.3 cm, 900 kHz: 1.0 cm, 600 kHz: 1.5 cm, 1600 kHz: 0.6 cm
TOWFISH	
Diameter	9.5 cm (3.75 inches)
Length	112 cm (44 inches)
Weight in Air	20 kg (44 pounds)
Tow Cable Type	Coaxial up to 600m max length (will provide a typical operational depth down to 200m)
Max Depth Rating of Towfish	200m
Material	Stainless Steel
Standard Sensors	Heading, Pitch, Roll, Pressure (Depth)
TOPSIDE PROCESSOR	
Power Input	12-24 VDC or 115/230 VAC, 50/60 Hz
Connections	AC, DC, Ethernet (to laptop), Towfish
Hardware	Laptop Computer (Optional: Splash Proof/Ruggedized Laptop)
Operating System	Windows® 7 & Windows® 10
Acquisition Software	EdgeTech DISCOVER
SYSTEM OPTIONS	
	Keel weight, v-fin depressor wing, pole mount, quick change hull scan bracket



info@EdgeTech.com | USA 1.508.291.0057

Teledyne Odom Hydrographic

Echotrac CV100

Single or Dual Channel Echo Sounder

Compact Survey Solution

Move into the digital age with echo sounders from Teledyne Odom Hydrographic. If your survey does not require traditional paper records, then forget about piles of hard copy – the CV-100 has eliminated all that in favor of digital imaging on a PC-based data acquisition system.

With the same technology as the popular Echotrac CV and Echotrac MKIII, including Ethernet communications, Teledyne Odom's CV100 single or dual channel sounder is ready to simplify your transition to the convenience of an all-digital system.

Photo courtesy of Teledyne Oceanscience.

PRODUCT FEATURES

- Multiple time varied gain (TVG) curves (10, 20, 30, and 40 log)
- DSP digitizer with manual filter control
- Manual or auto scale changes (phasing)
- Calibration menu with controls for transducer draft and index plus sound velocity and bar depth controls
- Rugged and waterproof (IP65)
- Help menus
- Flash memory upgradeable
- Auto Gain and Auto Power Modes for minimal operator input
- Suitable for autonomous vessels

A Teledyne Marine Company

TELEDYNE
ODOM HYDROGRAPHIC
Everywhereyoulook™

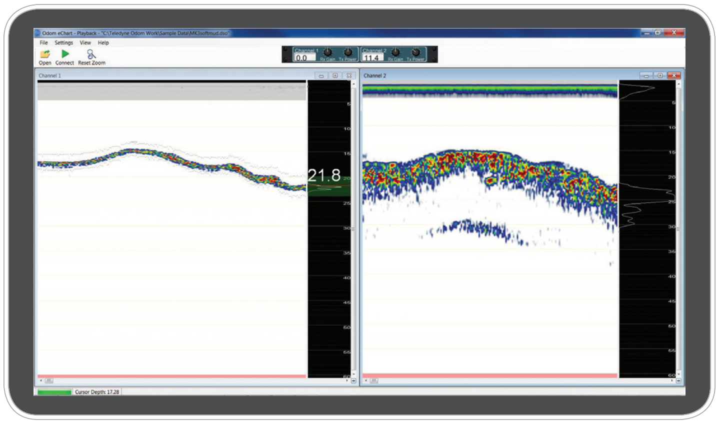
Echotrac CV100

Digital Hydrographic Echo Sounder

TECHNICAL SPECIFICATIONS

Single Channel Configuration[1]	High: 100kHz-750kHz (manual tuning in 1-kHz steps) Low: 3.5kHz-50kHz (manual tuning in 1-kHz steps) variable receiver bandwidth
Dual Channel Configuration	High: 100 kHz-340kHz Low: 24 kHz-50kHz
Resolution	0.01m, 0.1 ft.
Accuracy *(corrected for sound velocity)*	200kHz-0.01 m +/- 0.1% depth 33kHz-0.10 m +/- 0.1% depth
Output Power	Up to 300 watts RMS < 1 watt minimum
Ping Rate	Up to 20Hz in shallow water (10m) range
Depth Range	From <30cm to 600m (depending on frequency and transducer selected)
Input Power Requirement	9-32VDC < 15 watts
Weight	5kg (11lbs)
Dimensions	28cm W (11 in) x 23cm H (9 in) x 11.5cm (4.5 in) D
Mounting	Desktop or bulkhead mount (fixing hardware included)
Ports/Interface	Ethernet (LAN) plus 4 x RS232 or 3 x 232 and 1 x RS422 Inputs from external computer, motion sensor, sound velocity Outputs to external computer or remote display Output string: Odom Echotrac SBT, NMEA DBS, NMEA DBT, DESO 25 Heave Input-TSS1 or "Sounder Sentence" Echotrac Control SW - Simple Windows compatible graphical user interface Storage of full ping to seabed data in DSO format with e-Chart (easily compressed or converted to .XTF for additional processing)
Environmental	Operating 0-50°C Storage -20°-70°C
Options	Heave Sensor
Software Control & Logging Software	Windows based software included: eChart Display

1 Frequency agile in 2 bands (specify band at time of order).



eChart Software.

TELEDYNE ODOM HYDROGRAPHIC
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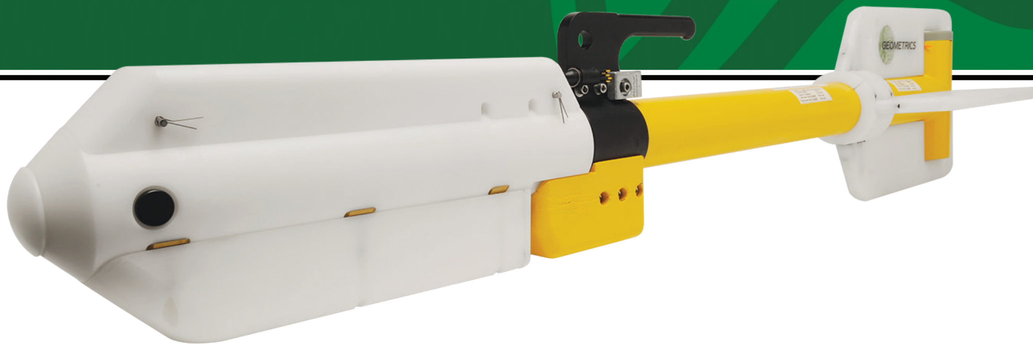
G-882

Cesium Marine Magnetometer

GEOMETRICS
Innovation • Experience • Results



Geometrics' G-882 Marine Magnetometer is the leading marine system in the industry with over 1,000 systems sold! The G-882 is the only system that meets the standards for UXO clearance in the North Sea.

This very high-resolution Cesium vapor marine magnetometer is low in cost, small in size, and offers flexibility for professional surveys in shallow or deep water. Use your personal computer with our MagLog™ software to log, display and print GPS position and magnetic field data.

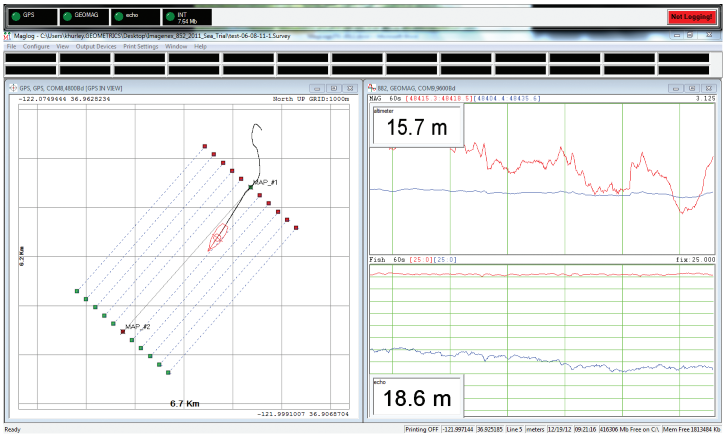
The system directly interfaces to all major side-scan manufacturers for tandem tow configurations. Being small and lightweight, it is easily deployed and operated by one person. But add several streamlined weight collars and the system can quickly weigh more than 100 lbs for deep-tow applications.

This marine magnetometer system is particularly well-suited for the detection and mapping of all sizes of ferrous objects. This includes anchors, chains, cables, pipelines, ballast stones and other scattered shipwreck debris, munitions of all sizes (UXO), aircraft, engines and any other object with a magnetic expression. The G-882 is also perfect for geological studies. Its high sensitivity and high sample rates are maintained for all applications.

Objects as small as a 5-inch screwdriver are readily detected provided that the sensor is close to the seafloor and within practical detection range (refer to table on back).

FEATURES & BENEFITS

- **Cesium Vapor High Performance** – Highest detection range and high probability of detecting all sized ferrous targets.
- **Streamlined Design for Tow Safety** – Low probability of fouling in fishing lines or rocks. Rugged fiber-wound fiberglass housing.
- **Sample at up to 20Hz** – Unparalleled data density while also covering larger areas per day.
- **Sensor can be Rotated for Optimal Signal** – Can be used worldwide.
- **Easy Portability and Handling** – No winch required. Built-in easy-carry handle. Operable by a single man; only 44 lb with 200 ft cable.
- **Combine Multiple Systems for Increased Coverage** – Internal CM-221 Mini-counter provides multi-sensor sync and data concatenation, allowing side-by-side coverage which maximizes detection of small targets and reduces noise.
- **Export Version Available** – Use anywhere in the world without need for an export license (except embargoed countries). See specifications.



MagLogLite™ Data Logging software is included with each magnetometer and allows recording and display of data and position with automatic anomaly detection. Additional software options include: MagLog Pro™, advanced logging software; MagMap™, a plotting and contouring package; and MagPick™ post-acquisition processing software.

MAGNETOMETER / ELECTRONICS

Operating Principle: Self-oscillating split-beam Cesium vapor (non-radioactive).

Operating Range: 20,000 to 100,000 nT.

Operating Zones: The earth's field vector should be at an angle greater than 10° from the sensor's equator and greater than 6° away from the sensor's long axis. Automatic hemisphere switching.

Noise: $<0.004\ nT/\sqrt{Hz}_{rms}$. (SX (export) version: $<0.02\ nT/\sqrt{Hz}_{rms}$).

Max Sample Rate: 20 Hz.

Heading Error: < 1 nT (over entire 360° spin).

Output: RS-232 at 1,200 to 19,200 Baud.

Power: 24 to 32 VDC, 0.75 A at power-on and 0.5 A thereafter.

MECHANICAL

Sensor Fish

DIA: 7 cm; L: 137 cm (2.75x54 in) (with fin assembly).
Weight: 18 kg (40 lb).

Includes sensor and electronics and 1 main weight. Additional collar weights are 6.4 kg (14 lb) each; total of 5 capable.

Tow Cable

DIA: 12 mm; L: 800 m (0.47 in x 2,625 ft).
Weight: 7.7 kg (17 lb) with terminations.
Break strength: 1,630 kg (3,600 lb)
Bend diameter: 30 cm (12 in).

Typical Detection Range for Common Objects

1.	Ship: 1000 tons	0.5 to 1 nT at 800 ft (244 m)
2.	Anchor: 20 tons	0.8 to 1.25 nT at 400 ft (120 m)
3.	Automobile	1 to 2 nT at 100 ft (30 m)
4.	Light Aircraft	0.5 to 2 nT at 40 ft (12 m)
5.	Pipeline (12 inch)	1 to 2 nT at 200 ft (60 m)
6.	Pipeline (6 inch)	1 to 2 nT at 100 ft (30 m)
7.	Iron: 100 kg	1 to 2 nT at 50 ft (15 m)
8.	Iron: 100 lb	0.5 to 1 nT at 30 ft (9 m)
9.	Iron: 10 lb	0.5 to 1 nT at 20 ft (6 m)
10.	Iron: 1 lb	0.5 to 1 nT at 10 ft (3 m)
11.	Screwdriver: 5-inch	0.5 to 2 nT at 12 ft (4 m)
12.	Bomb: 1000 lb	1 to 5 nT at 100 ft (30 m)
13.	Bomb: 500 lb	0.5 to 5 nT at 50 ft (16 m)
14.	Grenade	0.5 to 2 nT at 10 ft (3 m)
15.	Shell: 20 mm	0.5 to 2 nT at 5 ft (1.8 m)

ENVIRONMENTAL

Operating Temperature: -35°C to +50°C (-30°F to +122°F).

Storage Temperature: -45°C to +70°C (-48°F to +158°F).

Altitude: 9,000 m (30,000 ft).

Depth: 4,000 psi (2,730 m; 8956 ft).

Water Tight: O-Ring sealed for up to 4,000 psi depth operation.

ACCESSORIES

Standard: Operation manual, shipping/storage container, ship kit with tools and hardware, power supply, MagLogLite™, MagMap™ and MagPick™ processing software, depth transducer, altimeter.

Optional: Steel tow cable to 6,000 m (19,600 ft) with telemetry, longitudinal or transverse gradiometer, plastic Pelican® case, MagLogPro™, collar weights.

Specifications subject to change without notice. G-882_v1 (0118)

GEOMETRICS
Innovation • Experience • Results

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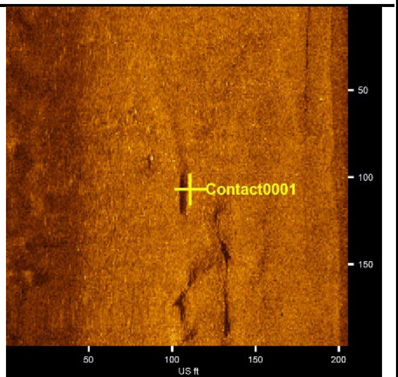
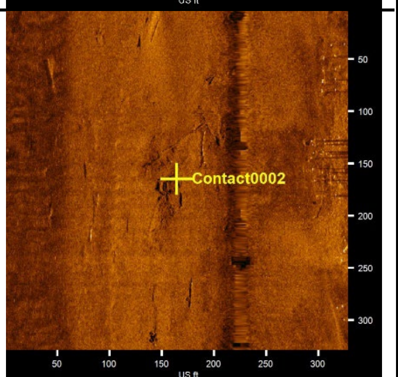
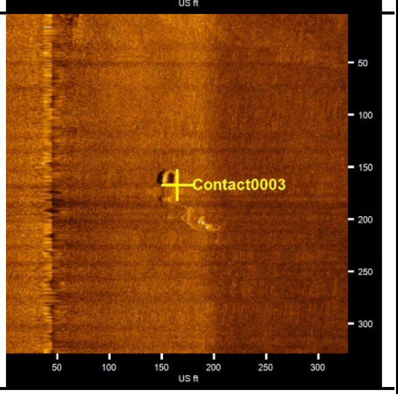
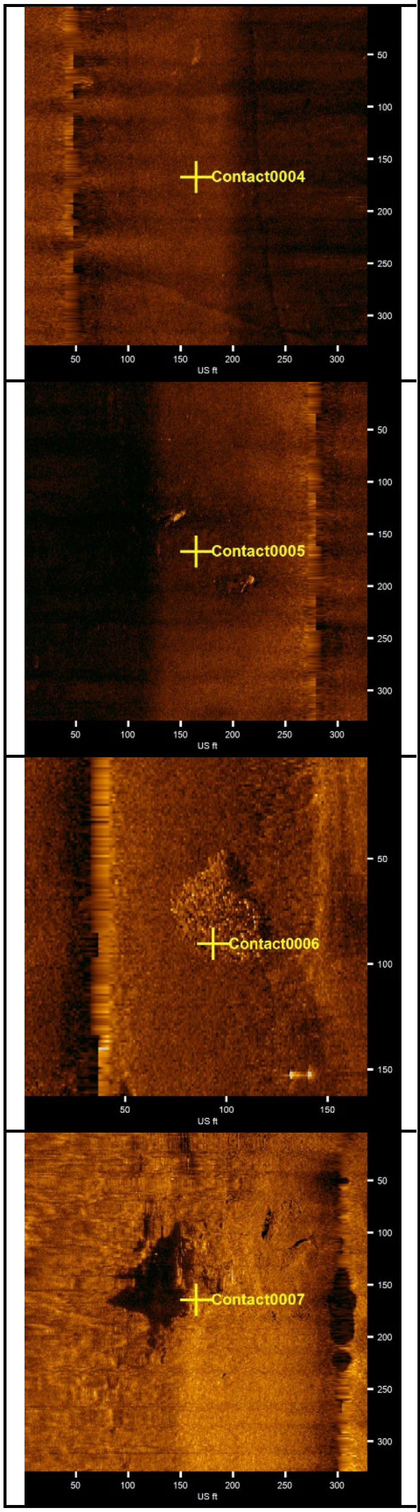
Appendix F: Side Scan Sonar Contact Report and Side Scan Sonar Mosaics

Side Scan Sonar Contact Report

Target Image	Target Info	User Entered Info
	[redacted]	
		
		



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US ft
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Contact0006
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Contact0007
US ft

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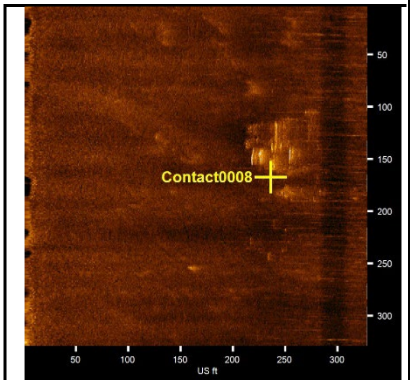
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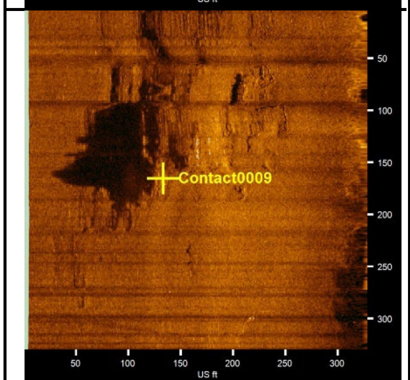
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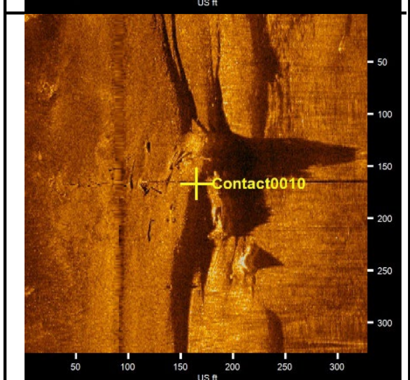
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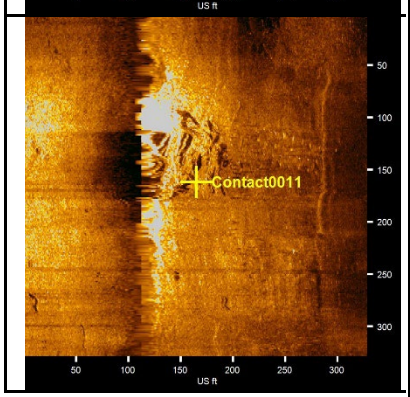
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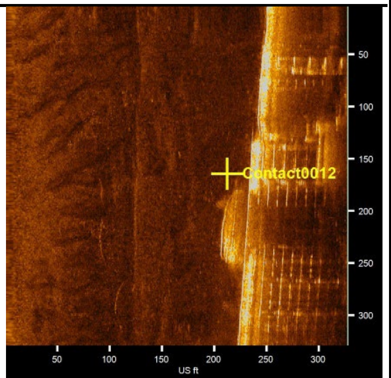
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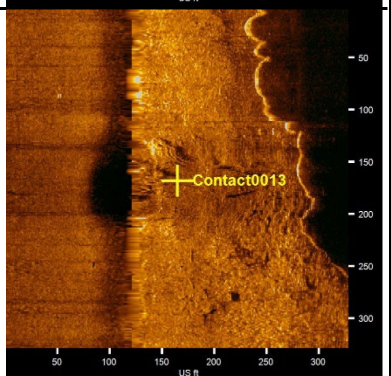
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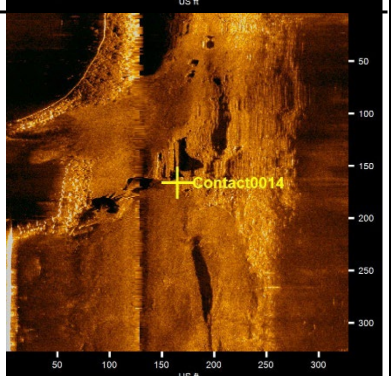
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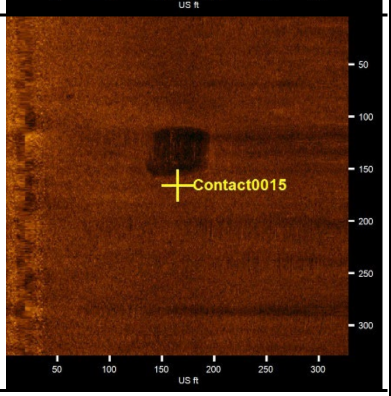
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US ft

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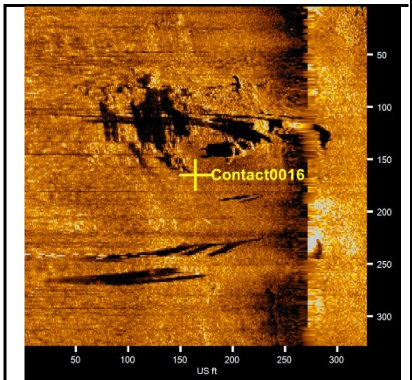
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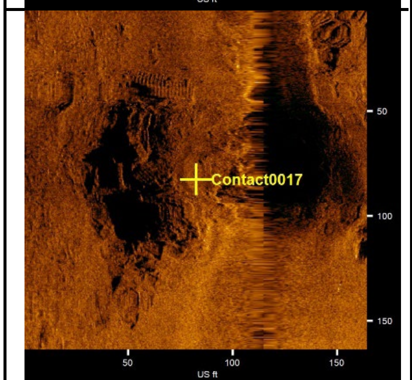
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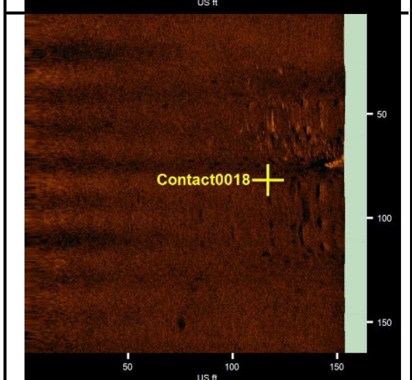
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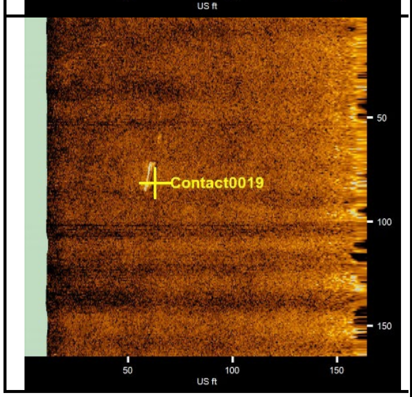
Contact0019
US ft

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Appendix G: Magnetic Anomalies and Magnetometer Anomaly Map Set

B1

Anomaly Number	Easting	Northing	Intensity (nT)	Duration (ft)	Signature	Status	Description
[redacted]							

Anomaly Number	Easting	Northing	Intensity (nT)	Duration (ft)	Signature	Status	Description
[redacted]							

B2

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

B3

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

B4

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

B5

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

B6

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

B8

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

B9

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Existing CCSC

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description

[redacted]

New Cut

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Number	Easting	Northing	Intensity (nT)	Duration (ft)	Type	Status	Description
[redacted]							

Appendix H: SS *Mary* (41NU252), *Utina* (41NU264/41NU292) and 41AS119

Utina (41NU264/41NU292)

41AS119

Appendix I: Memorandum of Agreement Between the US Army Corps of Engineers, Galveston District, The Port of Corpus Christi Authority and the Texas State Historic Preservation Officer Regarding Alternate Mitigation Measure for Site 41NU252

RECEIVED

JAN 2 6 2018

MEMORANDUM OF AGREEMENT
BETWEEN THE
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT,
THE PORT OF CORPUS CHRISTI AUTHORITY OF NUECES COUNTY, TEXAS
AND THE
TEXAS STATE HISTORIC PRESERVATION OFFICER
REGARDING ALTERNATE MITIGATION MEASURES
FOR SITE 41NU252

WHEREAS, the U.S. Army Corps of Engineers, Galveston District (USACE) and the Port of Corpus Christi Authority of Nueces County, Texas (PCCA) plan to carry out the Corpus Christi Ship Channel Improvement Project pursuant to Section 1001(40) of the Water Resources Development Act of 2007 (Public Law 110-114) and modified by Section 7003 of the Water Resources Reform and Development Act of 2014 (Public Law 113-121); and

WHEREAS, the undertaking consists of deepening and widening the Corpus Christi Ship Channel and construction of barge lanes; and

WHEREAS, the USACE has determined that the undertaking will have an adverse effect on site 41NU252 (the wreck of SS *Mary*), which has been determined eligible for listing on the National Register of Historic Places (NRHP) under criterion A and C, and has consulted with the Texas State Historic Preservation Officer (SHPO) pursuant to 36 CFR 800, of the regulations implementing Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108); and

WHEREAS, the USACE, the PCCA, and the SHPO have determined that standard data recovery for site 41NU252 is not possible due to the strong currents, the proximity to ship traffic, and near-zero visibility; and

WHEREAS, in accordance with 36 CFR 800.6(a)(1), the USACE has notified the Advisory Council on Historic Preservation (Council) of its adverse effect determination with specified documentation and the Council has chosen not to participate in the consultation pursuant to 36 CFR 800.6(a)(1)(iii);

NOW, THEREFORE, the USACE, the PCCA, and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

The following alternate mitigation measures shall be carried out:

I. *Remote Sensing Survey of SS* Mary. The USACE shall conduct a remote sensing survey of the site 41NU252 in the Corpus Christi Ship Channel including, but not limited to, side-scan sonar and/or multi-beam survey. The survey will meet or exceed the minimum state underwater archeological survey standards presented in the Texas Administrative Code, Title 13, Part 2, Chapter 28, Rule§28.6. The resulting data will be processed and analyzed by a Marine Archeologist and presented and summarized in a technical brief.

II. *Interactive Educational Materials for children ages 3 to 12.* The USACE shall develop educational materials including, but not limited to, hands-on activities such as interactive games, workbook activities, model building, simulated archeology, etc. targeting children ages 3 to 12. These materials are primarily intended for distribution to museums and schools to integrate into their existing Texas History programs. These materials should focus on Texas commercial maritime history and marine archeology within the time period between 1835 (beginning of the Texas Revolution) and 1914 (beginning of World War I). Additionally, the materials should include elements related to the unique craftsmanship of SS Mary and the role that craftsmanship played in Texas maritime history and marine archeology.

III. *Digital Educational Material.* The USACE shall develop digitally based educational material in the form of interactive media, such as a web page, mobile device application, or electronic book that focuses on Texas commercial maritime history and marine archeology. The target audience for this material will be the general public (ages 13 and up). The USACE shall provide for the maintenance of this material for a period of 5 years at which time the material will be curated on archival digital media (i.e. DVD or web archive).

IV. *Educational Poster.* The USACE shall develop a poster highlighting Texas commercial maritime history and marine archeology. This poster shall correlate directly with the digital educational material providing a web link or scannable QR/bar code for mobile devices allowing immediate access to digital content. The poster is intended to target the general public at museums, schools, or public places and connect the public with the digital content.

V. *Public and Professional Outreach.* The USACE shall provide personnel and/or materials that discuss maritime archeology in Texas with specific emphasis on SS Mary and the process of alternative mitigation for shipwrecks in Texas. This outreach is intended for venues such as professional meetings or conferences (SAA, SHA, TAS, etc.), community meetings, or academic settings.

VI. *Developers and Qualifications.* The development of the educational material shall include specialists from the following fields: Historian or Historic Archeologist, Marine Archeologist, Educational Specialist, and a Digital Media specialist.

A. The Historian/Historic Archeologist shall be responsible for the historic accuracy of information contained in the material and shall have either (1) a degree in history, with a demonstrated knowledge of maritime history along the Gulf Coast and at least five years experience along the Texas coast or (2) a graduate degree in Anthropology with a specialization in Gulf Coast maritime history and at least five years work on the Texas coast.

B. The Marine Archeologist shall be responsible for the accuracy of the information on Marine Archeology contained in the material and shall have a graduate degree in either Marine Archeology or in Anthropology with a specialization in marine Archeology and at least five years working as a marine archeologist.

C. The Educational Specialist shall be responsible for ensuring that the information contained in the material is presented at the appropriate age levels and for developing the workshop training packet for instructors; and shall have at least five years of full time classroom/museum teaching experience and one year related to developing social studies curriculum.

D. A Digital Media Specialist shall be responsible for developing a professional high quality electronic media for use on personal computers or mobile devices and have at least five years of relevant experience in web site development, computer programming, and/or electronic publications.

E. The same person may hold multiple roles, provided they meet the minimum qualifications for each role.

VII. *Training for Instructors.* The USACE shall be responsible for providing the required training to instructors at museums or schools for implementing the educational materials in their facilities.

VIII. *Distribution.* The USACE shall be responsible for making the educational materials available to all Intermediate Schools in Texas and Texas Museums requesting the materials.

IX. *Post-Review Discoveries.* Pursuant to 36 CFR 800.13(b)(3), if artifacts are discovered after construction on the undertaking has commenced, the USACE shall identify and evaluate the artifacts and notify the SHPO within 48 hours of the discovery. The notification shall include the USACE assessment of the artifacts and proposed actions to resolve the disposition of any recovered artifacts. Comments received from the SHPO within 48 hours of the notification shall be taken into account by the USACE in carrying out the proposed actions. The USACE may assume SHPO concurrence in its proposed actions unless otherwise notified by the SHPO within 48 hours of notification. USACE shall provide the SHPO a report of the USACE actions when they are completed.

X. *Anti-Deficiency Act.* The USACE's obligations under this MOA are subject to the availability of appropriated funds, and the stipulations of this MOA are subject to the provisions of the Anti-Deficiency Act. The USACE shall make reasonable and good faith efforts to secure the necessary funds to implement this MOA in its entirety. If compliance with the Anti-Deficiency Act alters or impairs the USACE's ability to implement the stipulations of this agreement, the USACE shall consult in accordance with the amendment and terminations procedures found at Stipulations XII and XIII of this agreement.

XI. *Duration.* This MOA will be null and void if its terms are not carried out within seven (7) years from the date of its execution. Prior to such time, the USACE may consult with the other signatories to reconsider the terms of the MOA and amend it in accordance with Stipulation XI below.

XII. *Dispute Resolution.* Should any signatory to this MOA object at any time to any actions proposed or the manner in which the terms of this MOA are implemented, the USACE shall consult with each party to resolve the objection. If the USACE determines that such objection cannot be resolved, the USACE will follow the procedures in 36 CFR 800.7.

XIII. *Amendments.* This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the Council.

XIV. *Termination.* If any signatory to this MOA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to attempt to develop an amendment per Stipulation XI, above. If within thirty (30) days an amendment cannot be reached, any signatory may terminate the MOA upon written notification to the other signatories. Once the MOA is terminated, and prior to work continuing on the undertaking, the USACE must either (a) execute an MOA pursuant to 36 CFR 800.6 or (b) request, take into account, and respond to the comments of the Council under 36 CFR 800.7. The USACE shall notify the signatories as to the course of action it will pursue. Execution of this MOA by the USACE, PCCA and the SHPO and implementation of its terms evidence that USACE has taken into account the effects of this undertaking on historic properties and afforded the Council an opportunity to comment.

Execution of this MOA and implementation of its terms evidences that the USACE has afforded the Council an opportunity to comment on the undertaking and its effects on historic properties, and that the USACE has taken into account those effects and fulfilled Section 106 responsibilities regarding the undertaking.

23 MAR 18

Colonel Lars N. Zetterstrom, District Engineer **Date**

Mark Wolfe 1/26/18

Mark Wolfe, Texas State Historic Preservation Officer **Date**

2-23-18

~~**John P. LaRue, Executive Director**~~ Sean Strawbridge, Chief Executive Officer **Date**
Port of Corpus Christi Authority of Nueces County, Texas

Appendix J: Basic Unanticipated Discoveries Plan

UNANTICIPATED DISCOVERIES OF SUBMERGED CULTURAL RESOURCES

Although a project area may receive a complete cultural resource assessment survey, it is impossible to ensure that all cultural resources will be discovered. Even at sites that have been previously identified and assessed, there is a potential for the discovery of previously unidentified archaeological components and features that may require investigation and assessment. Therefore, a procedure has been developed for the treatment of any unexpected discoveries that may occur during the current project.

If unexpected cultural resources are discovered, the following steps should be taken:

1) Initially, all work in the immediate area of the discovery should cease and reasonable efforts should be made to avoid or minimize impacts to the cultural resources.

2) The Port of Corpus Christi Authority (PCCA) should be contacted immediately and should evaluate the nature of the discovery.

3) The PCCA should then contact the State Historic Preservation Officer (SHPO) and if necessary, the State Marine Archaeologist.

4) As much information as possible concerning the cultural resource, such as resource type, location, and size, as well as any information on its significance, should be provided to the SHPO.

5) Consultation with the SHPO should occur in order to obtain technical advice and guidance for the evaluation of the discovered cultural resource.

6) If necessary, a mitigation plan should be prepared for the discovered cultural resource. This plan should be sent to the SHPO for review and comment. The SHPO should be expected to respond with preliminary comments within two working days, with final comments to follow as quickly as possible.

7) If a formal data recovery mitigation plan is required, development activities in the near vicinity of the cultural resource should be avoided to ensure that no adverse impact to the resource occurs until the mitigation plan can be executed.

In the event that unrecorded shipwreck sites and/or other underwater archaeological resources are discovered (adapted from The Commonwealth of Massachusetts, Board of Underwater Archaeological Resources, Office of Coastal Zone Management):

1) In the event that a suspected shipwreck or other site is uncovered during construction activity, that activity shall immediately be halted in the area of the find until it can be determined whether the object is a shipwreck or other underwater archaeological resource and if it represents a potentially significant feature or site.

2) The project field staff will immediately notify the PCCA upon the suspension of work activities in the area of the find. Notification will include the specific location in which the potential feature or site is located.

3) The PCCA will immediately contact its cultural resource management consultant (Terracon) to review the information. On-site personnel will provide information on the location and any discernible characteristics of the potential cultural resource (the target), and any survey

data depicting the find. This information will be forwarded for review by the PCCA for the cultural resource management consultant.

4) If the project archaeologist determines that the site, feature, or target is not potentially cultural, the project field staff through the PCCA will be notified by the project archaeologist that work may resume. The project archaeologist will also notify the SHPO of this determination.

5) If, based upon both previously acquired and current remote sensing survey data, or other indications (e.g., timbers, etc.), it is determined that the new target is possibly a shipwreck or other potential submerged cultural resource, the project archaeologist will inform the SHPO, who will inform the project field staff that work may not resume at the given location until notified in writing by the SHPO. The cognizant review agencies, SHPO (State Historic Preservation Officer), and Advisory Council (if applicable) will be notified of this determination within 2 working days.

6) A visual inspection by archaeological divers or remotely operated vehicle (ROV) will be conducted to determine if the site is potentially eligible for listing in the National Register. The results of the survey will be formally submitted to cognizant review agencies, SHPO, and the Advisory Council (if applicable) for final review and comment. The SHPO and PCCA will endeavor to respond within 2 working days of receiving the inspection results and recommendations.

7a) If it is determined that the target, feature, or site does not represent a potentially significant resource, and PCCA is in receipt of written comment from the review agency(s), work may resume in that area.

7b) If a National Register determination cannot be made in accordance with Step 6, the PCCA may either undertake additional research to satisfy Step 6 or exercise Step 8 (avoidance).

8) If agency review concurs or concludes that the site may be important and is potentially National Register eligible, the PCCA will develop avoidance measures to eliminate the site from the Area of Potential Effects. Any proposed avoidance measures will be made available to the cognizant review agencies for review and comment.

9) If avoidance measures cannot be developed and executed, the resource may be excavated and/or removed only under a memorandum of agreement with all interested parties including the State Marine Archaeologist, SHPO, USACE, and, if applicable, the Advisory Council subject to appropriate state permits. This memorandum will outline an adequate data recovery plan that specifies a qualified research team and an appropriate research design. The appropriate permits must also be secured from the Texas Historical Commission prior to conducting any further disturbance to the site.