Monitoring Coastal Boundary along Nueces County Beaches

Submitted to:
Nueces County- Coastal Parks
15820 Park Road 22 (S.P.I.D)
Corpus Christi, TX 78418
Attention: Scott Cross, Director

Prepared By:
Deidre D. Williams
The Division of Nearshore Research
The Conrad Blucher Institute for Surveying and Science
Texas A&M University-Corpus Christi
6300 Ocean Drive, Unit 5799
Corpus Christi Texas, 78412
Email: Deidre.Williams@tamucc.edu

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Introduction

Nueces County has been charged with the stewardship of approximately 22 miles of public beach stretching along Mustang and North Padre Islands from Aransas Pass to south of Bob Hall Pier (Fig. 1). This region of the coast has a diverse backshore beach environment including multiple beach access roads, a seawall (North Padre Island Seawall), paved parking (Padre Balli Park) as well as sections of continuous well-established dunes. The features that define the backshore limit of the beach can influence sediment transport across the beach. In addition, three sets of jetties limit and compartmentalize alongshore sediment transport to varying degrees both along the beach as well as in the nearshore. The diversity of backshore features and coastal structures along this stretch of barrier island beach creates a challenging environment for coastal resource managers. The maintenance and management of beaches within Nueces County is shared among the cities of Port Aransas and Corpus Christi, the Texas Parks and Wildlife Department (TPWD), and the National Park Service (NPS) as well as Nueces County Coastal Parks.

The monitoring of coastal jurisdictional boundary lines, such as annual high tide (AHT) and mean tide level (MTL), along the Gulf fronting beach is one critical component in establishing a research-based monitoring program that will assist Nueces County in the management of coastal resources including the beach and dune system. Providing access to data describing the coast and archiving that data for ease of access and use by resource staff is essential for proactive management of coastal resources which are subject to dynamic conditions that can change rapidly under storm forcing. Establishing this baseline and a publicly available through an online mapping tool for visualization and comparison, will assist in answering questions related to the rate of shoreline change and help to identify parameters that contribute to erosion and accretion along the beach in areas of high usage. In addition, establishing a baseline data set is critical to long-term land-use planning and for mitigation of impacts such as those sustained during tropical storms. The preliminary step toward this goal was addressed by conducting baseline surveys and the development of an online mapping interface and data archive for Nueces County data sets. The measurement and documentation of these baseline surveys was achieved through a collaborative effort between the Nueces County Parks System, the Conrad Blucher Institute for Surveying and Science (CBI) and Naismith Marine Services.

Task 1. Coastal Jurisdictional Boundary Surveys 2014

Two coastal jurisdictional surveys were conducted over a three day period (October 27-30, 2014); a mean tide level (MTL) survey and an annual high tide (AHT) survey. The surveys were conducted by Naismith Marine Services in collaboration with the Conrad Blucher Institute for Surveying and Science. A description of the survey method, control, and related exhibits are included in Appendix 1. The data is also provided online through the mapping tool website, Coastal Habitat Restoration GIS (CHRGIS), to allow for detailed review of the data at user defined extents. These data sets provide a baseline for the region extending from Aransas Pass to the Nueces-Kleberg county line.

Review of the data was divided into three regions based on limitations in sediment transport represented by coastal structures; 1) Aransas Pass to Fish Pass (Fig. 2), 2) Fish Pass to Packery Channel (Fig. 3) and 3) Packery Channel to Nueces-Kleberg county line (Fig. 4). Within these regions the review of the baseline positions of AHT and MTL was further subdivided with an emphasis on significant changes in backshore features or other parameters such as park boundaries where the type of beach management, including the lack of sargassum removal, differs significantly. The region from *Aransas Pass to Fish Pass* has large stretches of beach with a nearly continuous duneline. Along this region the duneline is interrupted by 9 access roads along approximately 13 miles of beach with the greatest concentration of access roads within the first 4 miles south of Aransas Pass. From *Fish Pass to Packery Channel* beach maintenance to facilitate vehicular access is limited to a one-mile stretch from Packery Channel to

Newport Pass Rd. which is located north of Newport Pass. This study region also includes the Mustang Island State park which limits all mechanical redistribution of sand to maintain access and does not remove or manage sargassum accumulations on the beach. There are 5 access roads along just less than 5 miles of beach between *Fish Pass and Packery Channel*, two of which straddle the State park picnic area. In contrast, the region south of *Packery Channel to Bob Hall Pier* is characterized by intermittent breaks in the duneline along a less than 3-mile long section of beach. The breaks in the duneline are not only due to numerous access roads (6) but also due to the North Padre Island Seawall (0.75-mile long) and Padre Balli Park infrastructure including paved parking, a roadway and park facilities. The beach south of Packery Channel sustains a large number of users from spring to fall and therefore is subject to frequent redistribution of sand in order to maintain vehicular access. The variability in position of the MTL line and AHT line with alongshore position and relative to backshore infrastructure in these three regions are provided in Appendix 2. The acquisition of future annual survey data will provide for the investigation of the relationship between accelerated shoreline recession and breaks in dune integrity. In addition future research will consider the relationship between beach management practices, such as the management of sargassum in place and shoreline stability.

Figure 1. Beach along Mustang and North Padre Island that is located in Nueces County, Texas

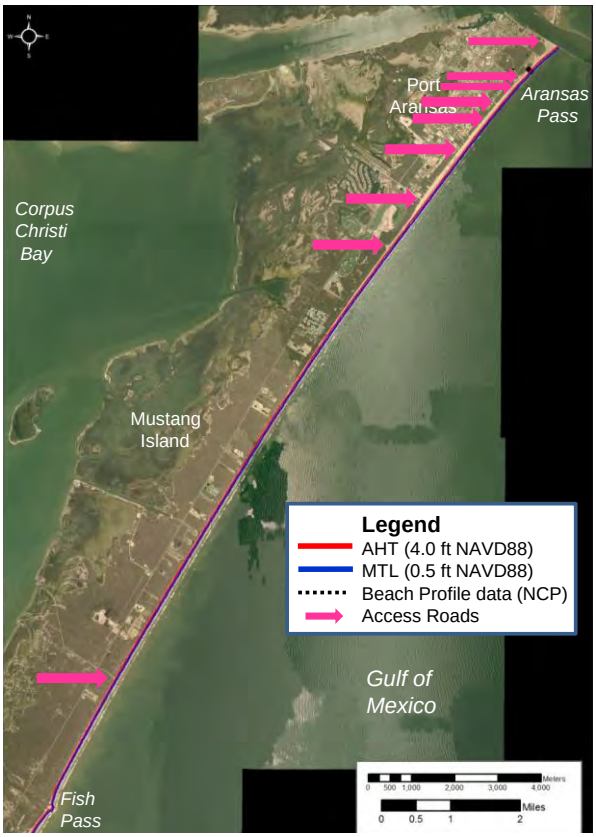


Figure 2. Position of AHT and MTL from Aransas Pass to Fish Pass

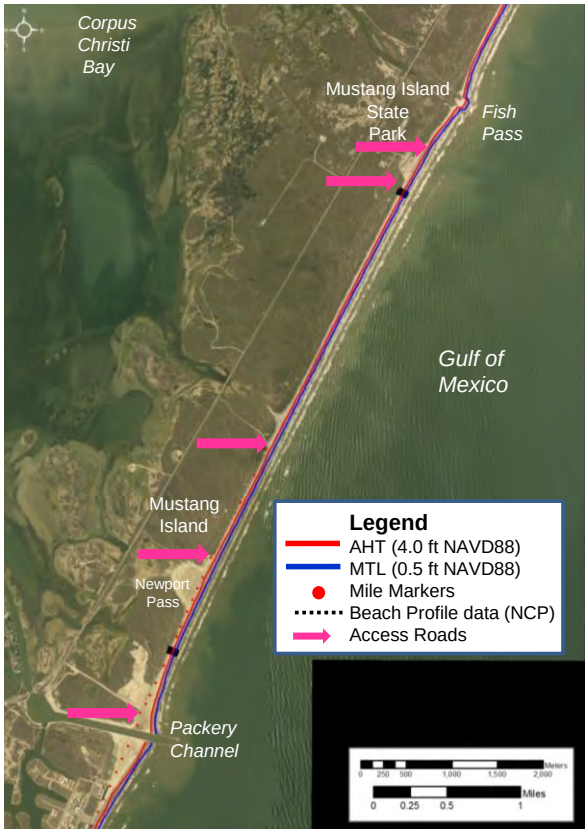


Figure 3. Position of AHT and MTL from Fish Pass to Packery Channel

Task 2. Review and Assimilation of Available Historic Data

A general data review was initiated to include the following; 1) beach profile data collected by Nueces County that is associated with localized habitat and sargassum studies, 2) coastal jurisdictional boundary survey data as available. These data sets were reviewed and assessed for the potential application to future analysis of historic change. One data set was identified through a local engineering group and a request from Nueces County Parks for the digital data is pending as of this reporting. The data provided thus far was not introduced due to lack of reliable coordinate/control information. This process will continue and data that is located and validated will be added to the database and CHRGIS.

Task 3. Coastal Habitat Restoration GIS (CHRGIS)

CHRGIS was established in an effort to provide an online mapping tool for use by coastal resource managers, the public and scientists through the sponsorship of the Texas General Land Office. The mapping tool is maintained and operated by the Conrad Blucher Institute for Surveying and Science at TAMUCC and accessible at http://cartogram.tamucc.edu/chrgis/maps/ (Fig. 5). The mapping tool functions similar to a GIS environment with data layers that may be selected for viewing. A tutorial is available online through the CBI webpage (https://www.cbi.tamucc.edu/wp-content/uploads/CHRGIS-Tutorial.pdf).

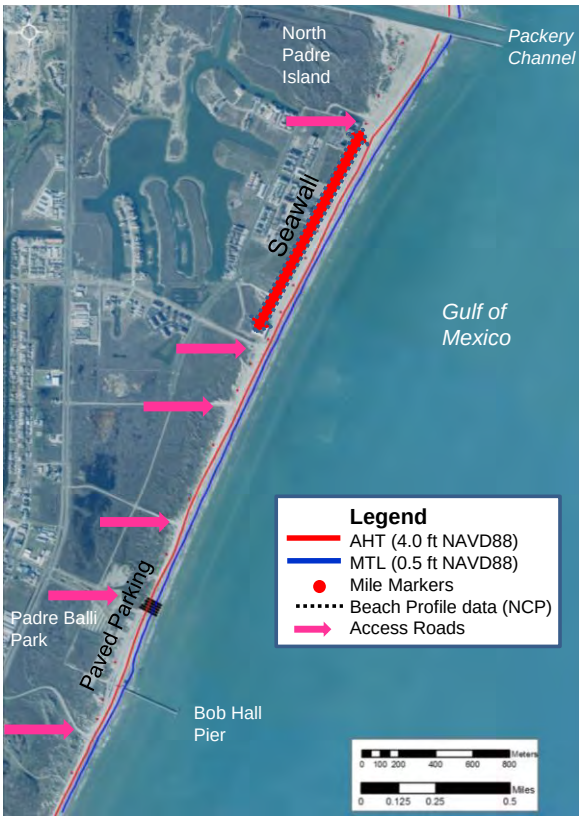


Figure 4. Position of AHT and MTL from Packery to south of Bob Hall Pier at the Nueces-Kleberg county line

The Nueces County survey data collected during 2014 was uploaded to a mapping window created to archive data assimilated and applicable to Nueces County. Additional historic data sets obtained from outside sources will be reviewed and added as available. Data sets collected outside of the CBI monitoring team are provided for reference only and CBI is not responsible for the accuracy of data not directly collected by CBI and Naismith Marine Services. The aerial imagery uploaded to the CHRGIS mapping tool was provided by two sources; 1) the National Agricultural Imagery Program (NAIP), USDA/FSA for the period July 2014 and 2) Texas General Land Office (TGLO), 01 Sep 2014.

The Nueces County CHRGIS interface provides 1) The position of the MTL and AHT, 2) existing aerial imagery obtained for the study period, 3) previously collected profile data provided by Nueces County Coastal Parks System. The CHRGIS interface provides online access of the most recent baseline data set to which future data can be uploaded and applied for comparison. The establishment of this baseline data set for Nueces County beaches is the first step in a broader goal of establishing a comprehensive monitoring program along North Padre Island and Mustang Island.

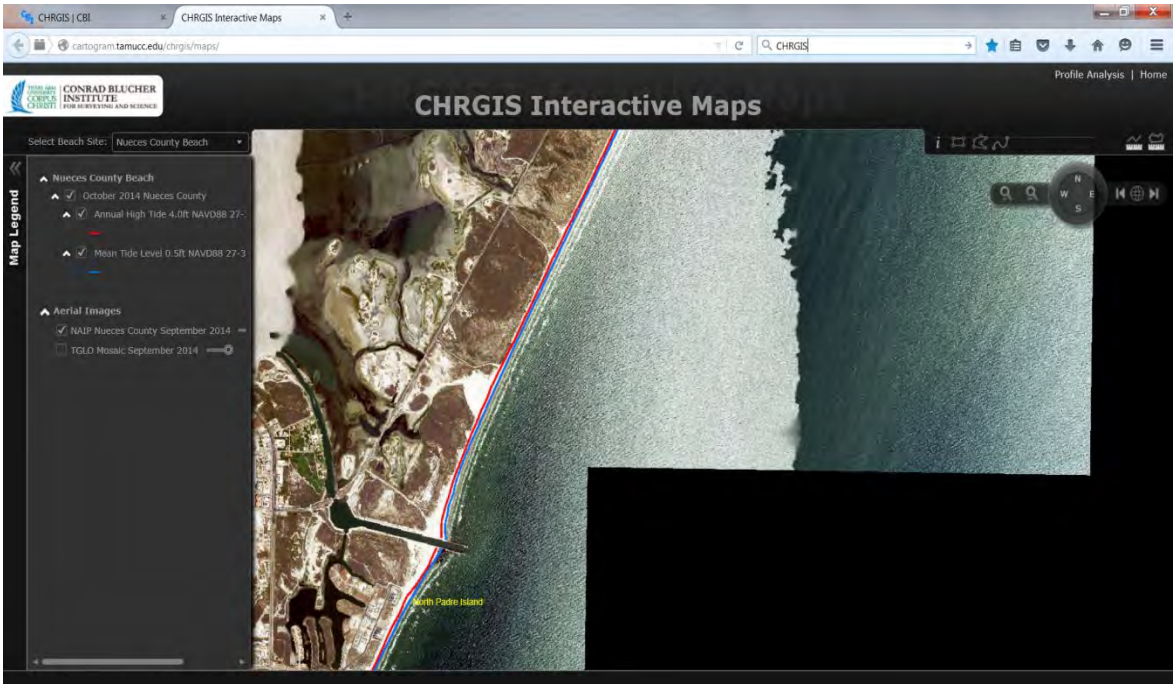


Figure 5. Nueces County mapping interface on CHRGIS (http://cartogram.tamucc.edu/chrgis/maps/)

Task 4. Summary and Recommendations

In order to identify trends in erosion and accretion annual surveys are recommended. Such surveys can be applied to determine longterm rate of change but also can be applied to assess annual changes that influence beach management and maintenance decisions. Recommendations include extending the southerly extent of the survey area to the Padre Island National Seashore (PINS) southern limit in 2015 to accommodate recent changes in beach management along this section of the coastline and to serve as an example of a beach representative of minimal maintenance south of Packery Channel. Additional recommendations include the addition of beach profile surveys from Aransas Pass to the Nueces-Kleberg county line to document both changes in morphology and to apply in the calculation of volume change and analysis of the rate of erosion.

Appendix 1
Survey Report: Nueces County Beach 2014

Naismith Marine Services, Inc.
3765 South Alameda, Suite 205
Corpus Christi, Texas 78411
www.naismithmarine.com (361) 945-0248

Naismith Marine
Hydrographic • Geophysical
Environmental

November 13, 2014

Report of Findings

Beach Surveys in Nueces County

Texas A&M University-Corpus Christi
Conrad Blucher Institute for Surveying and Science

Survey Area (Image from Google Earth)

INTRODUCTION

Naismith Marine, Inc. (Naismith) was contracted by Texas A&M University-Corpus Christi (TAMU-CC) and the Conrad Blucher Institute for Surveying and Science to survey a line of elevation along the Gulf of Mexico beach within Nueces County. The datum applied in this survey would be determined by interpretation of permits supplied by Nueces County by an RPLS designated surveyor. Nueces County supplied U.S. Army Corps of Engineers (USACE) permit SWG-2008-01272 by e-mail on October 6, 2014. This permit authorizes Nueces County to conduct beach maintenance activities between the Annual High Tide (AHT line and Mean Tide Line (MTL) on the Gulf of Mexico Beach within the permit action area. After a review of the USACE permit, it was determined that both the AHT and MTL datums were pertinent to the beach maintenance permit and that both lines should be surveyed. The methods and findings of the survey effort are discussed below.

METHODS

The AHT is synonymous with the "High Tide Line", which is the limit of Section 404 jurisdiction for the USACE in the absence of "adjacent wetlands". For a regulatory definition of the "High Tide Line", see 33 CFR 328.3. To determine the elevation of the AHT line on the Gulf of Mexico beach, Naismith began by reviewing historical tide data at the Port Aransas tide gauge (station 009) to see if there were correlations between the highest tide levels at the tide gauges and on-the-ground features at the project area. The most prevalent and persistent ground feature indicative of high tide levels at the project area was the upper limit of sargassum seaweed on the Gulf beach. A review of the available historical tide data showed that tide levels at the Port Aransas gauge rarely exceed +3.0' (0.91m) NAVD 88. At the Port Aransas tide gauge, a tide level of +3.0' (0.91m) NAVD88 or greater was only reached 4 of the 14 years evaluated. All of the high tide events in excess of +3.0' (0.91m) NAVD88 at both gauges appear to be due to tropical or hurricane events during the summer and fall months. An RTK GPS survey of the project area showed that the upper limit of sargassum seaweed on the beach during the time of the survey was located consistently at an elevation of +4.0' (1.22m) NAVD 88. As such, there is physical evidence on the beach indicating that tide levels reach the +4.0' (1.22m) NAVD 88 elevation level while historical tide data indicates tide levels only reaching near +3.0' (0.91m) NAVD88 with any frequency.

Under 33 CFR Part 328, "Definitions of Waters of the United States", Section 328.3-d states that the High Tide Line "encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm".

The vertical discrepancy between frequent high tides at the nearby tide gauges and physical evidence observed on the beach is most likely due to wave run-up on the sloped beach. During periods of high winds, wave-stacking and run-up on the beach can lead to water levels on the sloped portion of the beach that are higher than the actual tide levels in the adjacent Gulf of Mexico. Because high tide events often coincide with strong wind events, particularly preceding frontal passages in the fall and early spring, these events can be considered "normal" in context of the definition of "Waters of the United States". As such, Naismith determined that because

physical evidence on the beach indicates frequent water levels near the +4.0' NAVD88 elevation and these water level events are likely caused by "normal" wave stacking and wave run-up, all areas below the beach vegetation line (approximate +4.0' (1.22m) NAVD88 contour) are subject to Corps of Engineers jurisdiction and are "Waters of the United States". See Exhibit 2 for historical tide gauge data at the Port Aransas tide gauge.

To determine the MTL on the Gulf Beach, Naismith used the published "Mean Tide Level" datum at the Port Aransas tide gauge (MTL=+0.5' NAVD88), as required by USACE permit SWG-2008-01272.

Other Survey Methodology

The Corps of Engineers' standards for Hydrographic Surveying was followed, where appropriate. The survey also followed "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 were followed where applicable.

Control

Horizontal control was obtained using GPS-RTK. Vertical control was verified using GPS-RTK & static method. All checks were completed using published NOAA-NGS control points. The Horizontal Datum for this project is NAD 83 (North American Datum of 1983), projection is Texas South Zone, US Survey feet. Vertical Datum is feet, NAVD 88.

Control Points used for the survey are as follows:

Northing	Easting	NAVD 88	Control Point
17114439.96	1403745.61	5.2	SJ 175+00
17196944.33	1448233.31	5.7	CG71
17196570.36	1445506.18	6.6	877 5237 TIDAL 2
17158409.43	1425828.14	6.4	G1518
17185006.22	1441717.91	8.2	sf010

Equipment

GPS-RTK – Hemisphere S320 or Trimble R8

AHT Surveyed Near Upper Extent of Scattered Sargassum Weed

FINDINGS

The results of the AHT and MTL survey are shown in Exhibit 1. Both lines were delineated along the entire Nueces County Gulf of Mexico beachfront on October 27-30, 2014. Both continuous lines of elevations were broken at Packery Channel, a maintained, navigable pass between the Laguna Madre and Gulf of Mexico. No difficulties were encountered during the surveys. The AHT followed the upper extent of scattered and decayed sargassum weed along the beach and the MTL was both emergent and submerged during survey, depending on the tide level. Exhibit 3 contains a point list for all points surveyed along both the AHT line and MTL.

STATE OF TEXAS
REGISTERED
JAMES M. NAISMITH
4828
PROFESSIONAL
LAND SURVEYOR

7/9/2015

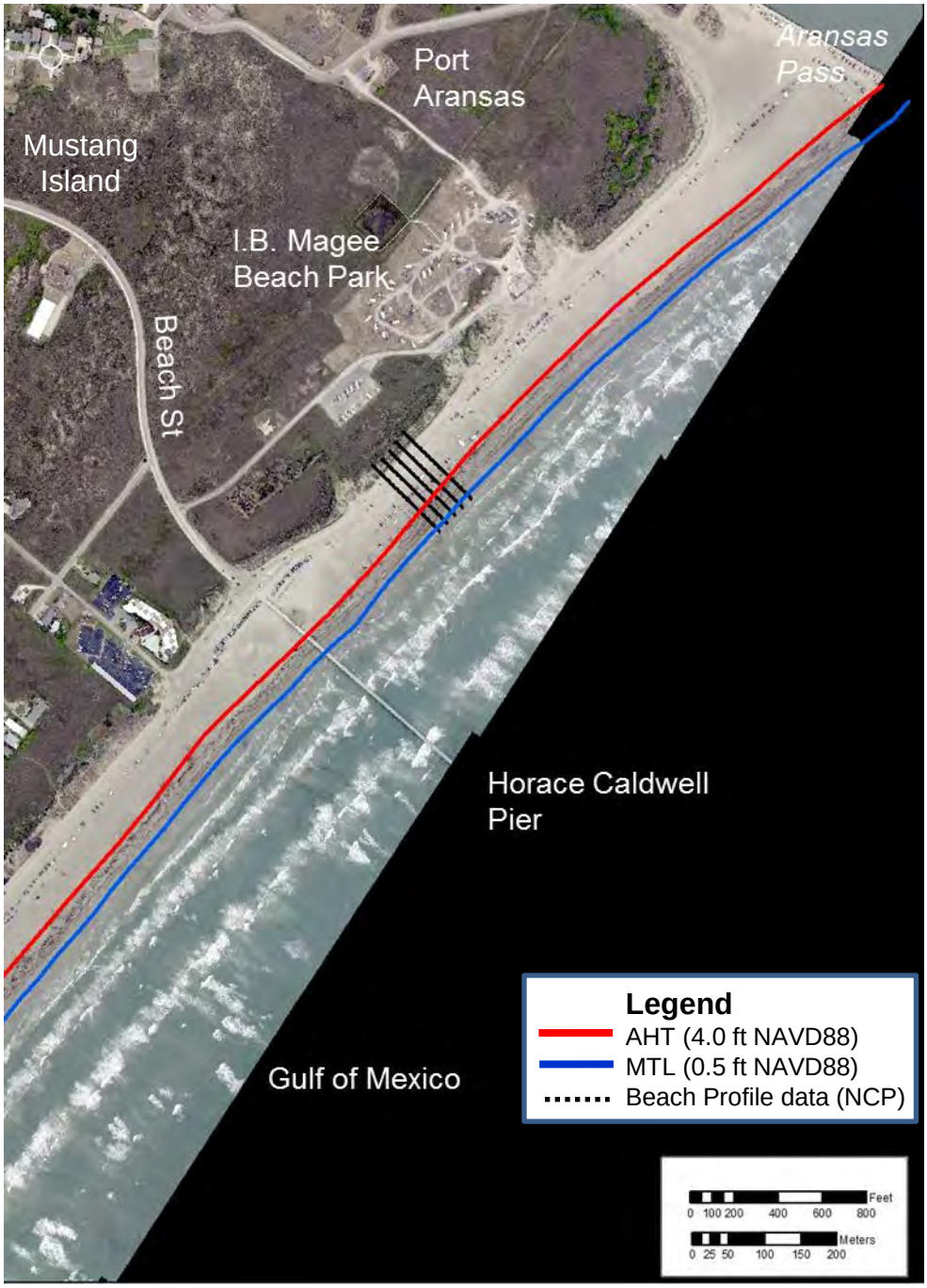
James M. Naismith, RPLS
Naismith Marine Services, Inc.
jim@naismithmarine.com

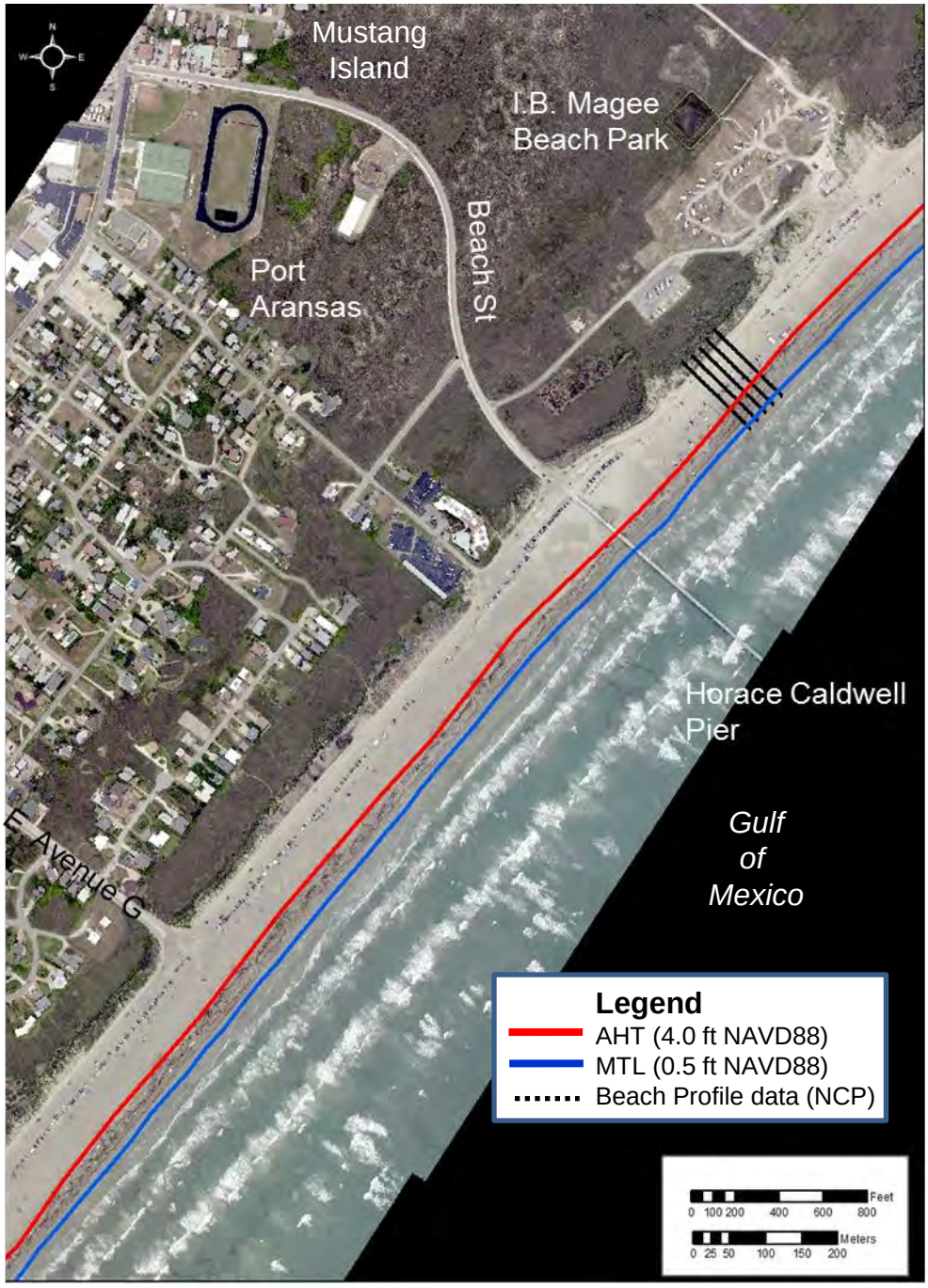
Appendix 2

AHT and MTL from Aransas Pass to Nueces/Kleberg County Line

Aerial Imagery Courtesy Texas General Land Office
(01 September 2014)

Section 1: Aransas Pass to Fish Pass




Mustang Island
I.B. Magee Beach Park
Beach St
Port Aransas
Horace Caldwell Pier
E Avenue G
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Beach Profile data (NCP)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200


N
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E Ave. G
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Sandcastle Dr
Sandcastle
Condominiums
Island Retreat
Gulf
of
Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Feet
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Meters
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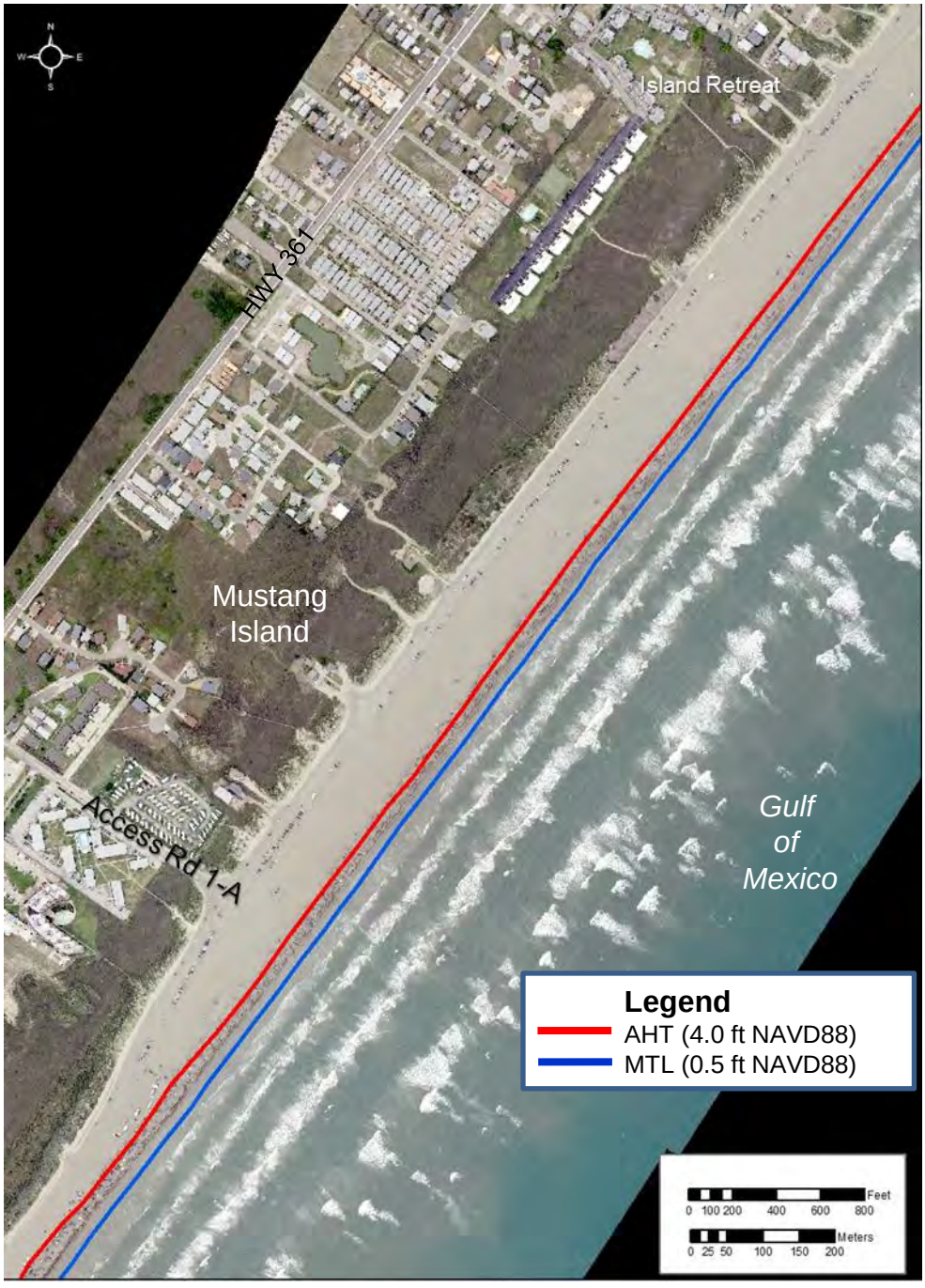
Island Retreat
HWY 361
Mustang
Island
Access Rd 1-A
Gulf
of
Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200


Mustang Island
Palmilla Beach Golf Club
Access Rd 1-A
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Feet
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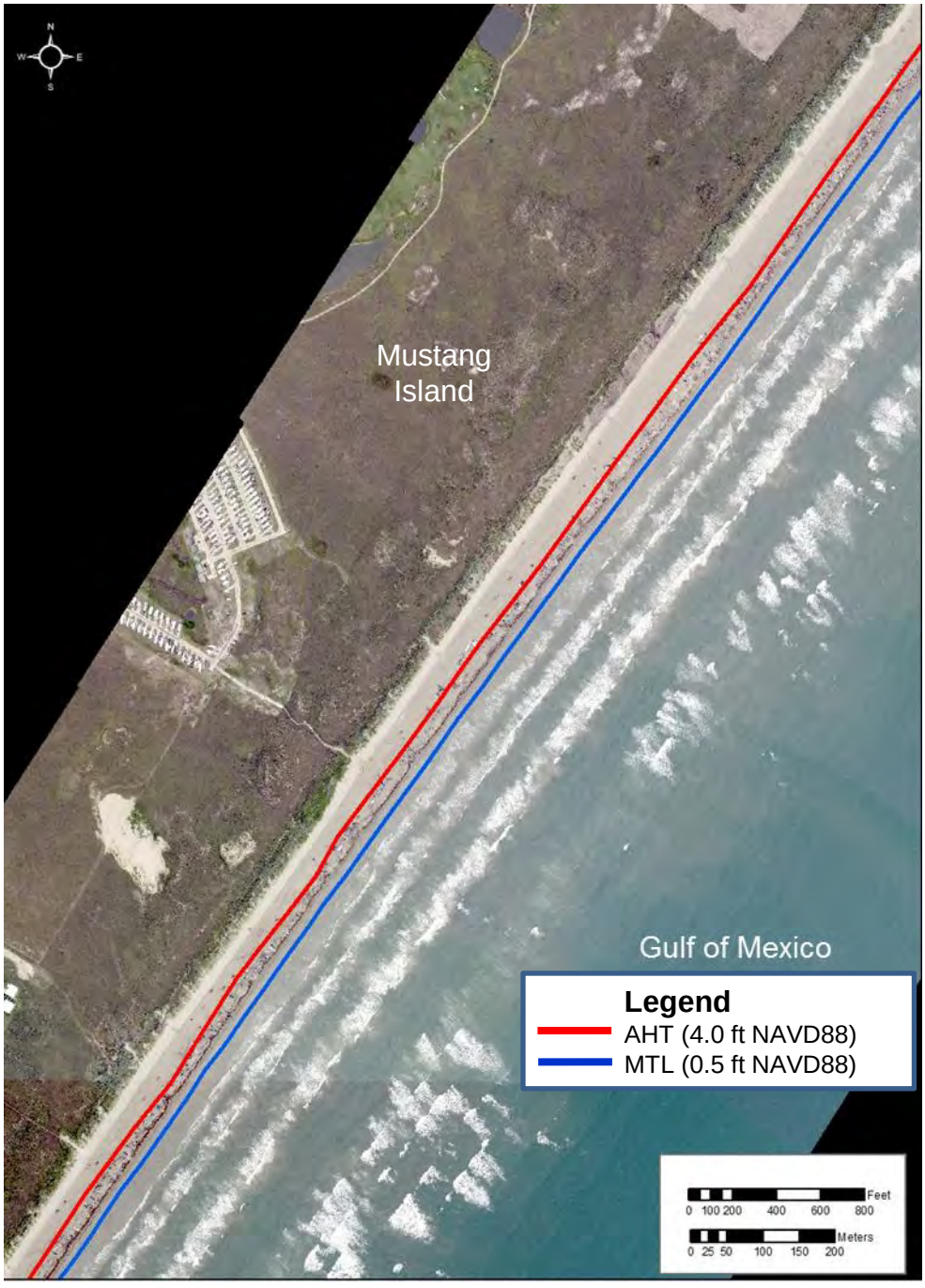
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MTL (0.5 ft NAVD88)
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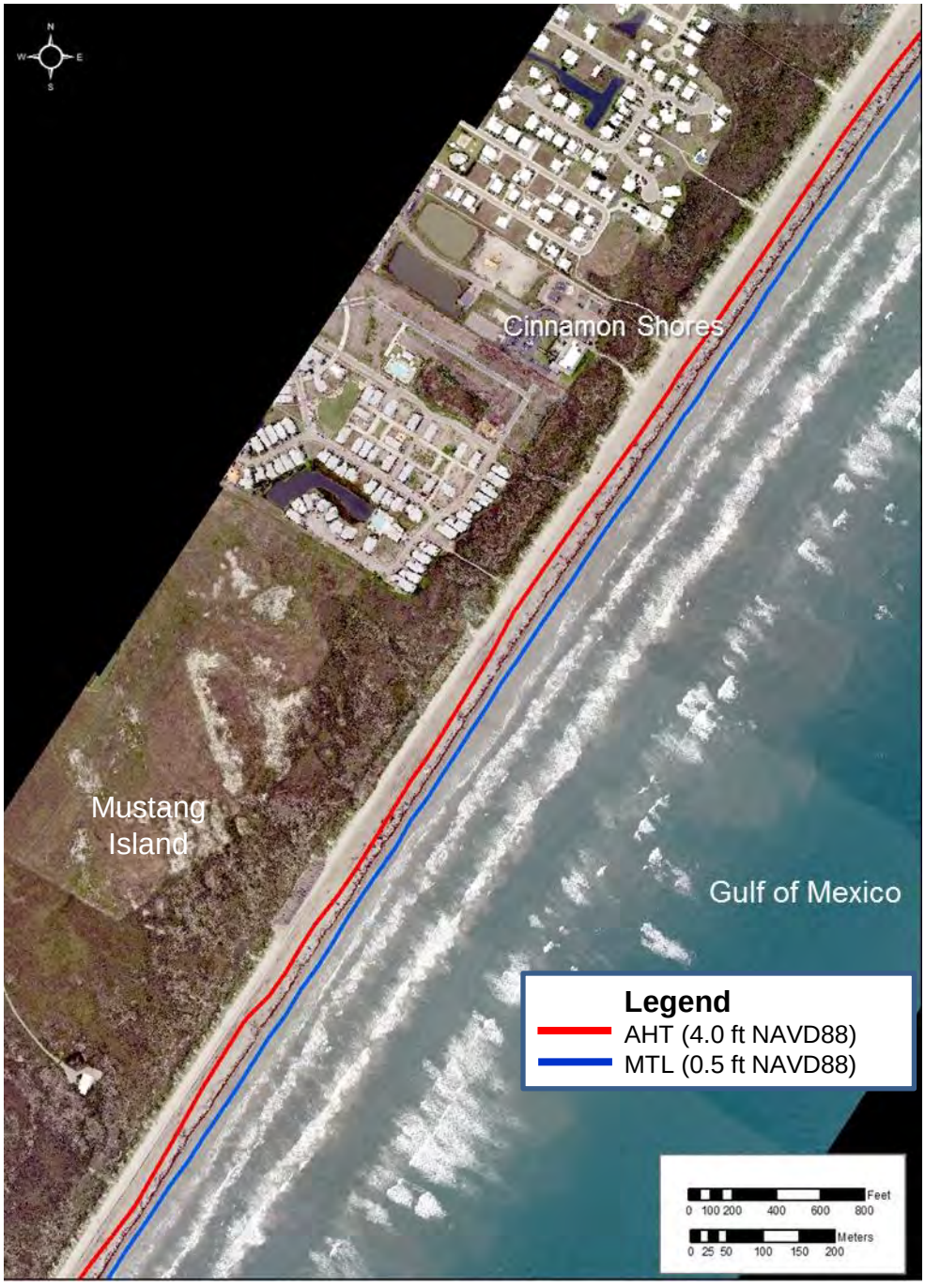
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Cinnamon Shores
Mustang Island
Gulf of Mexico
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MTL (0.5 ft NAVD88)
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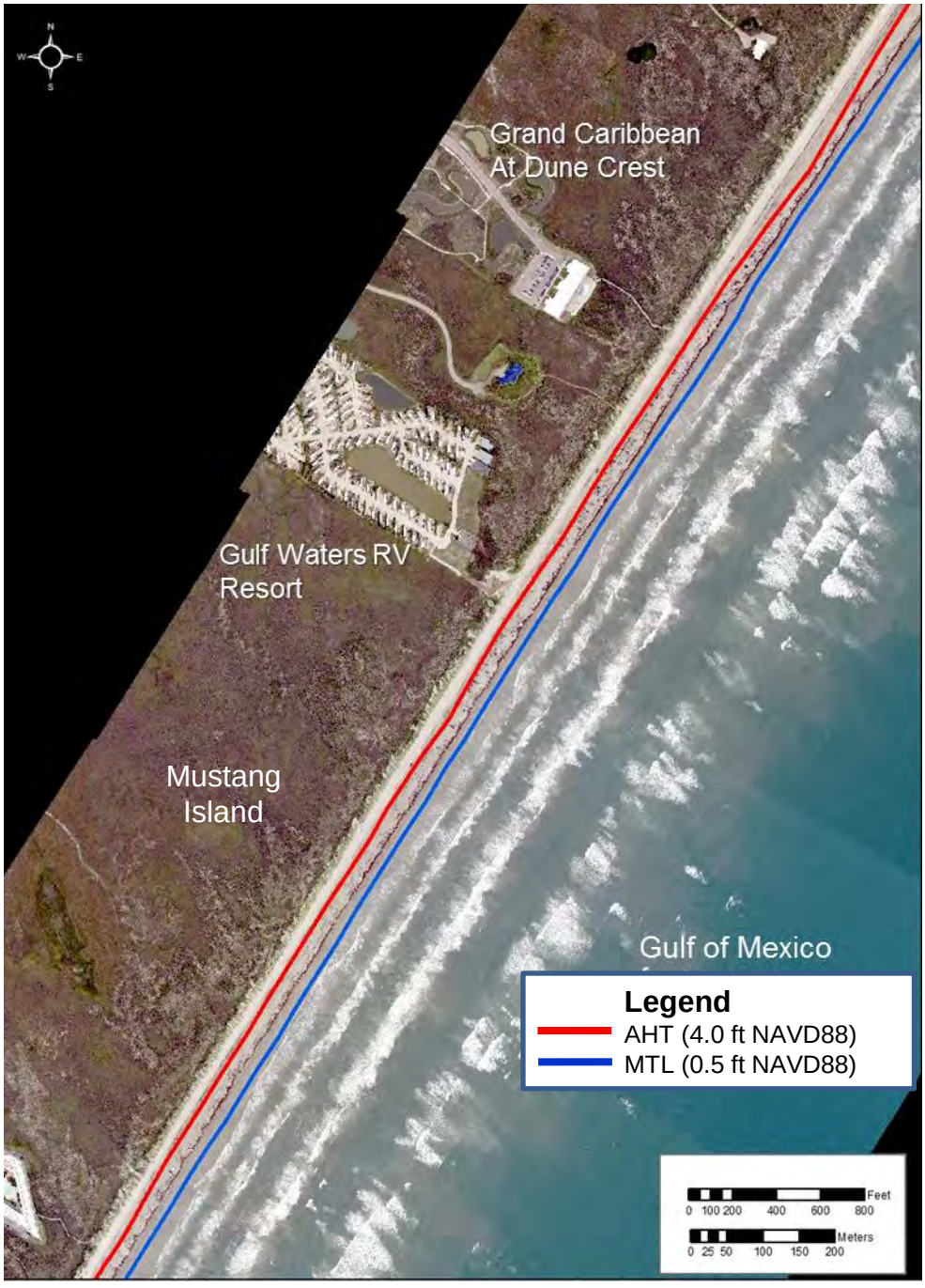
N
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Grand Caribbean
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Gulf Waters RV
Resort
Mustang
Island
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
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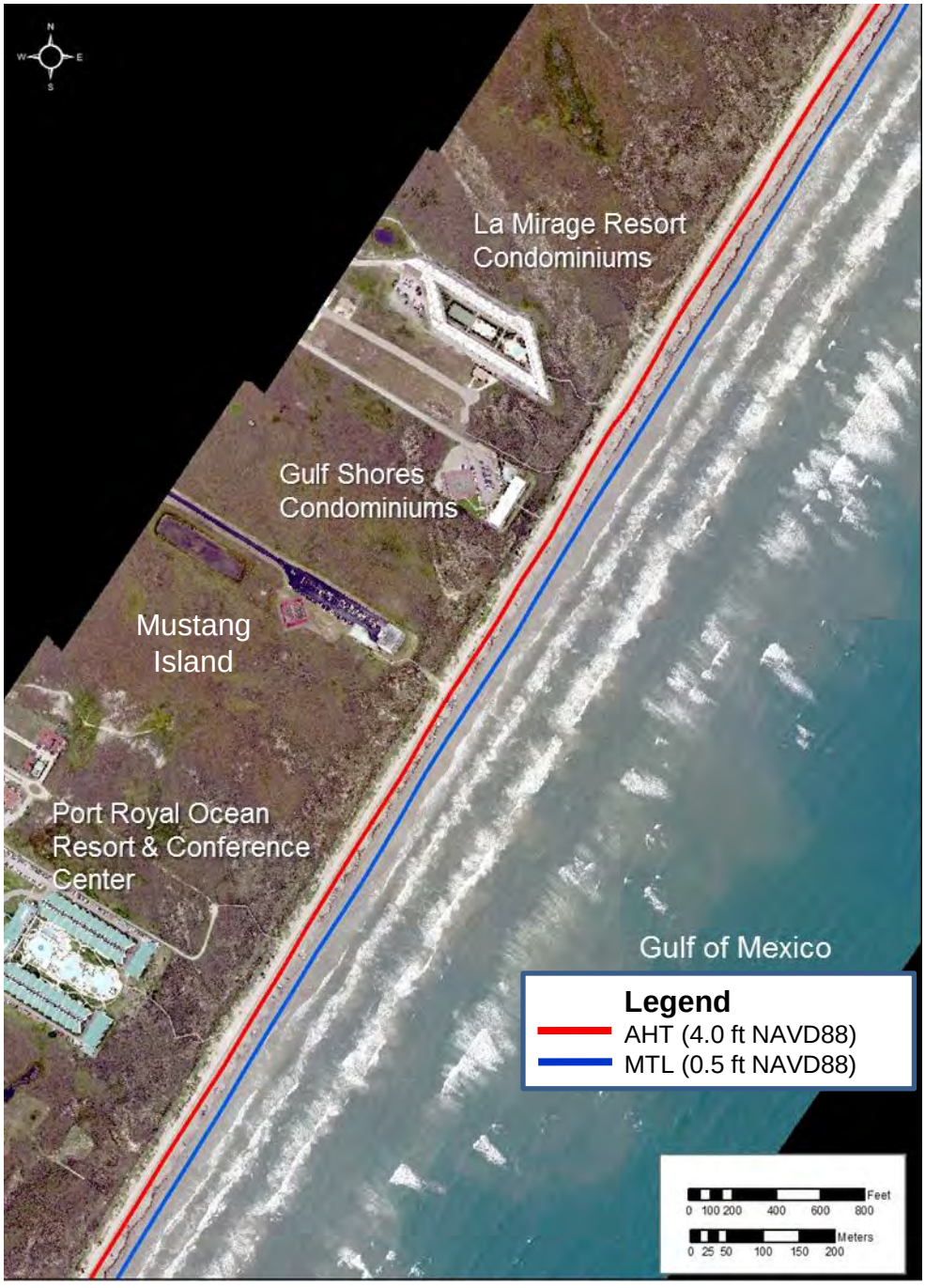
La Mirage Resort
Condominiums
Gulf Shores
Condominiums
Mustang
Island
Port Royal Ocean
Resort & Conference
Center
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
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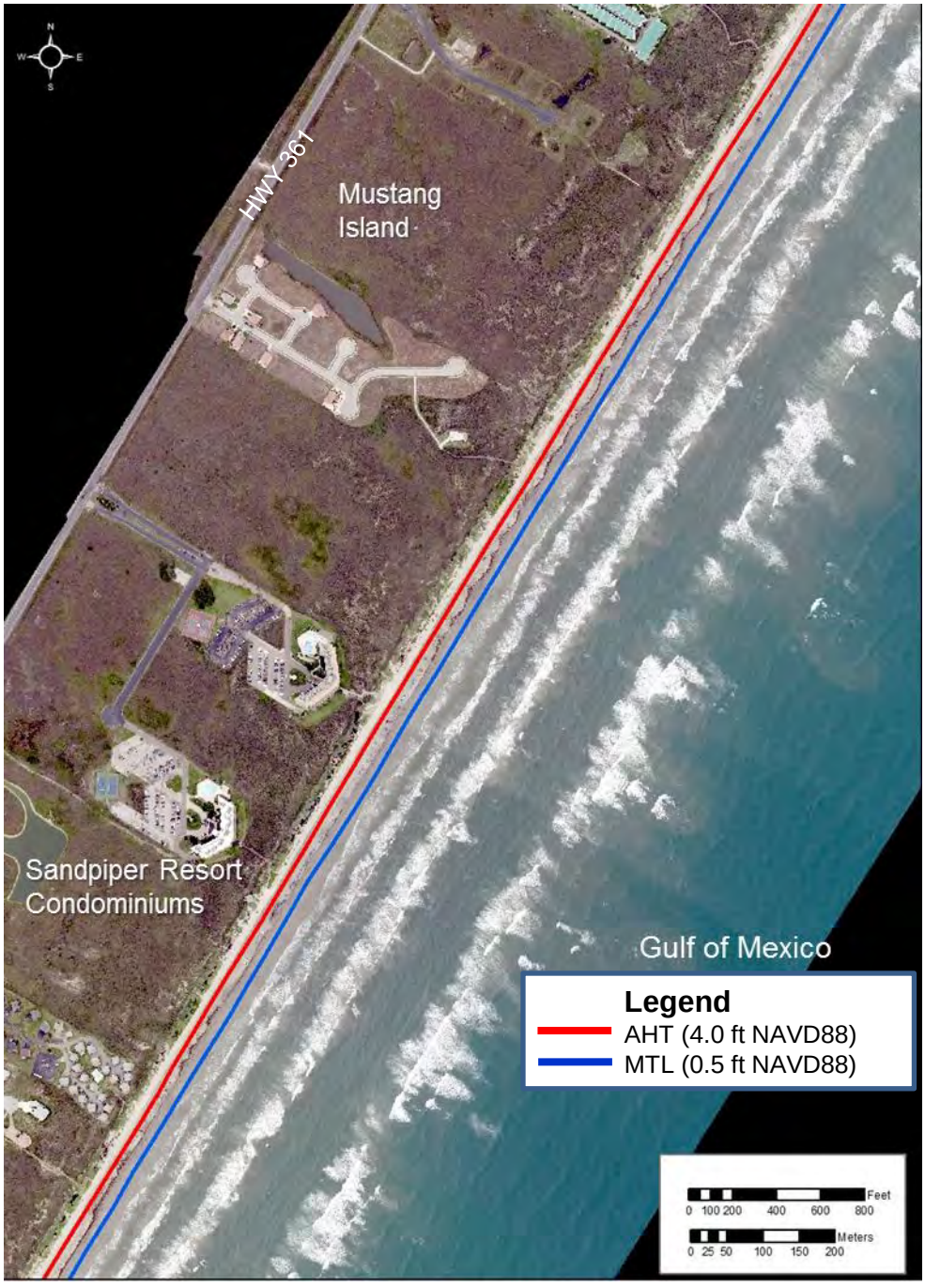
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HWY 361
Mustang
Island
Sandpiper Resort
Condominiums
Gulf of Mexico
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MTL (0.5 ft NAVD88)
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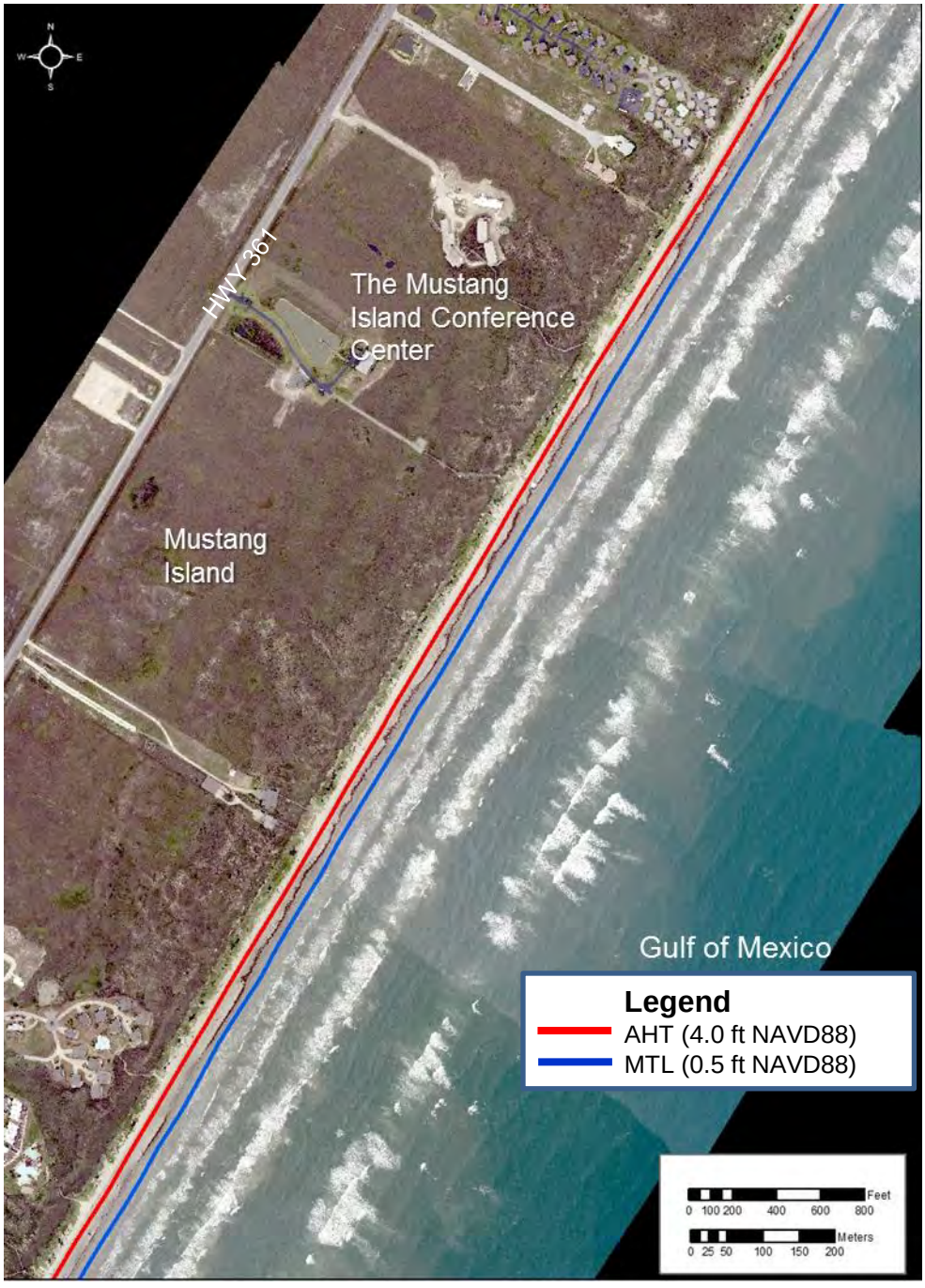
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HWY 361
The Mustang Island Conference Center
Mustang Island
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
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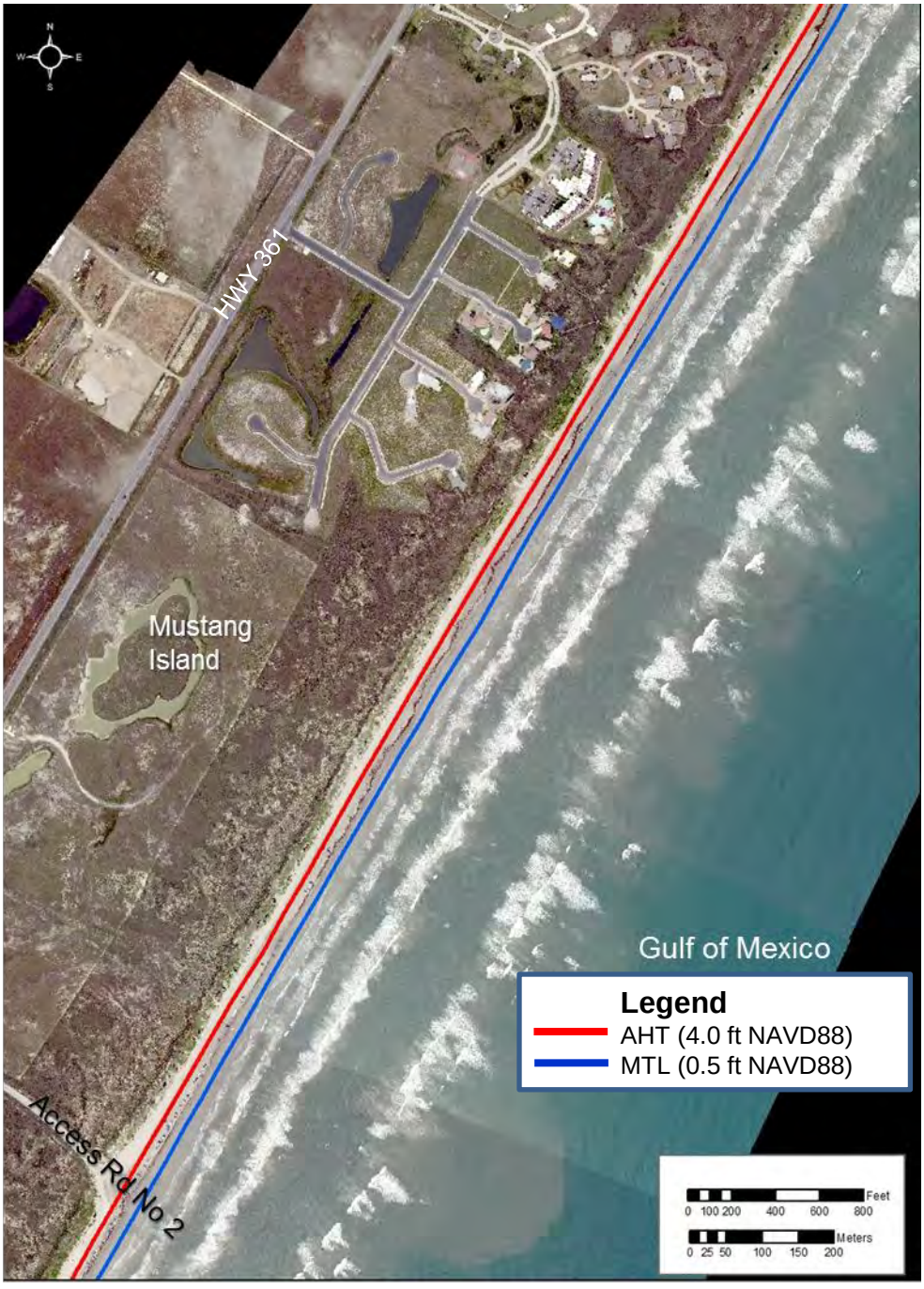
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Mustang
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Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Access Rd No 2
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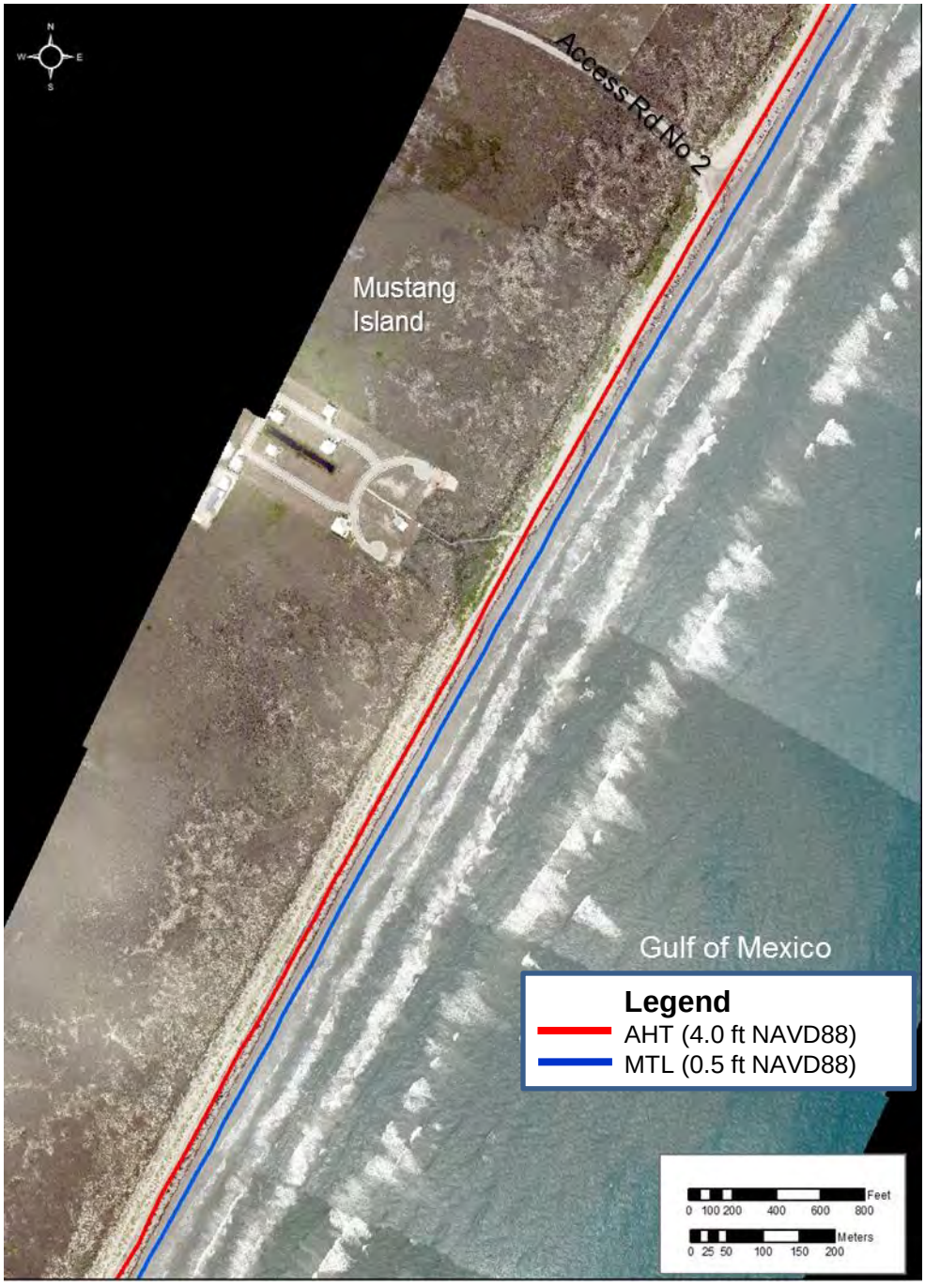
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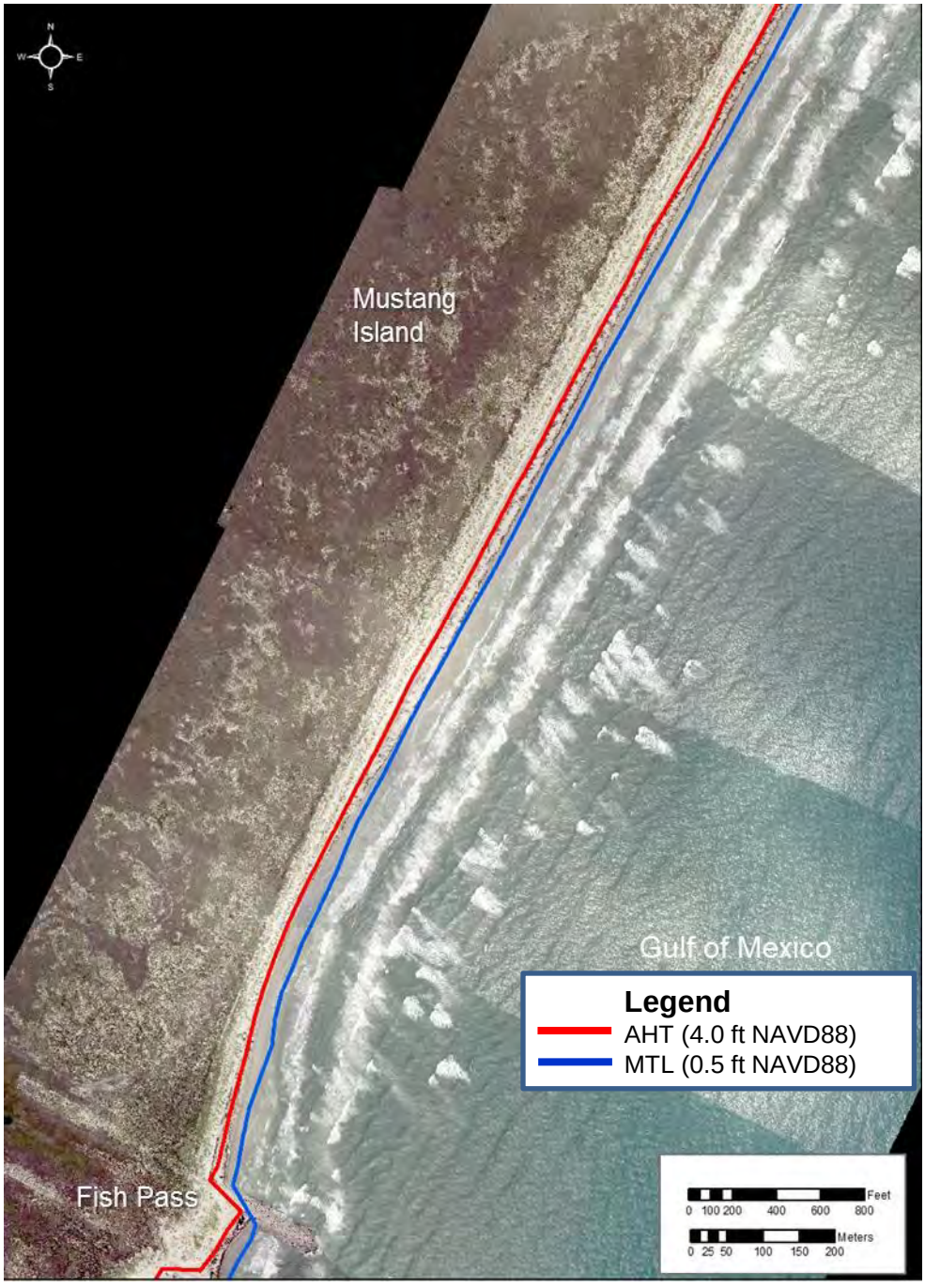
N
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Mustang
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Gulf of Mexico
Fish Pass
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Feet
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Meters
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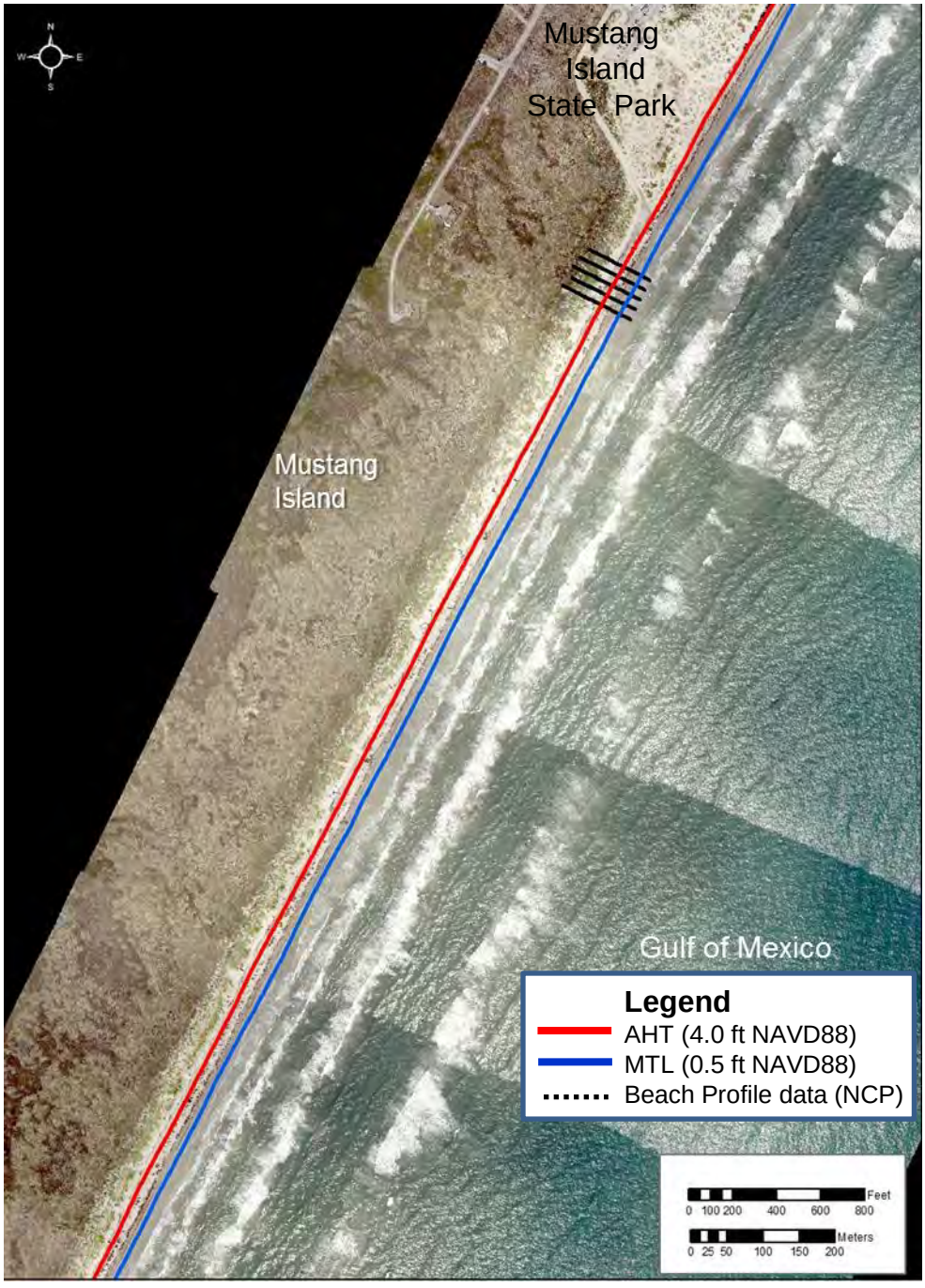
Section 2: Fish Pass to Packery Channel


Mustang
Island
State Park
Mustang
Island
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Beach Profile data (NCP)
Feet
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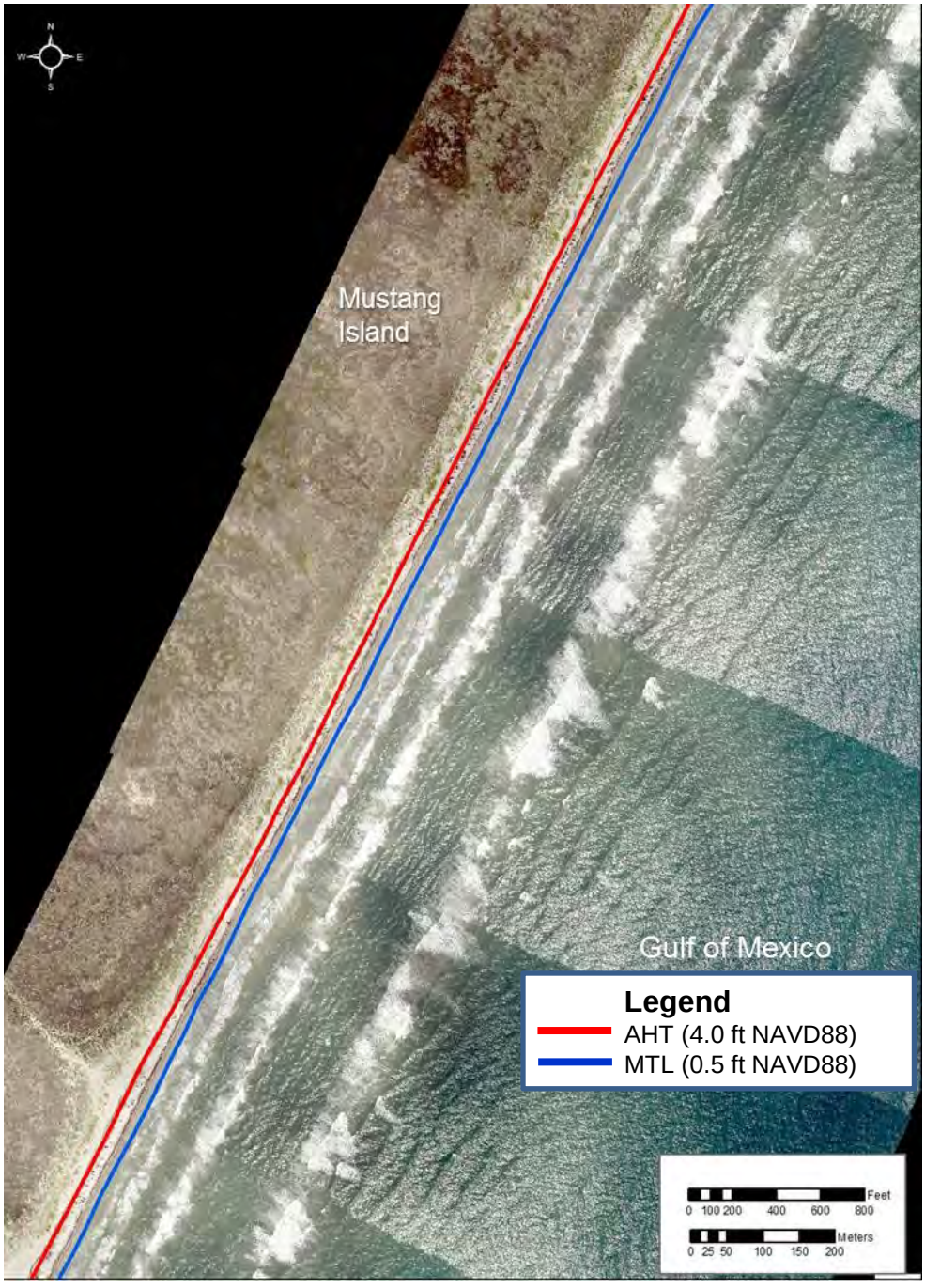
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AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
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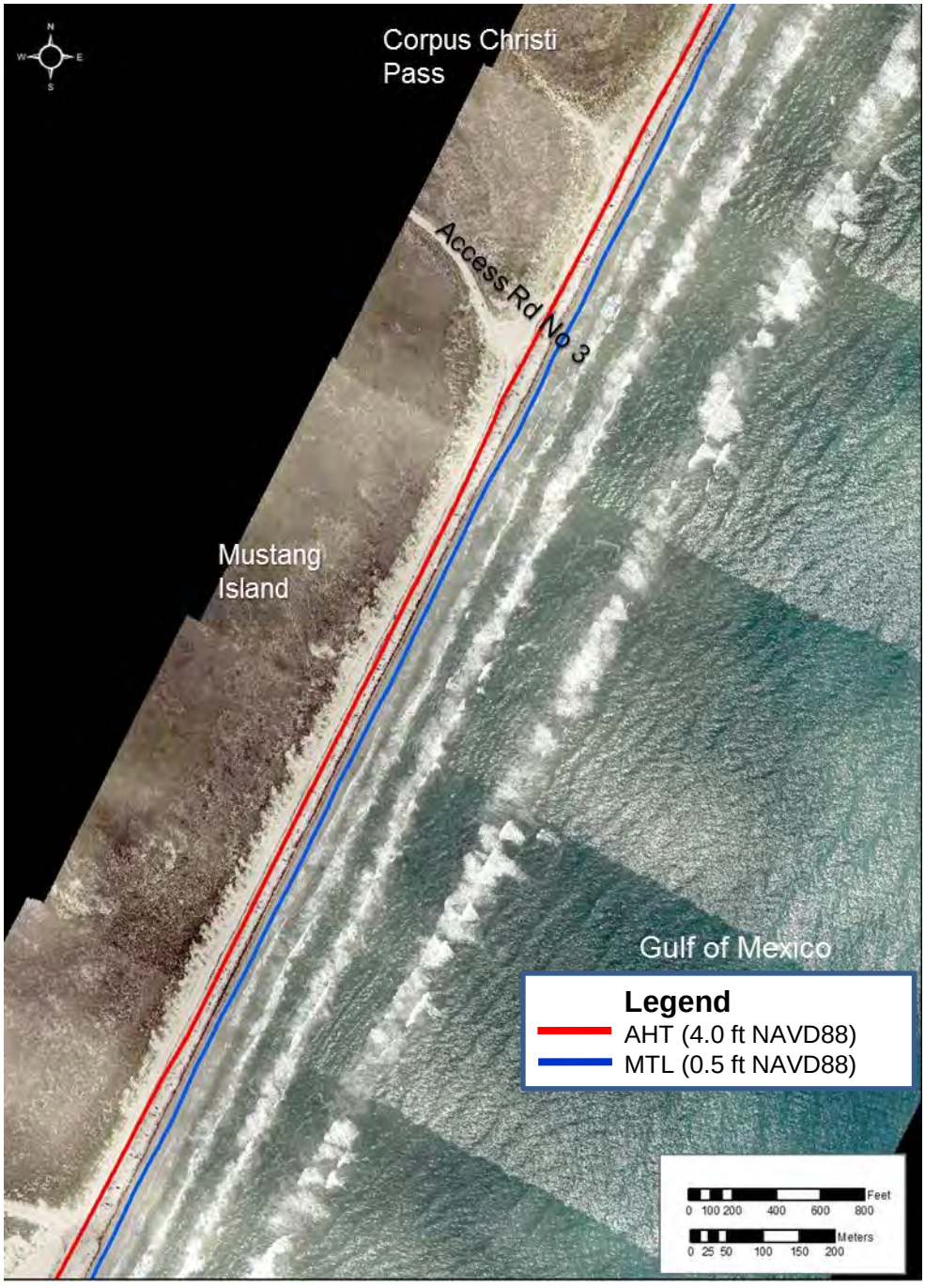
Corpus Christi
Pass
Access Rd No 3
Mustang
Island
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
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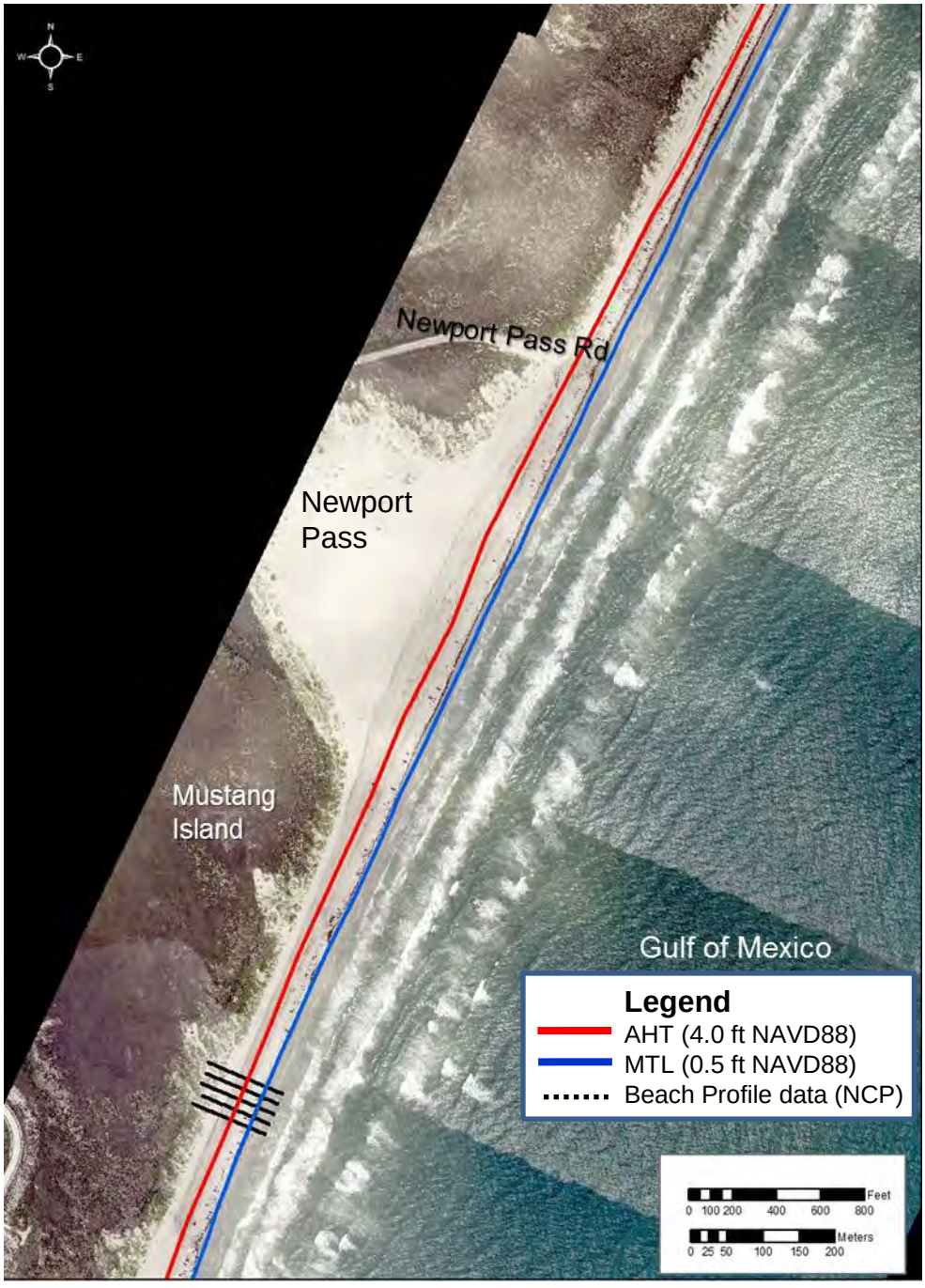
N
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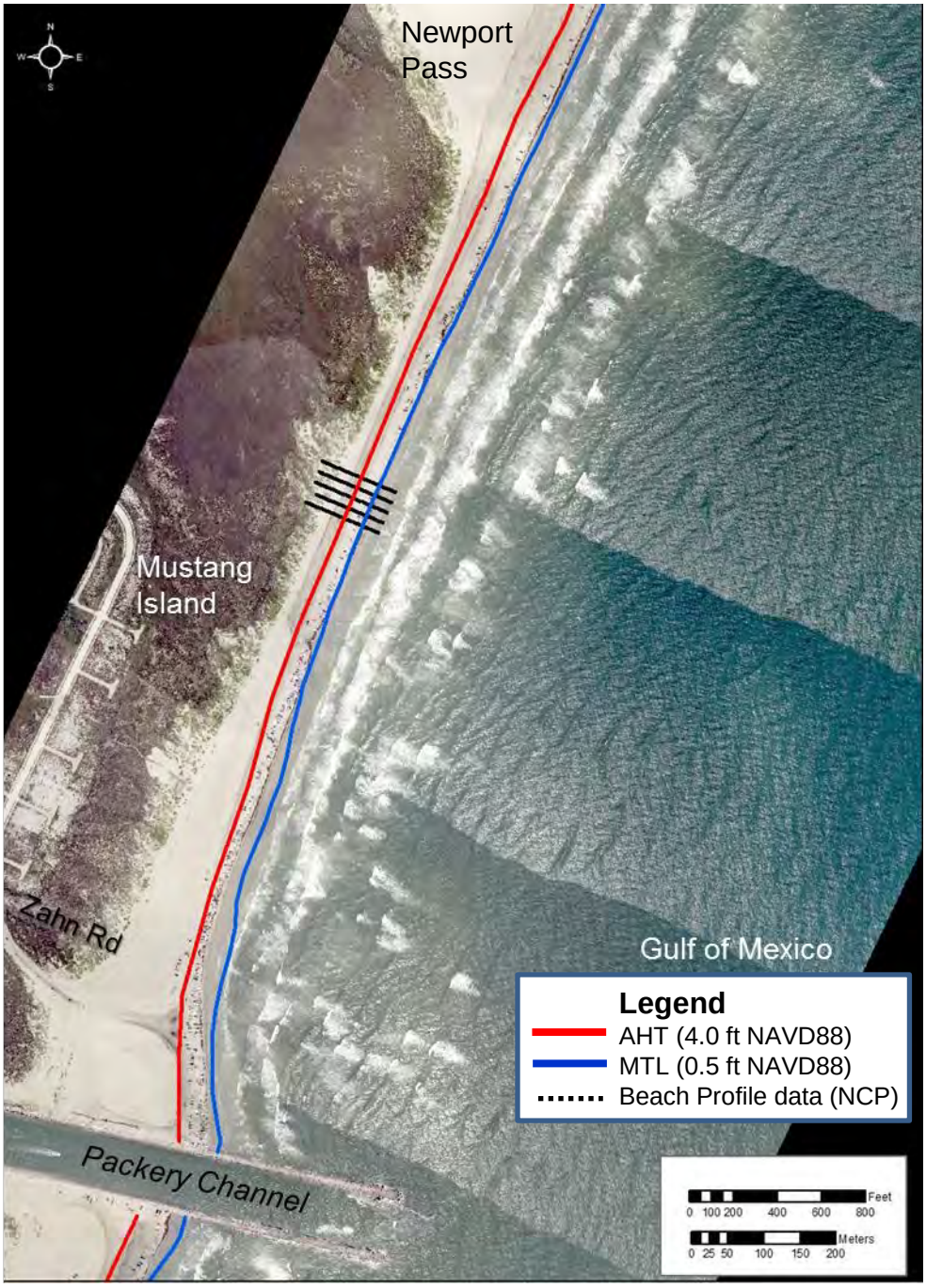
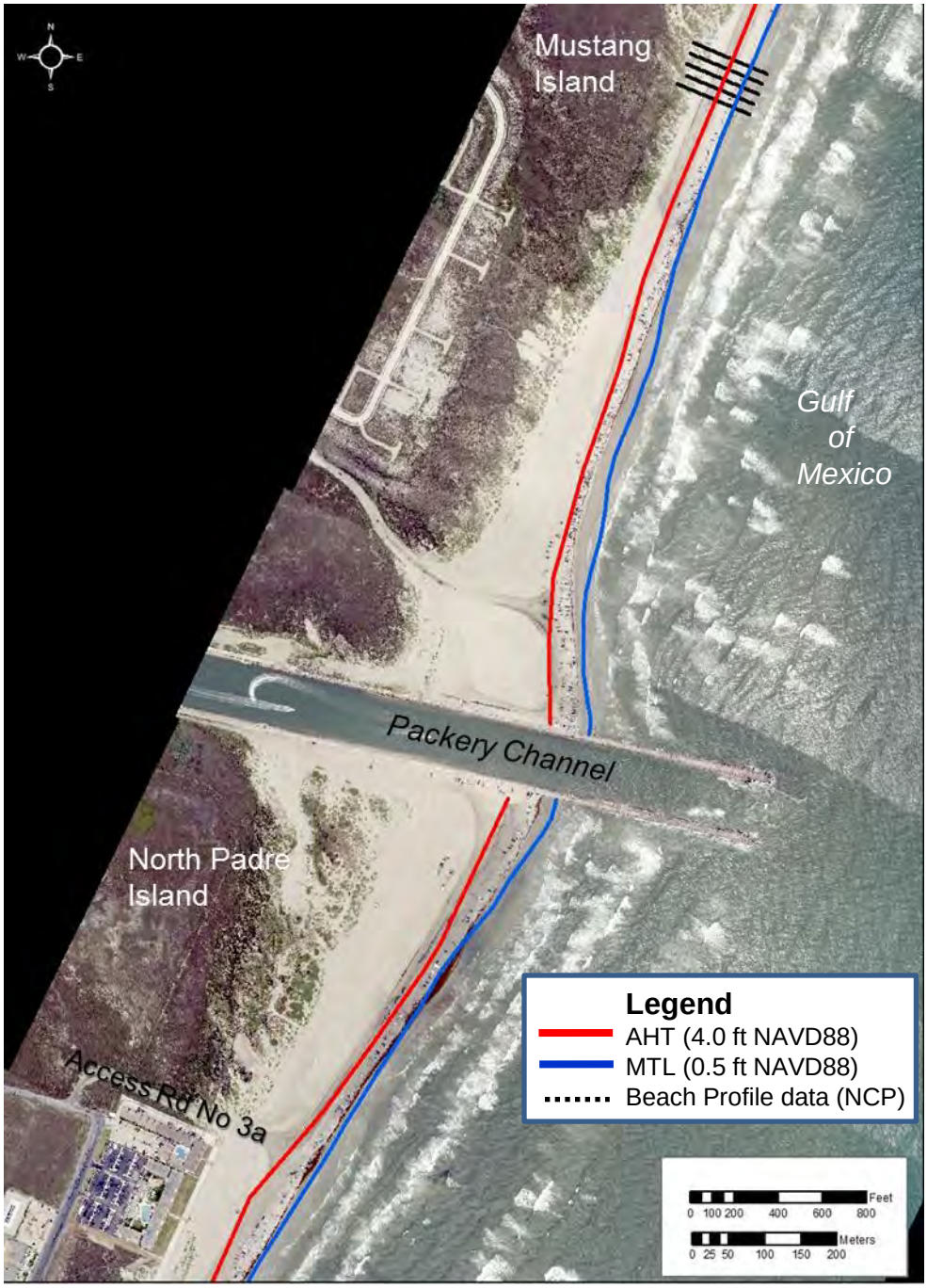
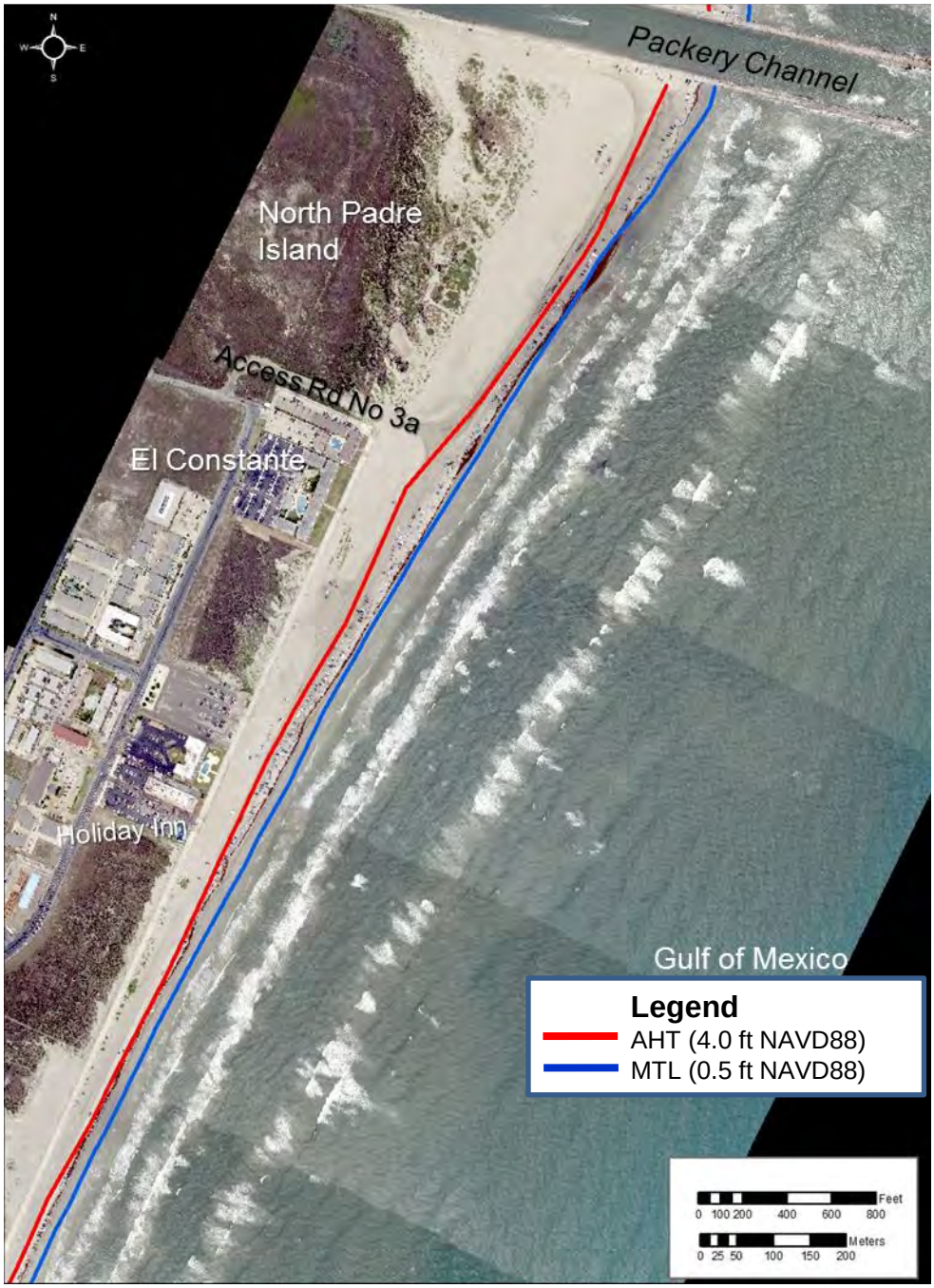
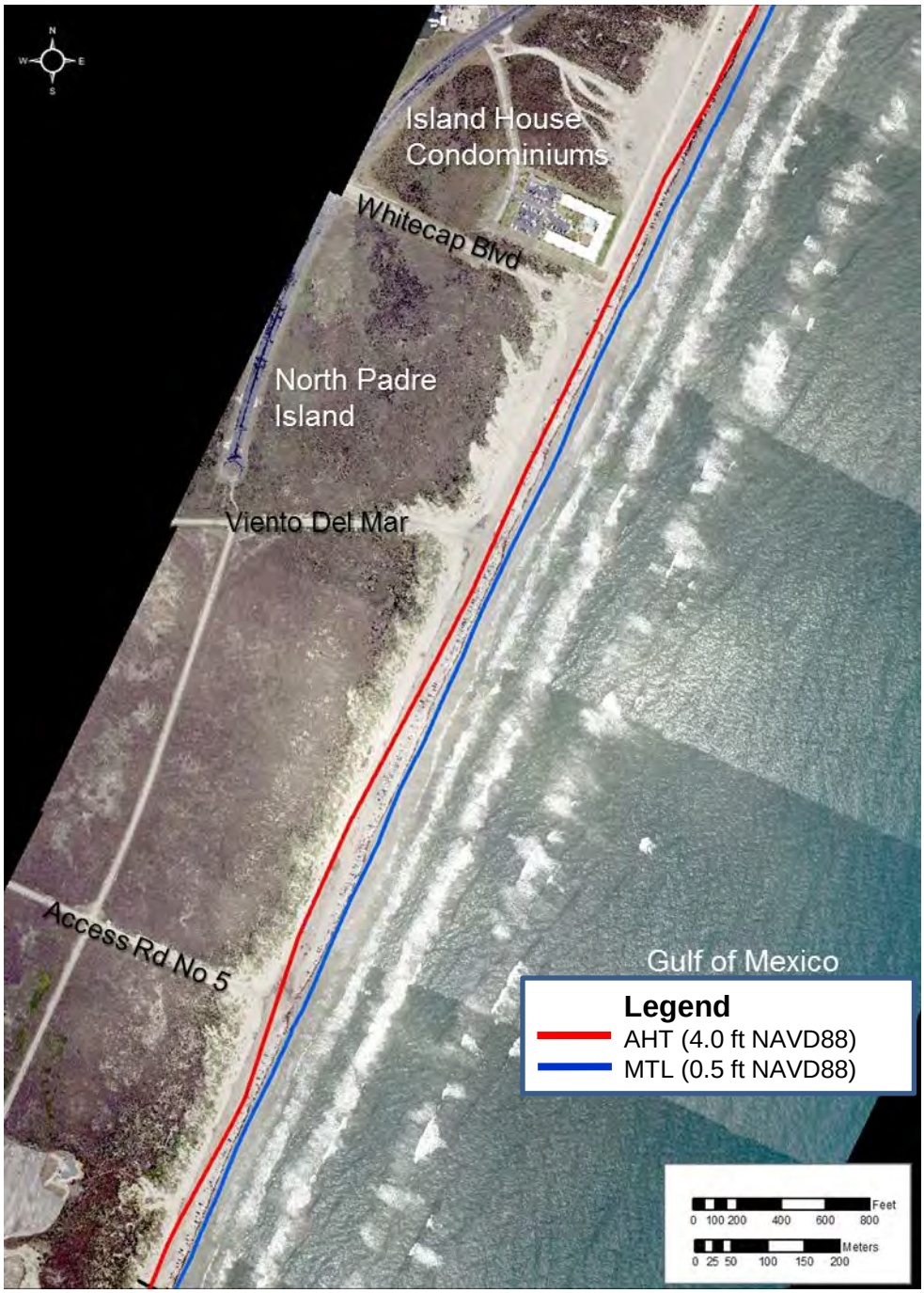
S
Newport Pass Rd
Newport
Pass
Mustang
Island
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Beach Profile data (NCP)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200

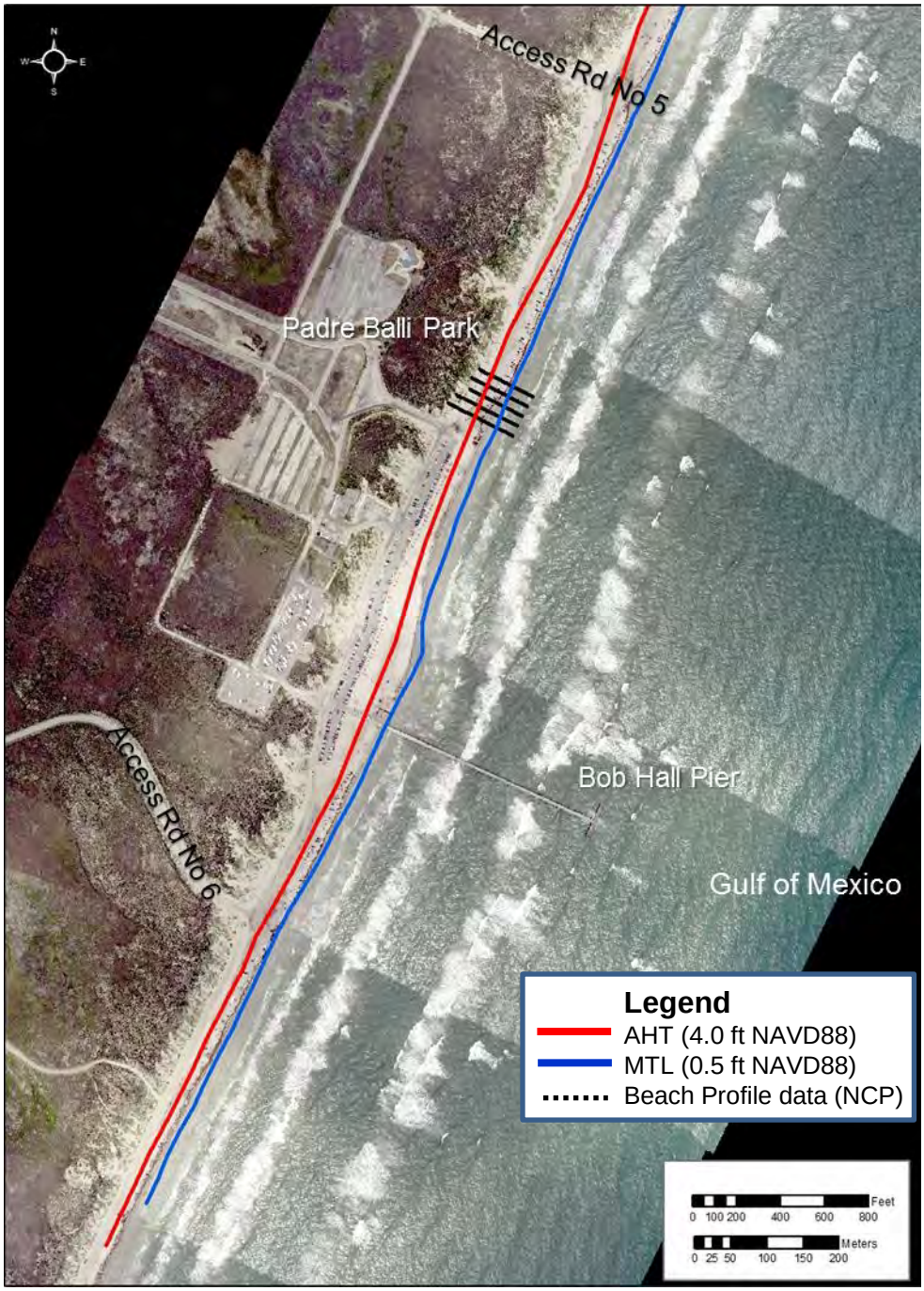

Newport
Pass
Mustang
Island
Zahn Rd
Gulf of Mexico
Packery Channel
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Beach Profile data (NCP)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200

Section 3: Packery Channel to Nueces Kleberg County Line




N
W
E
S
Packery Channel
North Padre Island
Access Rd No 3a
El Constante
Holiday Inn
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200


Island House
Condominiums
Whitecap Blvd
North Padre
Island
Viento Del Mar
Access Rd No 5
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200


N
W
E
S
Access Rd No 5
Padre Balli Park
Access Rd No 6
Bob Hall Pier
Gulf of Mexico
Legend
AHT (4.0 ft NAVD88)
MTL (0.5 ft NAVD88)
Beach Profile data (NCP)
Feet
0 100 200 400 600 800
Meters
0 25 50 100 150 200