Monitoring, Analysis and GIS Interpretation of Hydrodynamic and Sediment Transport Systems for Inlets on the Central Texas Coast

Submitted to:
US Army Engineer Research and Development Center
Coastal and Hydraulics Laboratory
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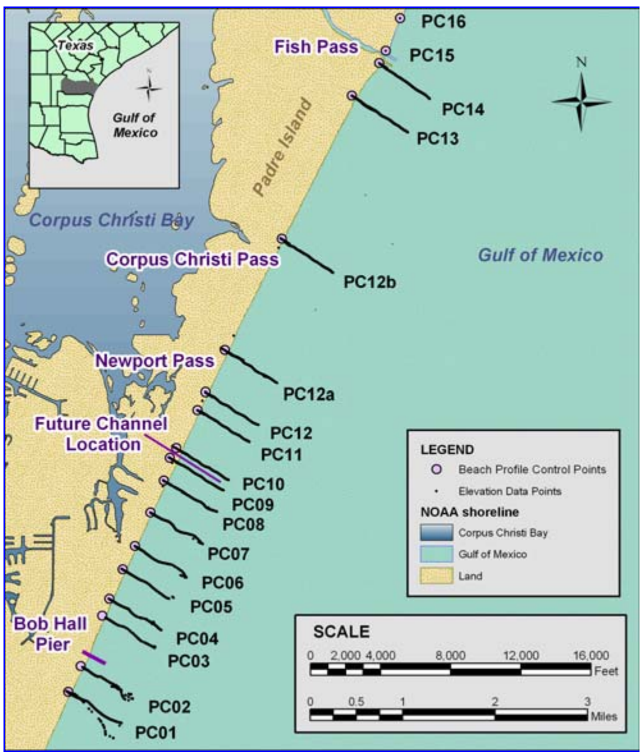

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EXECUTIVE SUMMARY
Report to US Army Engineer Research and Development Center
Coastal & Hydraulics Laboratory

"Monitoring, Analysis and GIS Interpretation of Hydrodynamic and Sediment Transport Systems for Inlets on the Central Texas Coast"

Under USACE Contract No. DACW42-03-C-0042
For the Period July 17, 2003 through September 30, 2003

The U.S. Army Corps of Engineers, Engineering Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL), awarded Texas A&M University-Corpus Christi (TAMU-CC), a Minority Institution, a contract (DACW42-03-C-0032) for the period July 17 through September 30, 2005. The project, "Monitoring, Analysis and GIS Interpretation of Hydrodynamic and Sediment Transport Systems for Inlets on the Central Texas Coast" is being performed for the U.S. Army Corps of Engineers, Galveston District, and the Coastal Inlets Research Program (CIRP) conducted at CHL.

The purpose of this project is to provide a dynamic local network of research and technical support to compliment Galveston District and CIRP initiatives for monitoring existing inlets and the response of the coast to development of new inlet infrastructure. The project encompasses data collection and analysis in support of present and continuing studies of existing and proposed inlets conducted by the Galveston District and the CIRP (Figure 1). Increased understanding of

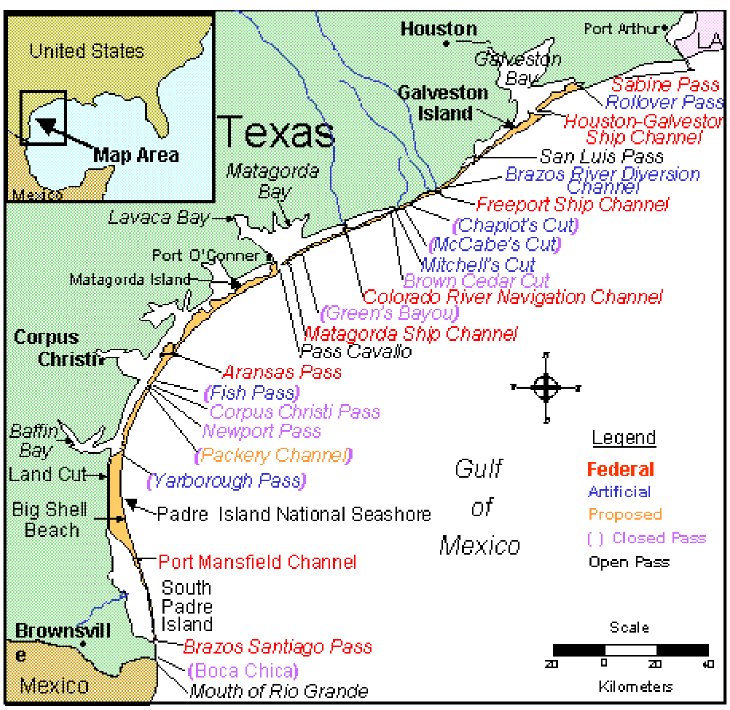

Figure 1. Site map of Texas Inlets of interest to CHL.

the hydrodynamics and sediment transport of these inlet systems will assist in improving inlet design and channel maintenance, thereby affording significant economic and navigational benefits.

This Annual Report covers work performed during July 17 through September 30, 2003 (FY03) by TAMU-CC and its two collaborating sub-recipients, Texas A&M University at Galveston (TAMUG), and the Texas Engineering Experiment Station, Corpus Christi Regional Division (TEES-CC). For this reporting period, the project accomplished all major tasks and subtasks, some of which operate on a continuing basis:

Task 1. Geographic Information System for Central Texas Inlets Analysis

- Architecture for a web-based, data-dissemination site was designed, reviewed by CHL and published online.
  See http://www.cbi.tamucc.edu/ResearchProjects/TexasInletsOnline.
- Population of the website with this project's data was completed, and mechanisms to facilitate data and imagery dissemination were initiated (continuing).
- Color aerial photographs were obtained for Packery Channel covering the Gulf of Mexico inland to the GIWW.
- Color aerial photographs of Texas Inlets were obtained covering Sabine Pass to the Mouth of the Rio Grande.
- The development of baseline Arc View project in support of GIS for Central Texas Inlets analysis and CHL applications was initiated. Aerial imagery and beach profile survey data collected for Packery Channel serve as the prototype for future project development (continuing).

Task 2. Inlet and Channel Morphology Surveys

- CBI's survey sea sled was overhauled, reinforced and modularized for assembly on site.
- Sled and wading-depth surveys were conducted for 14 profiles, PC-01 through PC-14.
- PC-15 and PC-16 located north of Fish Pass Jetty were not surveyed due to deteriorating weather and damage to the sea sled.
- Sediment samples (96) were collected for PC-01 through PC14.
- Sediment samples were processed and analyzed.
- Data reduction, review, verification, and plotting were completed.

Task 3. Monitoring and Measurements

- An Acoustic Doppler Current Profiler (ADCP) was deployed in the existing Packery Channel close to its intersection with the Gulf Intracoastal Waterway (GIWW).
- Data collected are being stored onsite until a real-time communications link for posting data from the ADCP to the website is established (continuing).

1.0 Introduction

The U.S. Army Corps of Engineers, Engineering Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL), in collaboration with the U.S. Army Corps of Engineers, Galveston District, awarded Texas A&M University-Corpus Christi (TAMU-CC), a Minority Institution, a contract (DACW42-03-C-0032) for the period July 17 through September 30, 2005, to perform "Monitoring, Analysis and GIS Interpretation of Hydrodynamic and Sediment Transport Systems for Inlets on the Central Texas Coast" for the Coastal Inlets Research Program (CIRP).

The purpose of this project is to provide a dynamic local network of research and technical support to compliment CIRP research initiatives for existing inlets and for the potential development of new inlet infrastructure along the Texas coast. Both data collection and analysis are being performed in support of present and continuing studies of existing and proposed inlets as identified by the Galveston District and the CIRP. Increased understanding of the hydrodynamics and sediment transport of these inlet systems could assist in improving inlet design, thereby affording significant economic and navigational benefits.

This Annual Report covers work performed during July 17 through September 30, 2003 (FY03) by TAMU-CC and its two collaborating sub-recipients, Texas A&M University at Galveston (TAMUG), and the Texas Engineering Experiment Station, Corpus Christi Regional Division (TEES-CC). For this reporting period, the project accomplished all major tasks and subtasks.

This report and all graphics and photographs are presently being made available on the "Texas Inlets Online" website. Because of the quantity of pages of color graphics and photographs, only selected examples are included in this report.

2.0 Task 1. Geographic Information System (GIS) for Central Texas Inlets Analysis

Work under Task 1 focused on the three subtasks: 1) development an online data dissemination and archiving resource, called Texas Inlets Online; 2) acquisition of baseline aerial imagery for inlets of interest, as directed by CHL; and 3) development of a GIS (ArcGIS) Geodatabase for archiving and manipulation of imagery and coastal data sets.

2.1 "Texas Inlets Online," A Data Dissemination and Archiving Resource for Inlet Data and Imagery

The architecture and initial population of Texas Inlets Online was completed during August and September of 2003. The site's front page (Figure 2) complements and will support the CHL website, Inlets Online (http://www.oceanscience.net/inletsonline). CBI's website was designed using MS FrontPage and will host historic information for all inlets of interest, including coastal data, imagery, reports, topics of interest, and relevant links.

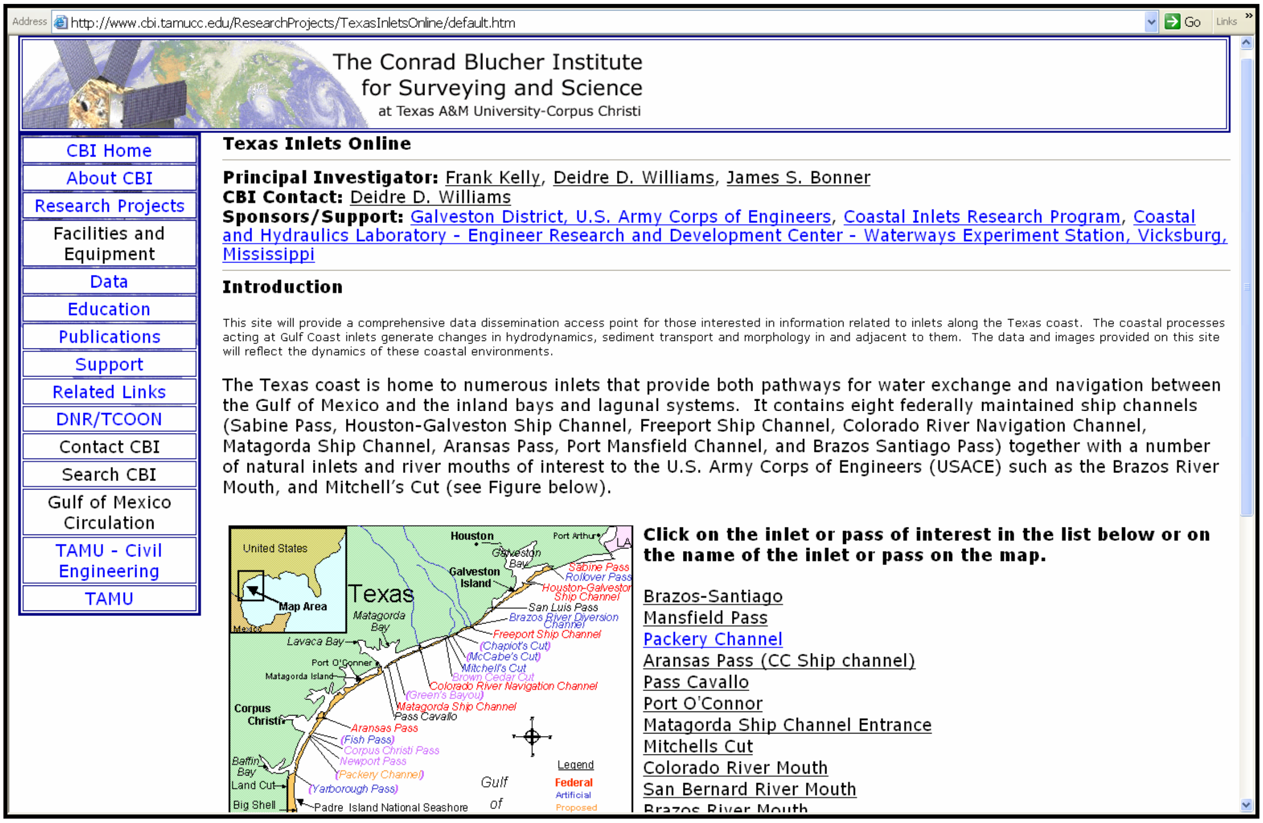

Figure 2. Front page of the Texas Inlets Research site on the CBI website, providing a focal point for data dissemination and archiving of Texas inlet research. See http://www.cbi.tamucc.edu/ResearchProjects/TexasInletsOnline.

2.2 Aerial Photography of Texas Inlets of Interest

A comprehensive set of color aerial photographs of Texas inlets (Table 1) was taken during August and September 2003. The image library for Texas inlets will include: rectified images, associated metadata, 36 by 36-inch prints as well as relevant DOQQ images that were applied during image rectification. Metadata for the aerial images will be made available online during FY2004. During fiscal year 2003 both the Colorado River (Figure 3) and Packery Channel (Figure 4) were identified as primary inlets of interest by CHL. Therefore, two sets of photographs were taken of Colorado River mouth (one post- tropical storm season) and a baseline series of photographs were taken from Aransas Pass to just south of Bob Hall Pier prior to the initiation of construction operations of Packery Channel. The Texas Inlets image library will be accessible through the web-based dissemination site, Texas Inlets Online.

Table 1. Summary of aerial photographs taken during this project period by Lanmon Aerial Photography, Inc.

Inlet/Pass	Description	Scale (ft/in)	Date (2003)
Brazos River Mouth	Centered on Inlet	200/500	08/07 and 08/08
Brazos-Santiago Pass	Centered on Inlet	200/500	08/08
Colorado River Mouth	Centered on Inlet	200/500	08/06 and 08/07
Corpus Christi Ship Channel		200/500	09/23 and 09/24
Freeport Ship Channel	Centered on Inlet	200/500	09/23 and 09/24
Galveston-Houston Ship Channel	Centered on Inlet	200/500	09/23 and 09/24
Mansfield Pass	Centered on Inlet	200/500	09/23 and 09/24
Matagorda Ship Channel	Centered on Inlet	200/500	08/06 and 08/07
Mitchell's Cut	Centered on Inlet	200	08/06
Mouth of Rio Grande	Centered on Inlet	200	08/07
Packery Channel	Proposed location	200/500	08/07
Packery Channel	Padre Island shoreline from South Aransas Pass Jetty to south of Bob Hall Pier	200 (inlet) 500	09/08 and 09/23
Packery Channel	Existing channel and wash over from Gulf of Mexico to GIWW intersection	200	09/08 and 09/23
Pass Cavallo	Centered on Inlet	500	08/06
Port O'Conner	Centered on Inlet	200	08/07
Rollover Pass	Centered on Inlet	200	08/2003
Sabine Pass	Centered on Inlet	200/500	09/23 and 09/24
San Bernard River Mouth	Centered on Inlet	200/500	08/06
San Luis Pass	Centered on Inlet	500	09/2003

Figure 3. Colorado River 09/08/2003 (Lanmon Aerial Photography, Inc.)

Figure 4. Existing Packery Channel and proposed inlet location along Padre Island (photo on 09/08/2003 by Lanmon Aerial Photography, Inc.).

2.3 Geographic Information System for Central Texas Inlets Analysis

An ArcGIS Geodatabase was established to archive all data describing coastal parameters related to inlets of interest. All elevation data collected to date have been processed in the ArcGIS 8.3 environment. These data and the appropriate vector base map layers are stored in the ESRI Personal Geodatabase format of MS Access (*.mdb). This format allows for export of the classic *.shp format. The ongoing GIS effort is in preparation for the migration of all point and vector data into the Enterprise Geodatabase on CBI's MS sequel Server. This format will allow for importing all the historic, current and future imagery as raster layers in the Geodatabase.

The Geodatabase containing the imagery is in place and the implementation of an ArcIMS (Internet Map Server) for this project will be possible and is recommended for more efficient and practical dissemination of complex imagery via Texas Inlets Online.

2.4 Key Milestones for Task 1 and Continuing Work

- Architecture for a web-based, data-dissemination site was designed, reviewed by CHL and published online.
  See http://www.cbi.tamucc.edu/ResearchProjects/TexasInletsOnline.
- Population of the website with this project's data was completed, and mechanisms to facilitate data and imagery dissemination were initiated (continuing).
- Color aerial photographs were obtained for Packery Channel covering the Gulf of Mexico inland to the GIWW.
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- The development of baseline Arc View project in support of GIS for Central Texas Inlets analysis and CHL applications was initiated. Aerial imagery and beach profile survey data collected for Packery Channel serve as the prototype for future project development (continuing).

3.0 Task 2. Inlet and Channel Morphology Surveys

3.1 Colorado River Mouth

The principal activities of TAMUG between July 17 and September. 30, 2003 were: (1) a land and hydrographic survey of the Colorado River inlet (2) the design of a video camera system to be installed at the Colorado River inlet to monitor construction projects and beach morphodynamics, and 3) personnel and equipment support for the Packery Channel Beach Survey conducted by TAMU-CC.

3.1.1. Colorado River Inlet Survey

Beach and hydrographic surveys of the Colorado River Inlet were conducted August 19-23, 2003. Across-shore, the surveys covered a distance from the vegetation line on the beach to about one mile offshore. Alongshore, the survey covered a distance of about 2.5 miles centered on the inlet. The beach surveys were accomplished using a Nikon Total Station using temporary benchmarks created with an RTK-GPS system. For the hydrographic survey, an RTK-GPS-equipped Jet Kki was employed. A contour plot based on the survey (Figure 5) revealed the 30-ft deep sedimentation basin (in blue), which had been dredged a few weeks previously. Plots of nearshore, beach-profile, wade survey and offshore profiles taken by Jet Ski show good agreement in elevation in the region of survey overlap (Figures 6a and 6b).

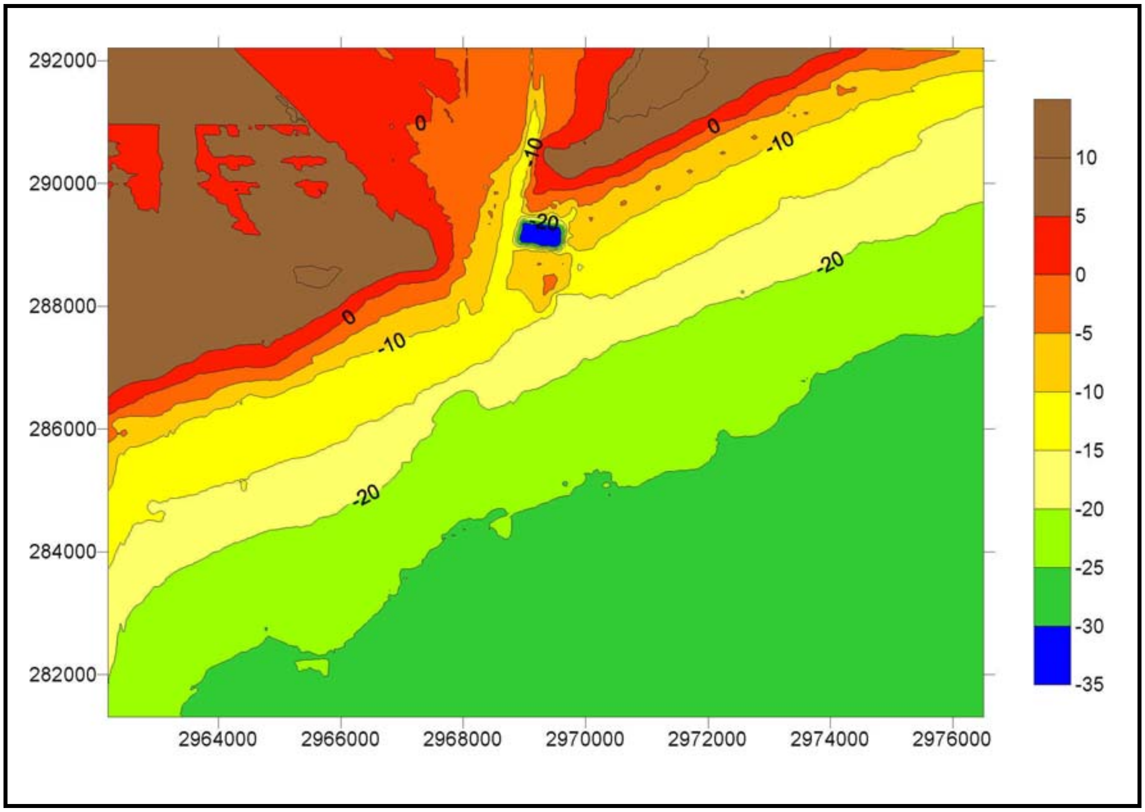

Figure 5. Contour plot of the Colorado River Inlet (August 19-23, 2003). The plot provides sediment position (US State Plane NAD 1927) as a function of its position (Texas South Central 4204 US feet) and depth (NAVD 88 US feet).

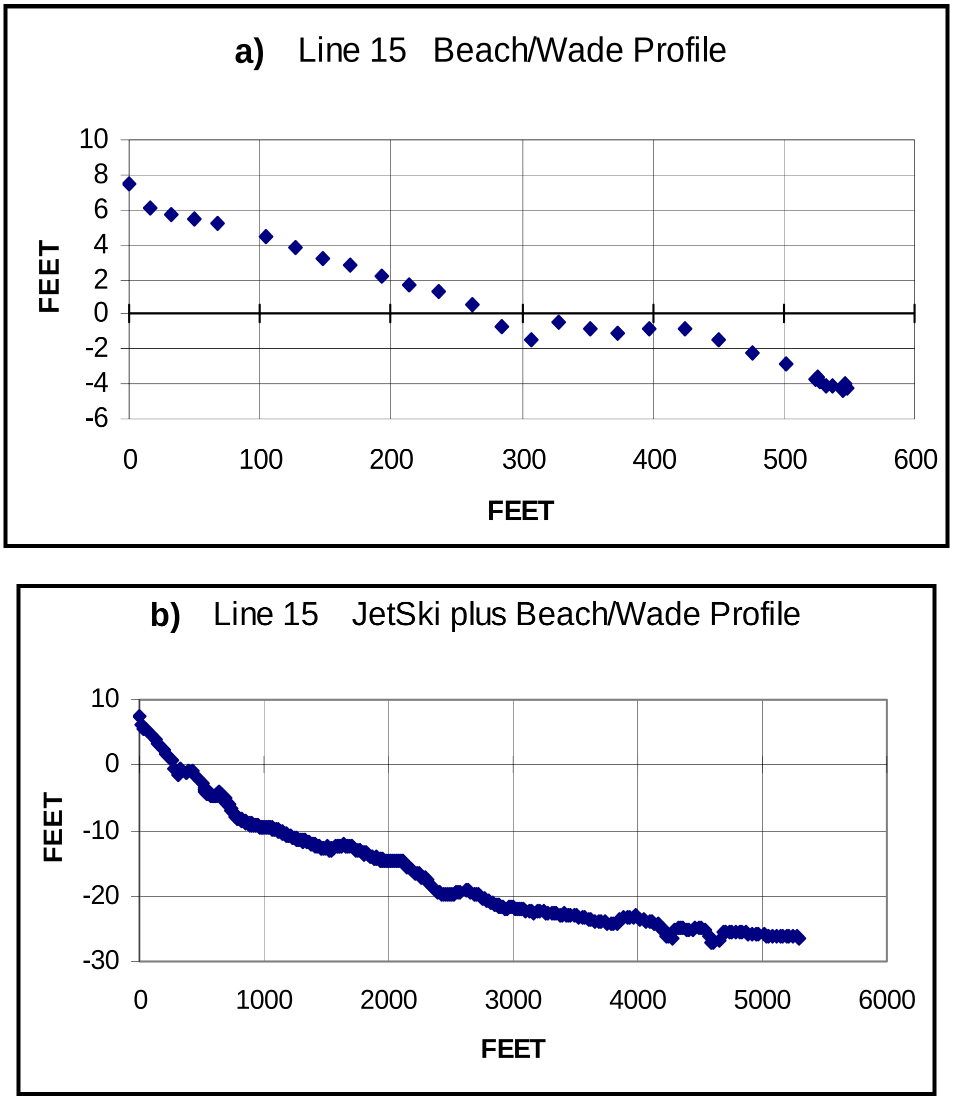

Figure 6. Line 15 profiles. a) Results from topographic survey (beach/wade); b) results from the Jet Ski hydrographic survey plus the beach/wade data. Points overlap between topographic and hydrographic surveys. Depths match very well. Results for lines 13, 14, 16, are like these.

3.1.2 Design of Video Camera System

The camera system employs an Axis 2130R Pan/Tilt/Zoom (PTZ). This camera has a Sony 1/4" CCD element with a 2-lux light sensitivity and a 16x optical lens. The camera has a digital resolution of 704 x 480 pixels. The camera has a built in web server and network interface. High-speed, hardware-based, image compression supports high-quality JEPG still images and motion-JPEG video in full color. The camera supports event-triggered actions for remote-image storage via File Transfer Protocol (FTP) and e-mail (SMTP) with time stamp and text overlay. Security is provided through username and password protection. Complete technical information can be found at: http://www.axis.com/documentation/datasheet/2130/2130ds.pdf

Two Cisco 350 Aironet Wireless Bridge transceivers are employed to bridge the camera network via Wireless Local Area Network (WLAN) with a DSL cable at the Corps of Engineers locks on the Intracoastal Waterway four miles from the camera position at the mouth of the Colorado River in Matagorda County, Texas. The WLAN will use data transfer Network Standard IEEE 802.11b at frequencies of 2.4 to 2.497 GHz. It operates license-free under FCC part 15 and complies as a Class B device. High gain Yagi antennas transmit the data over the 4-mile distance. Complete technical information can be found at http://www.cisco.com/en/US/products/hw/wireless/ps458/products_data_sheet09186a008008883c.html.

Although a computer would not be necessary at the locks, a modem or Ethernet connection would be required to access the web. We provide for this connection through a Dell Pentium-4 computer, which also provides hard disc storage of the camera video images on site. The remote power requirements are provided through the use of a 120-watt solar panel, two 50-AH gel batteries and a voltage regulator. The 120-watt solar panel will provide 60-AH of charge on a sunny day, based on six hours of direct sunlight on the panel. With a 20-AH daily usage it will take three sunny days to recharge fully discharged batteries.

3.2 Packery Channel

A baseline study of Packery Channel was initiated by the Galveston District and CHL in anticipation of construction activities scheduled to begin September 2003. To capture the pre-construction morphology and sediment conditions, a beach profile survey was performed September 6-16, 2003. The research team included CBI staff supported by a survey team from Frontier Surveying Company and visiting researchers. Dr. Ping Wang of University of South Florida was a primary investigator during the 1996 CBI Packery Channel survey. Dr. Wang and graduate student Mr. David Tidwell participated during the first four days of the 2003 survey to ensure maximum efficiency, data reliability and safety of sea sled operation. In addition, Mr. Randall Thomas from Texas A&M University at Galveston (TAMUG), operating the Jet Ski, performed line and bridle transfers to the boat, sled and shore.

3.2.1 Profile Surveys

The beach profile surveys were conducted along the stretch of coast from approximately 5 miles north to 5 miles south of Packery Channel, i.e., control points PC-01 through PC-14 in Figure 7. The southern boundary of the survey lies just south of Bob Hall Pier, and the northern boundary is the southern jetty of Fish Pass at Mustang Island State Park. The spacing of the profile lines is more concentrated around the (to-be-reopened) intersection of Packery Channel with the Gulf of Mexico and the nourished beach located directly adjacent to the inlet. The profile transect locations agree as closely as possible with profile locations occupied during a survey conducted in 1996 by CBI (Kraus and Heilman 1997). Only one of the 1996 control points was relocated (PC-06). To search for the 1996 control locations and to establish new controls in the vicinity of the unrecoverable control points, an RTK differential GPS was utilized, referencing two local base stations for increased accuracy. The locations and elevations of the control points as well as survey datum information are given in Table 2.

The beach profile surveys extended from landward of the primary dune (or to other onshore limiting features) to a minimum offshore elevation of -24 ft (NAVD 88). National Ocean

Service Benchmark elevations at Bob Hall Pier tide gauge were applied to determine the relationship of MSL to NAVD 88 (NAVD 88 + 0.48 = MSL). The land survey was conducted to wading depth, and the nearshore elevations were measured by sea sled. An overlap of 100 ft (at least five elevation locations) between land and marine surveys was maintained throughout the survey (Figure 8). The profile plots for PC01 through PC14 are given in Appendix A.

The rigging and towing systems of an existing CBI sea sled, previously applied during the 1996 Packery Channel survey as well as surveys at Galveston and South Padre Island, were reassembled and reinforced in anticipation of deployment. The sea sled consisted of two 16-ft long "skis" connected by a 16-ft long center beam and supportive cross beams (Figure 9). The 31-ft tall mast was stabilized by a 12-cable system extending from the top sections of the three-piece mast to the ski tips and mast base. A 360° prism was affixed to the top of the mast, serving as the target of an infrared light beam emitted from a surveying total station placed at each bench mark.

The beach profile surveys were delayed and surveys were terminated on three occasions due to boat mechanical problems, high waves (5-7 ft), or strong longshore currents. These latter conditions made navigation difficult, particularly in the vicinity of nearshore obstacles such as ballards along the Mustang Island Park boundaries and the Fish Pass Jetties. In addition, the sea sled encountered large submerged obstacles at –12 ft and -24 ft (NAVD 88) on two occasions causing delays and damage to the tips of the skis. PC15 and PC16 located north of Fish Pass were eliminated from the beach profile survey due to these navigation, safety, and mechanical issues. The sled will require maintenance prior to future survey operations.

The historic 1996 data were originally reported relative to MSL at the Bob Hall Pier tide gauge and were, therefore, converted to the NAVD 88 vertical datum for comparison with the 2003 survey data. The conversion was based on the three-tiered relationship of MSL at the Bob Hall Pier tide gauge to the Bob Hall Pier location benchmark (a Primary Station referenced as BM5870A or NGS PID AC8459) datum, and the NGS documented conversion to NAVD 88 for that benchmark. The result of the three-tiered conversion from MSL to NAVD 88 was the subtraction of 0.246 ft from the 1996 data. Note that the 1996 data were originally collected relative to an arbitrary local vertical datum unique to each profile control location. Each individual vertical control was later related to MSL at the Bob Hall tide gauge during post processing. The horizontal control for the 1996 data was established by non-differential GPS (Kraus and Heilman 1997).

Verification and review of the 2003 and 1996 beach profile survey data show reasonable vertical agreement for all profiles. Good agreement was observed at PC06 (Figure 10), the only original control point physically relocated during the 2003 survey, as well as for profiles where new control was established in the absence of benchmark relocation (Figure 11). Although the original PC06 benchmark was located, differences in horizontal (>25 ft) and vertical position (0.47 ft) were observed between the 2003 and 1996 data. The 2003 position of the PC10 control is within 50 to 100 ft of the estimated location of the original control point. Differences are attributed to increased accuracy in GPS technology applied to establish control during the 2003 survey. The relocation of original control locations was hindered because of the lack of differential GPS for the local established control benchmarks during the 1996 survey and because of reported vandalism of some benchmarks. The entire set of comparative profile plots is given in Appendix B.

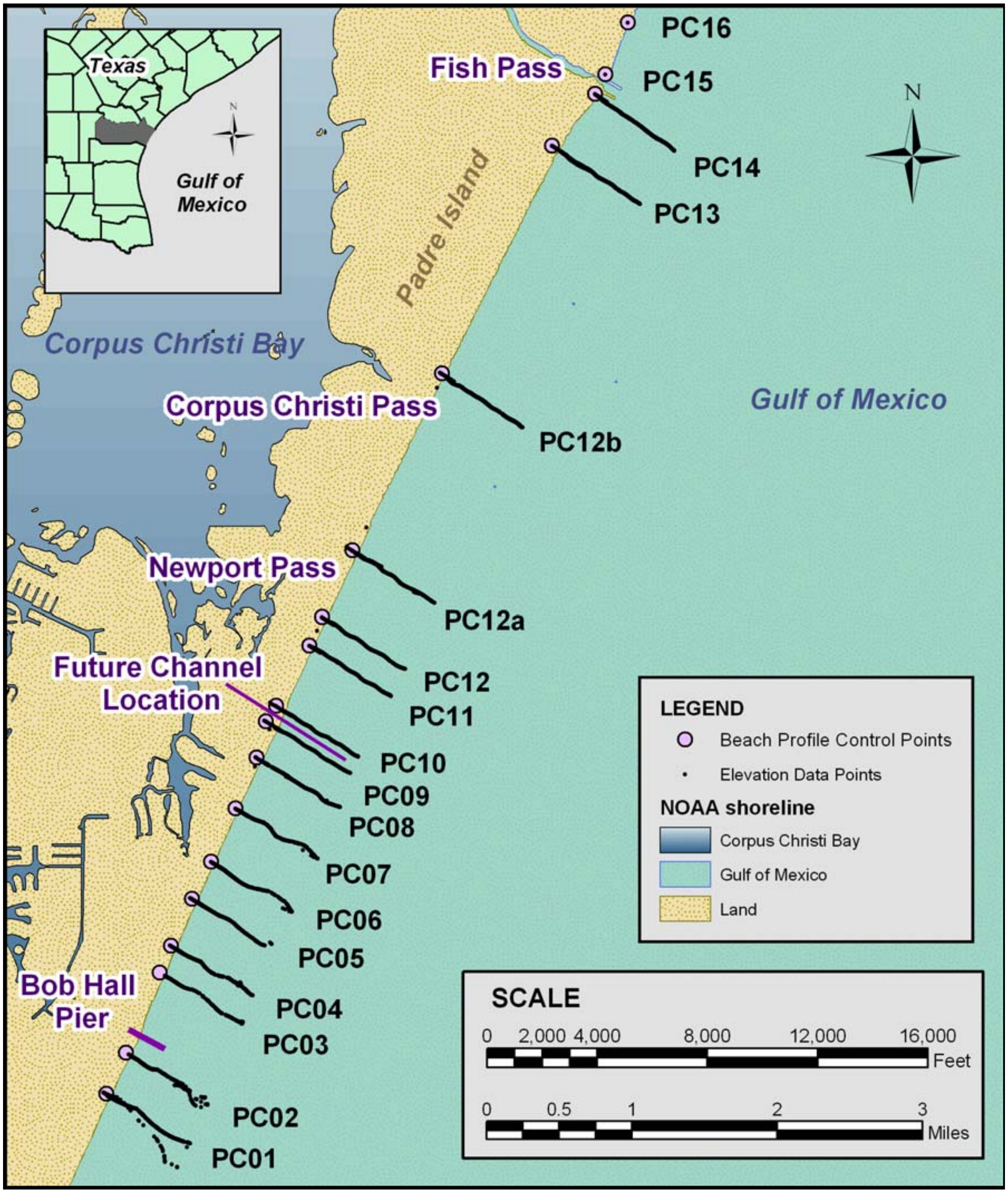

Figure 7. Site map indicating the location of survey control points and beach profile data north and south of the future site of Packery Channel inlet.

Table 2. Packery Channel Beach Profile Control Point Information.			
Control Point	Northing (Feet)	Easting (Feet)	Elevation (U.S. Survey Feet)
PC-01	17100537.925	1397907.186	5.880
PC-02	17102035.167	1398618.439	7.379
PC-03	17104954.444	1399847.700	6.436
PC-04	17105928.891	1400249.393	7.907
PC-05	17107640.301	1401008.198	3.657
PC-06	17108993.891	1401702.255	13.514
PC-07	17110937.657	1402588.760	13.726
PC-08	17112780.5837	1403352.1547	2.943
PC-09	17114099.630	1403704.602	4.282
PC-10	17114656.546	1404065.769	3.500
PC-11	17116856.714	1405286.919	5.972
PC-12	17117875.220	1405750.499	5.643
PC-12a	17120296.817	1406842.270	4.251
PC-12b	17126733.227	1410091.854	5.813
PC-13	17135028.854	1414103.213	3.573
PC-14	17136905.496	1415662.905	4.749
PC-15	17137616.641	1416041.762	6.577
PC-16	17139498.336	1416860.704	4.689
Datum Information			
Horizontal Datum		Vertical Datum	Azimuth Point
NAD 83 Texas South Zone 4205		NAVD 88	N 16756617.298 E 1988751.918

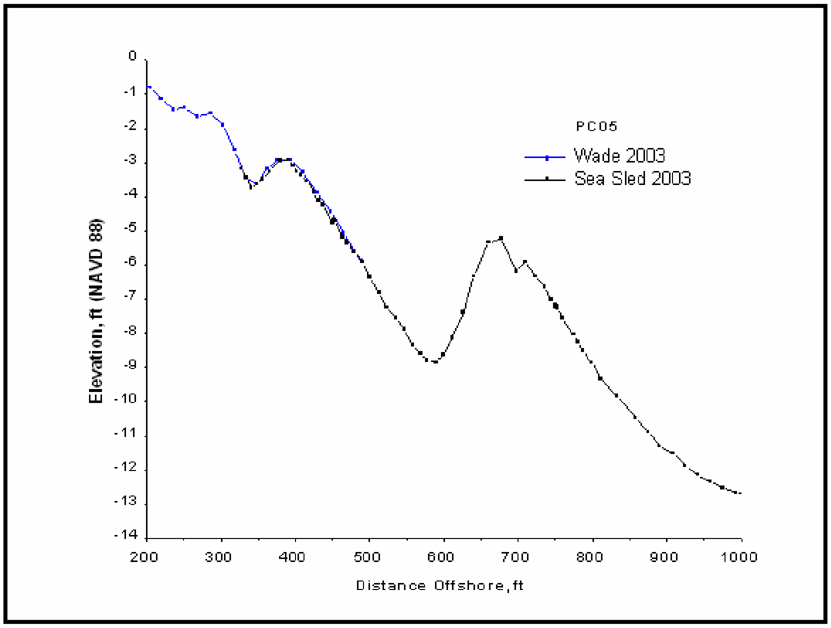

Figure 8. Overlap of sled/wade survey of greater that 100 ft as observed on profile PC-05.

Figure 9. Sea sled preparation during survey of PC-04 located north of Bob Hall Pier.

The comparison plots of the 1996 and 2003 profile data indicate significant change in the backshore features such as dune toe position (Appendix B). The region from PC01 to PC10 has experienced a large amount of mechanical sand manipulation. The dune toe shown by the 2003 data indicates the seaward extent of the mechanically placed dunes. These dune features in some cases had been "placed" days in advance of the 2003 profile survey and, therefore, do not reflect dune accretion by natural processes. The placement of piles of sand and beach debris (generally seaweed) at the existing dune toe is standard practice in this area in an effort to combine routine beach cleaning and maintenance with dune reinforcement. Furthermore, Christmas trees are seasonally deposited along the dune toe to aid in sand accretion. In addition, the data show a region of significant sand accretion at the landward extreme of profile PC13. This profile is located on Mustang Island State Park in the center of the park facilities. Nearly all of the park picnic tables and benches were completely covered by sand at the time of the 2003 survey. Wind driven transport and extended periods of higher-than-average water levels are likely responsible for the accretion observed in this area.

3.2.2 Sediment Samples

Sediment samples were collected at six locations along each profile (dune toe, mid berm, shoreline, and -3 ft, -12 ft, and -24 ft elevations). Ninety-six sediment samples were collected among the 16 profiles. Sediment grain size analysis was conducted according to standard sediment processing and sieving methodology (Mason and Folk, 1958; Folk, 1976). Sediment samples were desalted and mechanically sieved (Ro-Tap machine) at 0.25-Phi increments for 15 minutes.

Sediment analysis showed consistency in grain size characteristics at onshore locations for all profiles with variability increasing at nearshore and offshore locations throughout the study site. The Coastal Engineering and Design System (CEDAS) software Automated Coastal Engineering System (ACES) was applied to determine statistical parameters describing grain size distribution (median, mode and inclusive graphic standard deviation). Statistical analysis followed methods described by Folk and Ward (1957), Mason and Folk (1958) and Folk (1976). Inclusive graphic standard deviation is a measure of sorting that has been applied to describe the sediments of Mustang Island (Mason and Folk, 1958) and is defined as:

$$\sigma_I = \frac{\phi 84 - \phi 16}{4} + \frac{\phi 95 - \phi 5}{6.6} \; ;$$

Where ø = grain size (Phi)

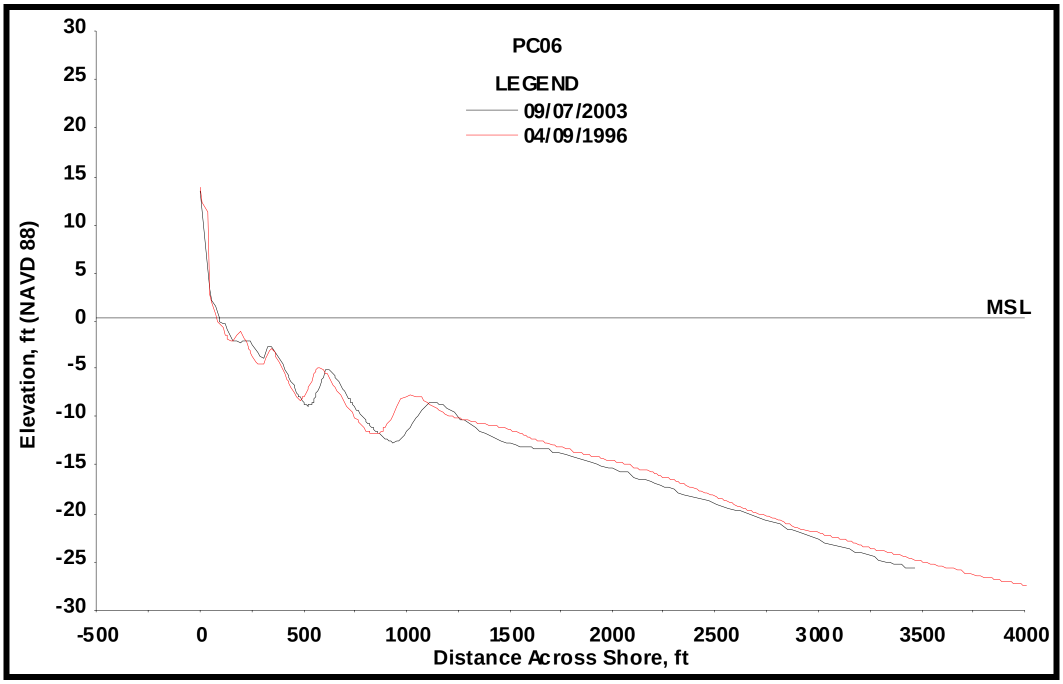

Figure 10. Fall 2003 beach profile survey data compared to 1996 data at PC-06.

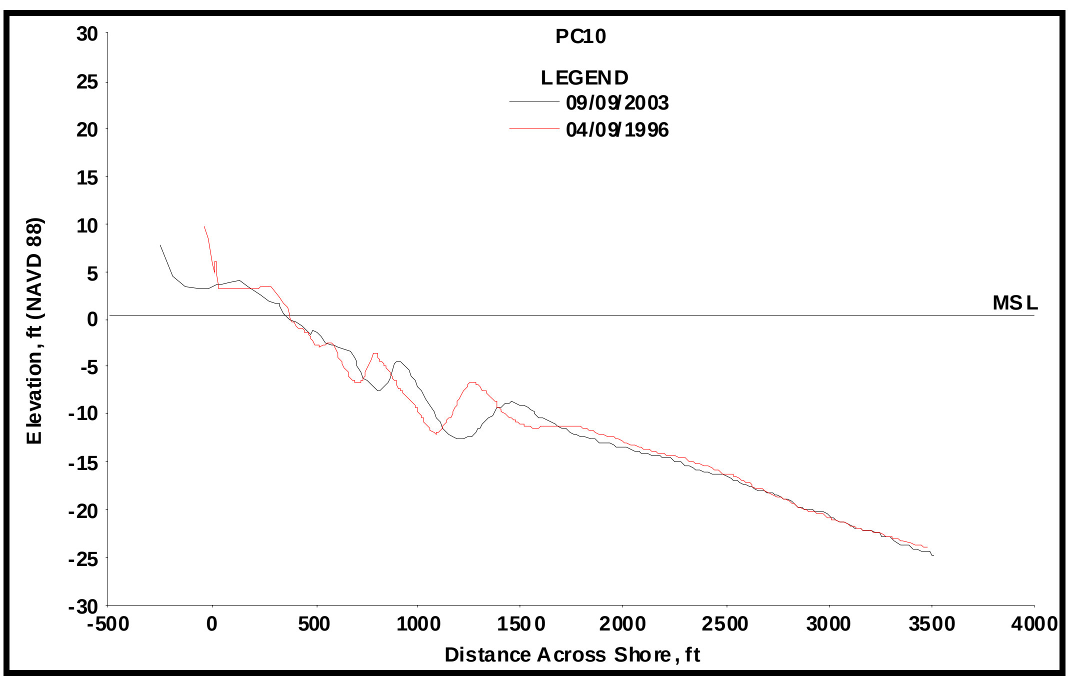

Figure 11. Fall 2003 beach profile survey data compared to 1996 data at PC-10.

This formula includes 90% of the distribution and is the best overall measure of sorting (Folk 1974). A classification system for sorting defined by the inclusive graphic standard deviation is given in Table 3.

Table 3. Sorting classification system for inclusive graphic standard deviation

σ_I	Classification
< 0.35	Very well sorted
0.35-0.50	Well sorted
0.50-0.71	Moderately well sorted
0.71-1.00	Moderately sorted
1.00-2.00	Poorly sorted
2.00-4.00	Very poorly sorted
> 4.00	Extremely poorly sorted

The data show that the sediment found at the most offshore locations (-24 ft) was composed of, moderately sorted sand (m = 0.60ø) and that sorting improved as the dune toe was approached, which had the best sorting (m = 0.24ø). The sediment in the study area was classified as Fine Sand with a median grain size ranging from 0.14 mm (-4 ft) to 0.17 mm (shoreline to dune toe). Data indicate a trend of finer sand progressively offshore. Table 4 summarizes the mean and range of values determined for all profiles (PC01-PC14) at the location indicated. A more detailed account of grain size statistics is given in Table C1 (Appendix C).

Table 4. Summary of Grain Size Statistics for Profiles (PC01-PC14)

	Median Grain Size (mm)		Inclusive Graphic Standard Deviation (ø)	
Location	Range	Mean	Range	Mean
Toe of Dune	0.14-0.16	0.15	0.22-0.30	0.24
Mid Berm	0.14-0.17	0.15	0.20-0.34	0.28
Shoreline	0.14-0.17	0.15	0.22-0.66	0.36
- 3 ft	0.14-0.16	0.14	0.21-0.48	0.34
-12 ft	0.11-0.15	0.14	0.17-0.63	0.37
-24 ft	0.11-0.15	0.13	0.24-0.97	0.60

3.2.3. Key milestones for Task 2 and continuing work

- TAMUG completed land and hydrographic surveys of the Colorado River inlet.
- TAMUG designed a video camera system to be installed at the Colorado River inlet to monitor construction projects and beach morphodynamics.
- TAMUG supplied personnel and equipment support to TAMU-CC for the Packery Channel Beach Survey.
- (TAMU-CC) Construction, reinforcement and assembly on site of the sea sled were completed.
- (TAMU-CC) Sled and wading depth surveys were conducted for 16 profiles, PC-01 through PC-14.
- (TAMU-CC) PC-15 and PC-16 located north of Fish Pass Jetty were not surveyed due to deteriorating weather, sea conditions and a damaged sea sled.

- (TAMU-CC) Sediment samples (96) were collected for PC-01 through PC14.
- (TAMU-CC) Sediment sample processing and analysis were completed.
- (TAMU-CC) Data reduction, review, verification and plotting were completed.

4.0 Task 3. Monitoring and Measurements

On September 30, 2003, the TEES-CC component of this project began installation of a bottom-mounted 1200-kHz RDI Monitor Work Horse ADCP in the existing Packery Channel near its intersection with the GIWW (see Figures 12 and 13). The ADCP monitors the vertical profile of horizontal currents. It is located near the middle of the channel in about 9-ft water depth in a trawl-resistant-bottom-mount (TRBM) to protect it from normal ship traffic in the channel. The ADCP is configured to sample 5-min averages in 0.2-m depth bins. The current velocity profile data are transmitted through a double-armored cable to a nearby remote site, which provides data control and storage (Figure 14). Various real-time telemetry pathways to CBI were tested. The most successful was found to be a radio link from the Packery Channel site to CBI's Shoreline Environmental Research Facility (SERF) located on Flour Bluff, where the data are then transferred by T1 ethernet cable to CBI. Storage at the nearby remote site secures the data in the event the instrument or transmission link is lost. Transmission of the data to CBI provides additional backup, permits continuous QA/QC, and allows some preliminary data analysis if requested. Wind speed and direction measurements will also be collected at the remote site during the next fiscal year.

Figure 12. View from the JFK Causeway GIWW bridge of location of the data controller/logger/telemetry site and the bottom-mounted ADCP. A double armored cable connects the ADCP to the shore site.

Figure 13. Aerial photo showing the location of the ADCP relative to the intersection of existing Packery Channel and the GIWW.

Figure 14. Photo of the components of the data controller/logger/telemetry box.

As a note, the divers reported that the bottom of the channel between the bank and the location of the TRBM consisted of hard-packed sand. Also, the current was weak between the surface and middepth, but near the bottom the current was significantly stronger, requiring the divers to kick continuously with their swim fins to maintain position during placement of the TRBM.

Coincident water level observations from the nearby Packery Texas Coastal Ocean Observation Station will be obtained. In addition, the ADCP will provide a measurement of water level in the channel. The model of ADCP that CBI is using includes pressure and temperature sensors. The pressure sensor can accurately determine water level though measurement of pressure changes. The pressure measurements are converted to water level measurements using water temperature, an assumed salinity, and barometric pressure measurements from other sensors operated by CBI in CC Bay.

4.1 Key Task 3 milestones and continuing work:

- Installation of ADCP in Packery Channel was completed.
- Establishment of a real-time communications link to CBI is in progress.

5.0 Summary

Table 5 provides a summary of the project milestones completed and in progress at the end of the first fiscal year of the contract (September 30, 2003).

Table 5. Status of project milestones.

Task	Description	Date Conducted	Status
	Task 1		
Aerial photography	Rectified aerial photography for inlets of interest	08/06/2003 to 09/24/2003	Completed
Data dissemination and archiving	Develop website architecture	08/15/2003 to 09/12/2003	Completed
Propagation of data dissemination system	Historic information, data, reports, images and aerial photos	09/12/2003 to present	Continued during 2004
Development of baseline Arc View Texas Inlets project	Packery prototype developed and propagated	09/06/2003 to present	Continued during 2004
	Task 2		
Colorado River Hydrographic Survey	Beach and hydrographic surveys of the Colorado River Inlet	08/19/03 to 08/23/03	Completed
Design of a video camera system for	Monitor construction projects and beach	09/01/03 to 9/30/03	In Progress

Colorado River inlet	morphodynamics	09/01/03 to 9/30/03	(50% complete)
Provide personnel and equipment support for TAMUCC survey	One experienced person and Jet Ski to assist in Packery Channel survey	09/06/2003 to 09/16/2003	Completed
Packery Channel Beach profile survey (Baseline Fall 2003)	16 Beach profile surveys and sediment samples at Packery Channel	09/06/2003 to 09/16/2003	Completed
Verification and review of Packery Channel survey data	Data reduction, verification and graphical display against previous data	08/07/2003 to present	Completed
Sediment Processing	Washing, drying, sieving samples	09/17/2003-12/30/2003	Completed
Sediment Analysis	Statistical analysis	09/30/2003-12/30/2003	Completed
Task 3			
Installation of Monitoring Station at intersection of Packery Channel and GIWW	Station constructed and ADCP deployed	09/30/2003	Completed
Establishment of real-time link to CBI database and website	Ensure reliability of data collection and archiving	9/30/03 to present	In Progress (10% complete)

6.0 Reference

Folk, R.L. and W.C. Ward, 1957. Brazos River bar: a study in the significance of grain size parameters: *Journal of Sedimentary Petrology*, Vol. 27, pp. 3-26.

Folk, R.L., 1974. Petrology of Sedimentary Rocks. Hemphill Publishing Company, Austin, Texas, 182 p.

Kraus, N.C. and D.J. Heilman, 1997. Packery Channel Feasibility Study: Inlet Functional Design and Sand Management, Report 1 of a Two-Part Series, Final Report. Technical Report: TAMU-CC-CBI-96-06, Prepared for Naismith Engineering, Inc., 106 p.

Mason, C.C and R.L. Folk, 1958. Differentiation of Beach, Dune, and Aeolian Flat Environments by Size Analysis, Mustang Island, Texas. *Journal of Sedimentary Petrology*, Vol. 28, No. 2, pp. 211-226.

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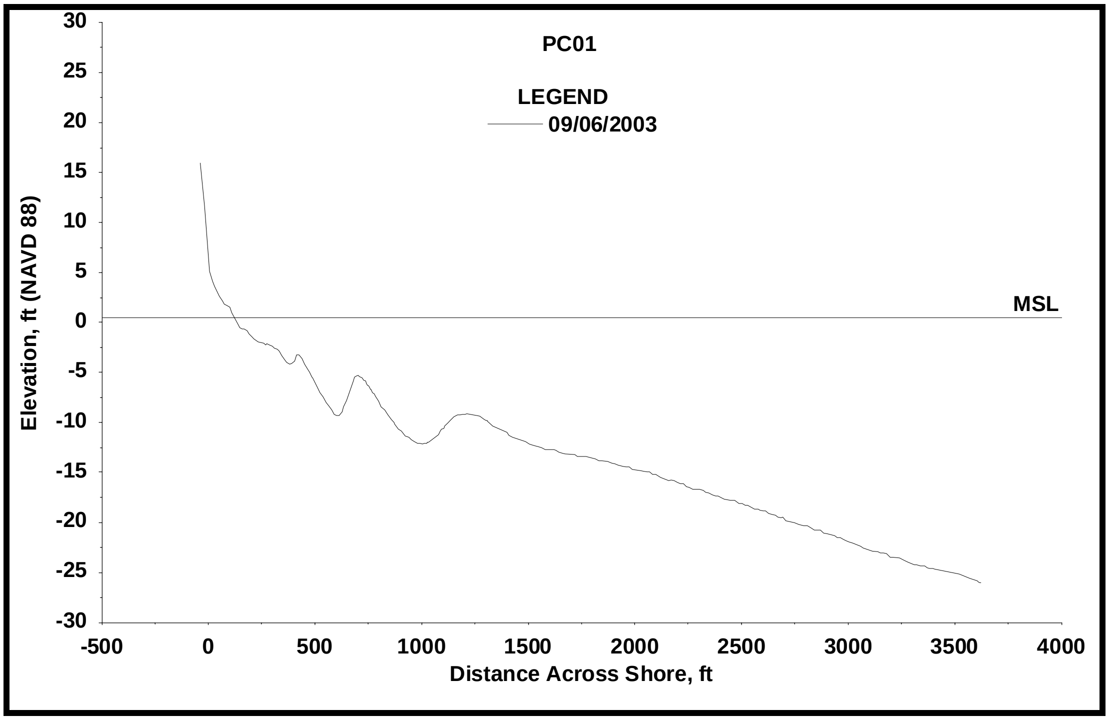
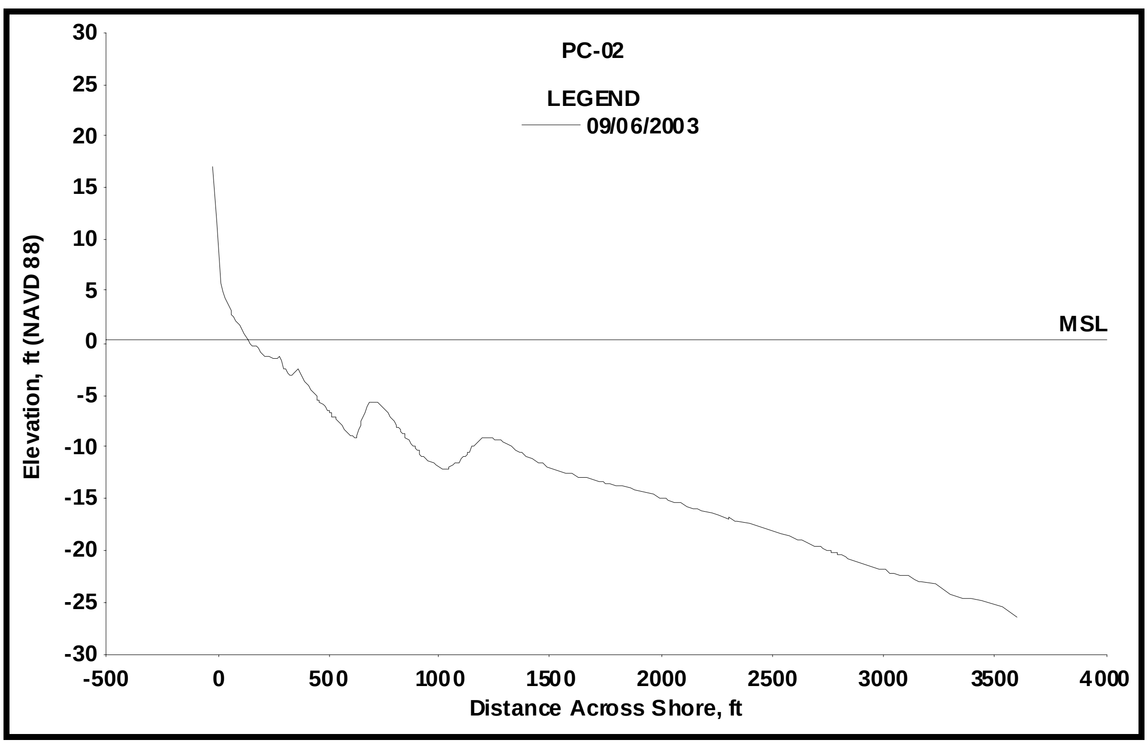
APPENDIX A: Plots of Profile Surveys, September 2003

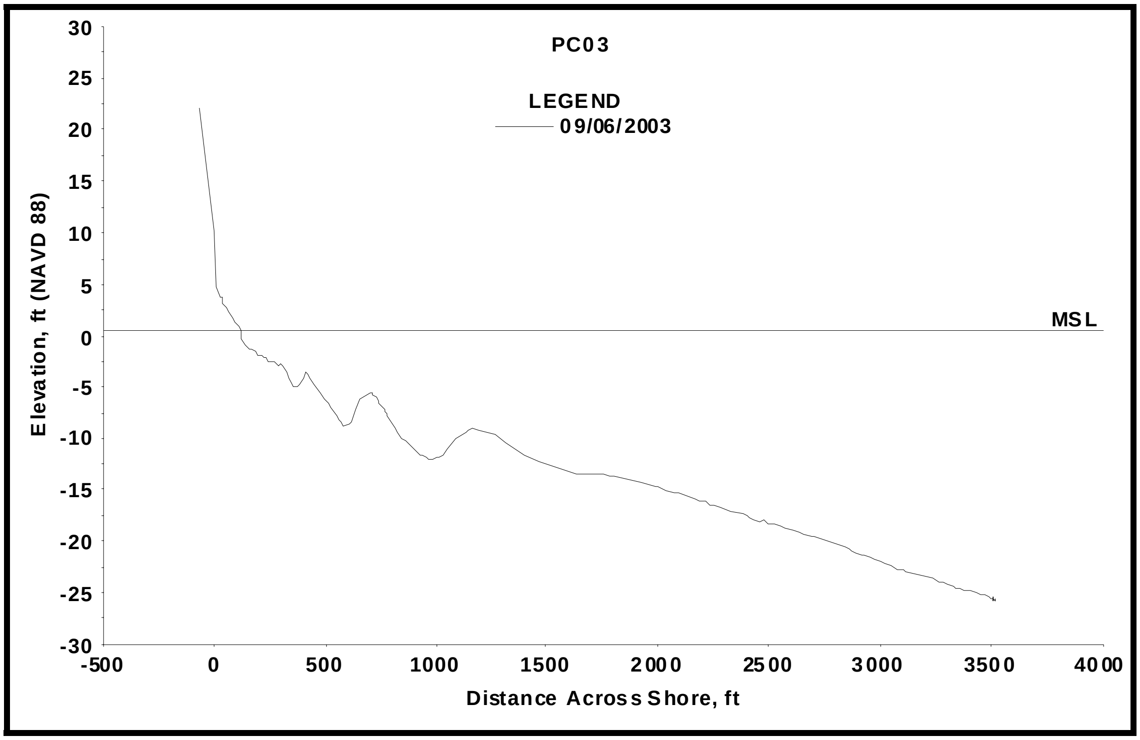
This section presents plots of the beach survey profiles collected during September 2003. The locations of the profiles are shown in Figure 7 in the main text.



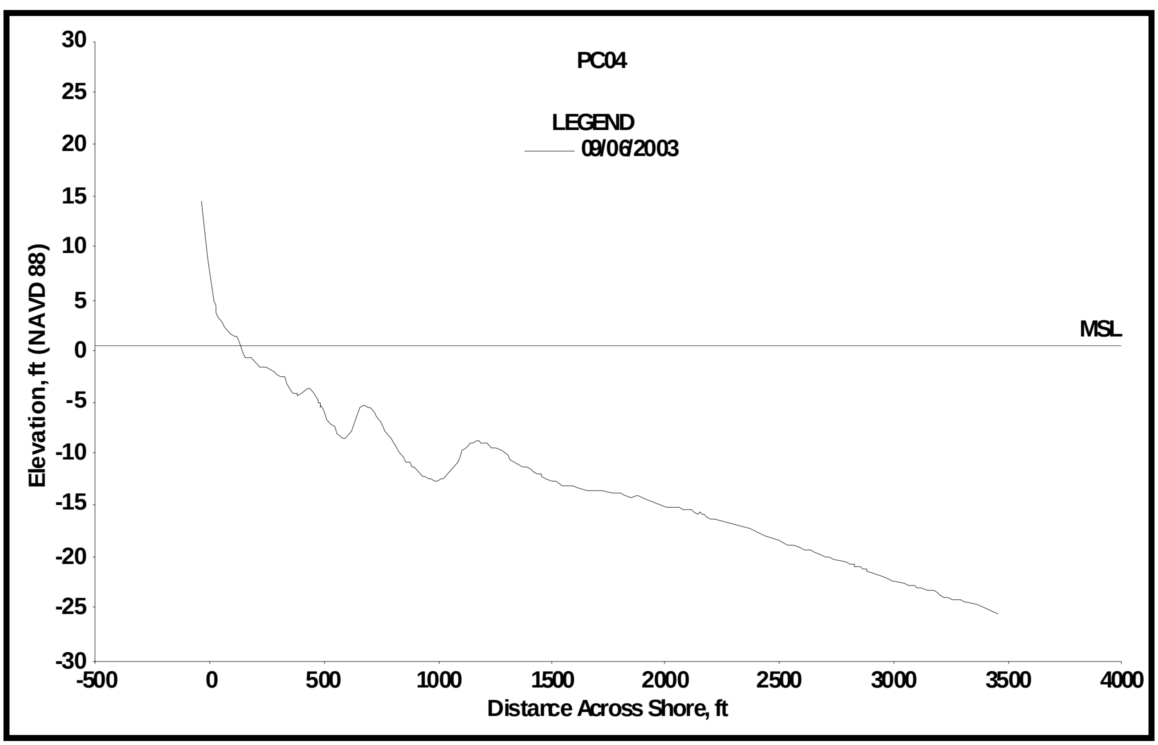
Profile 1: 09/06/2003



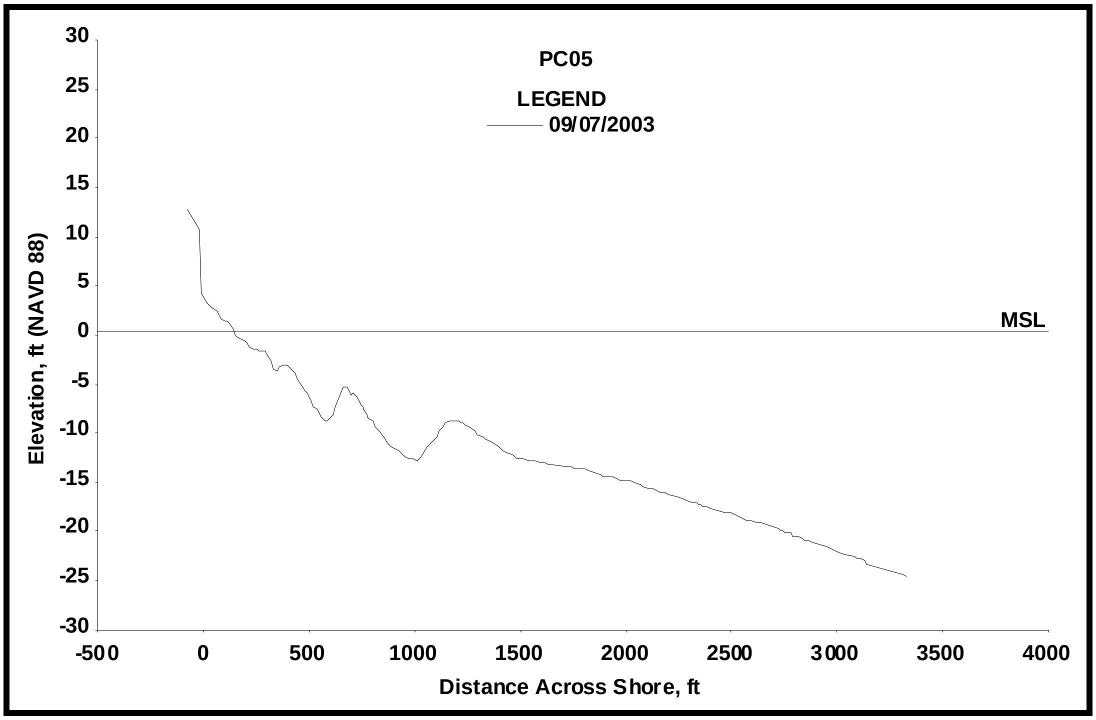
Profile 2: 09/06/2003



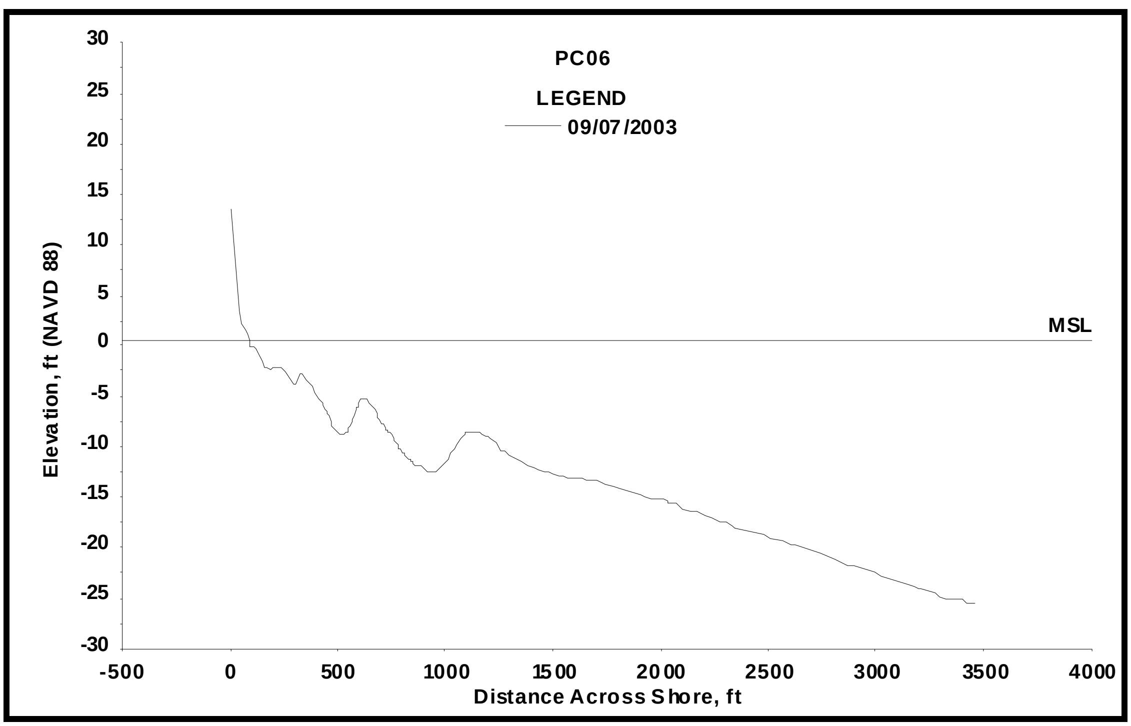
Profile 3: 09/06/2003



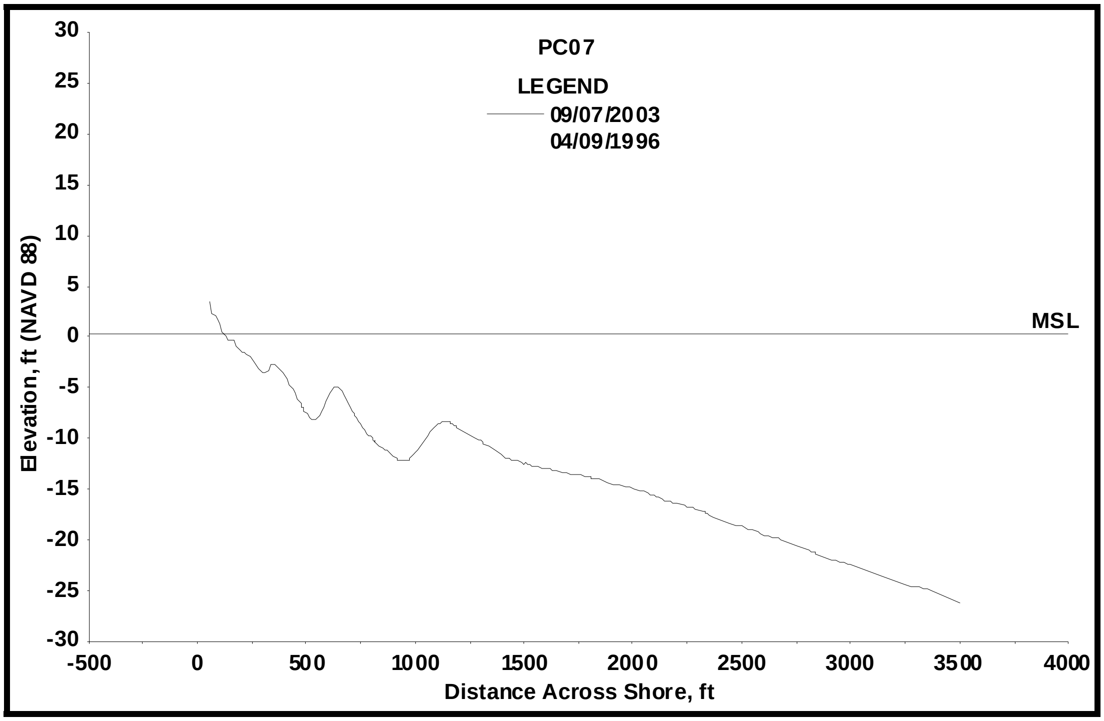
Profile 4: 09/06/2003



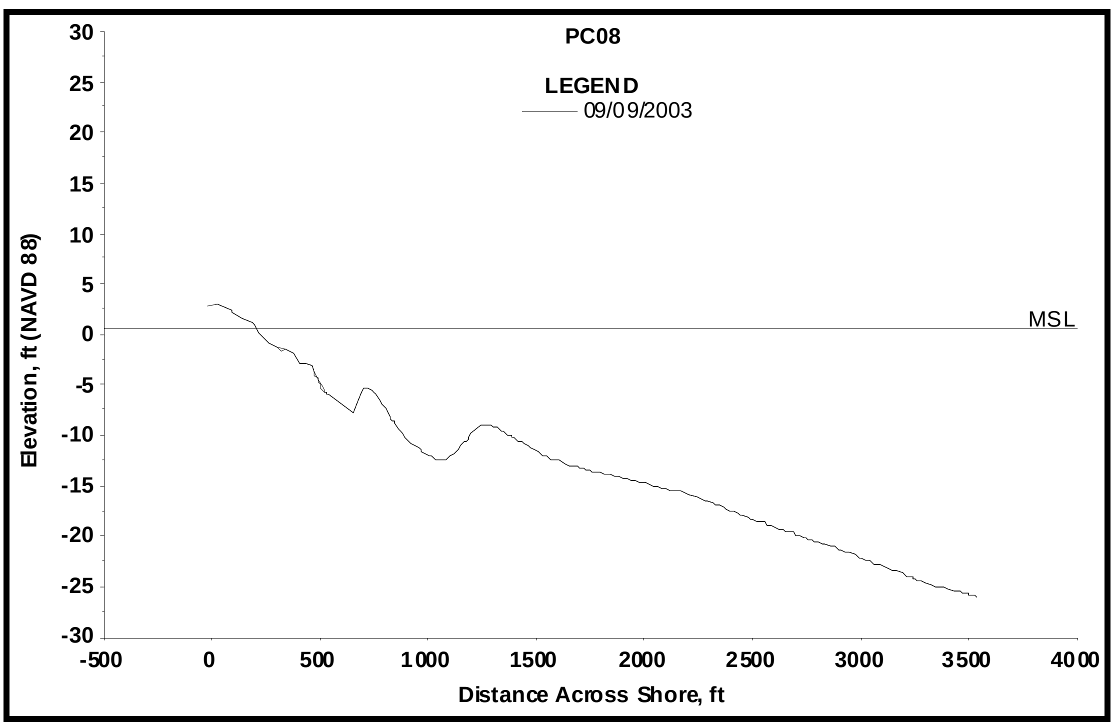
Profile 5: 09/07/2003



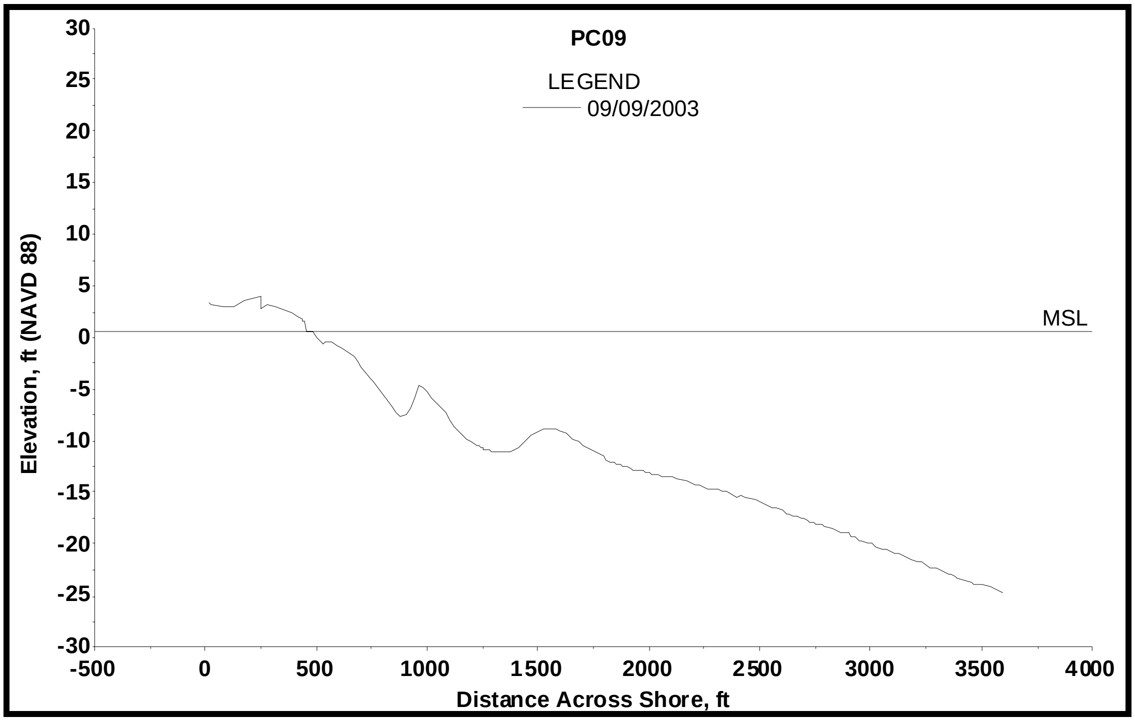
Profile 6: 09/07/2003



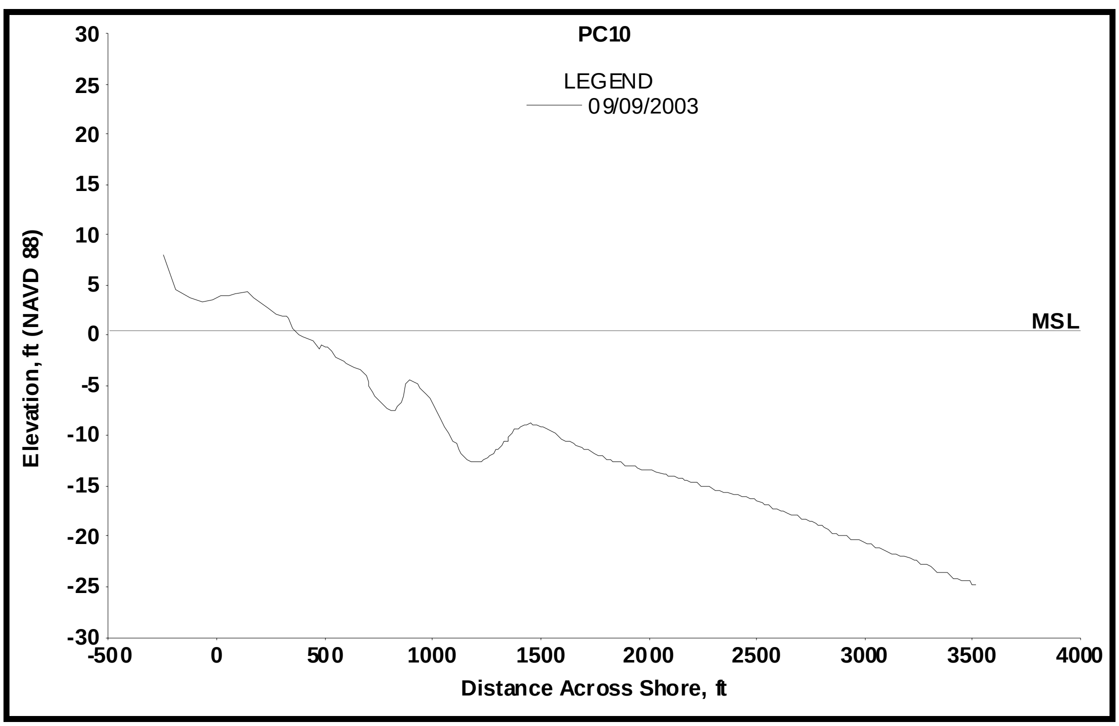
Profile 7: 09/07/2003



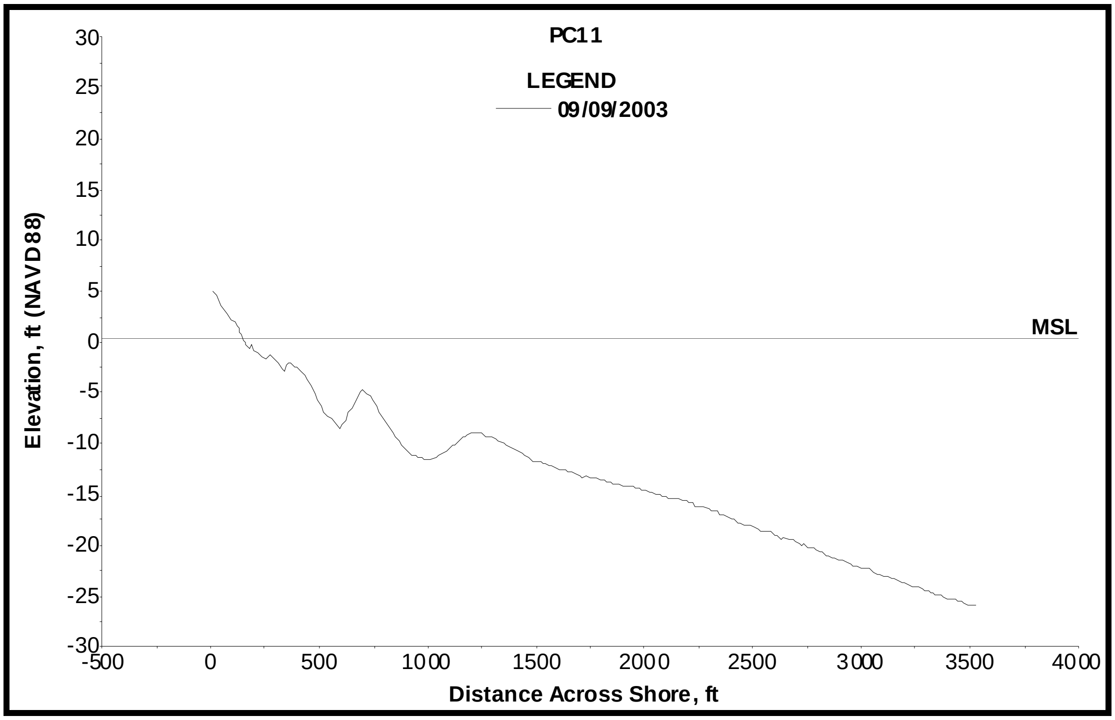
Profile 8: 09/07/2003



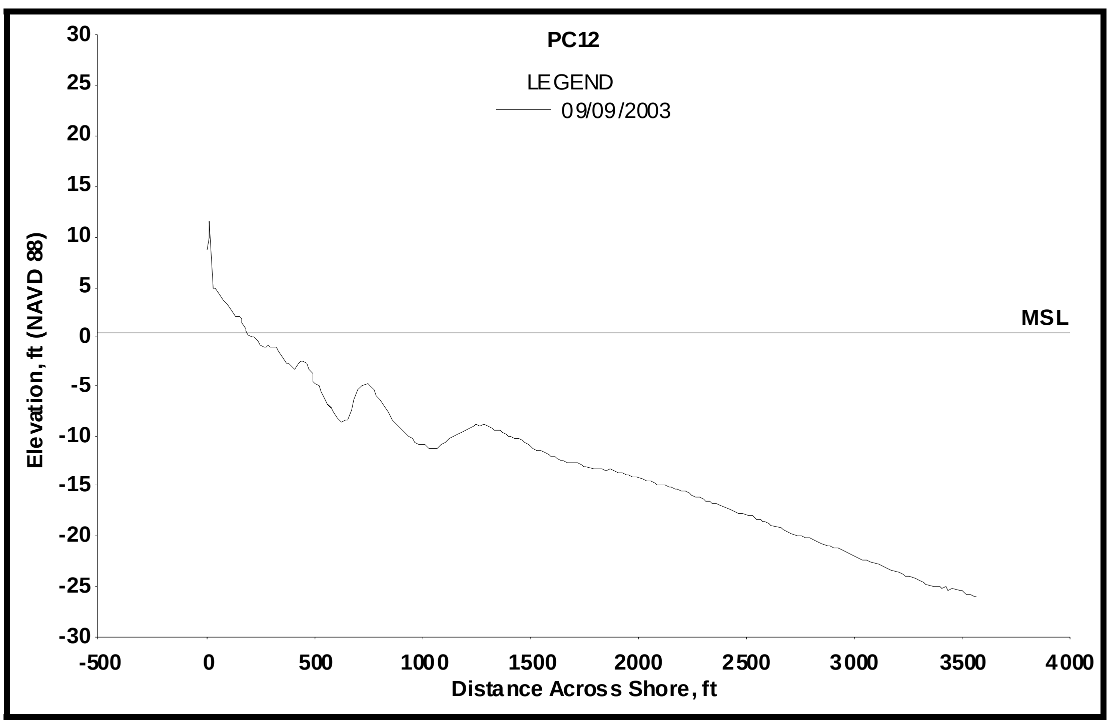
Profile 9: **09/09/2003**



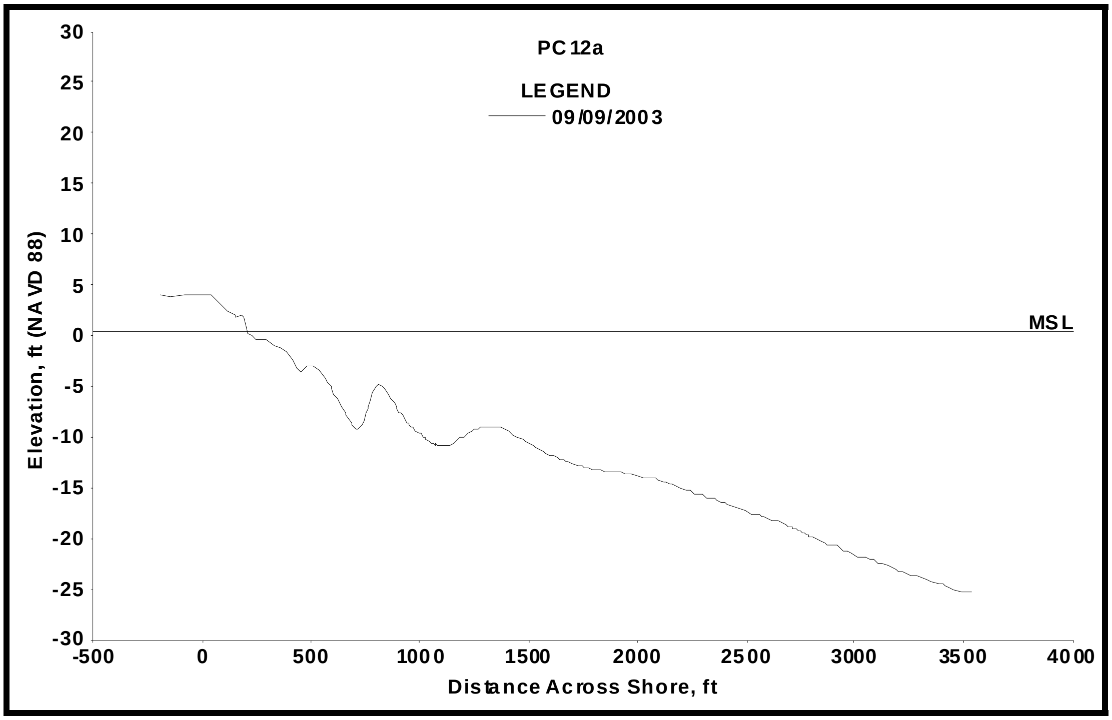
Profile 10: 09/09/2003



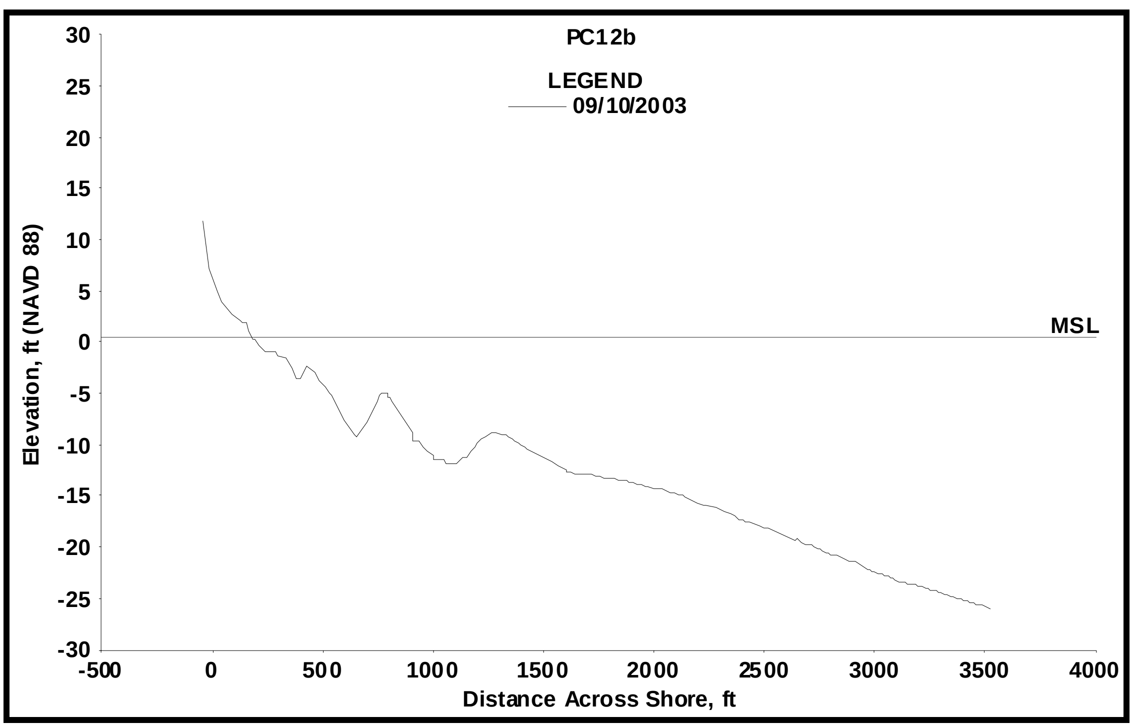
Profile 11: 09/09/2003



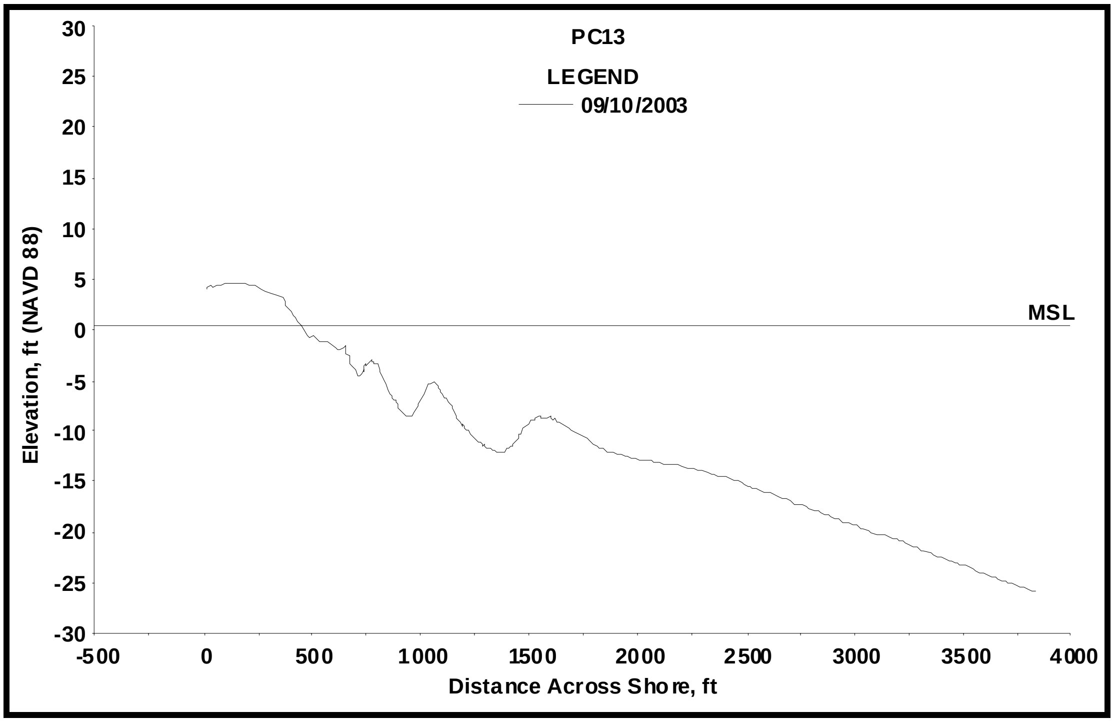
Profile 12: 09/09/2003



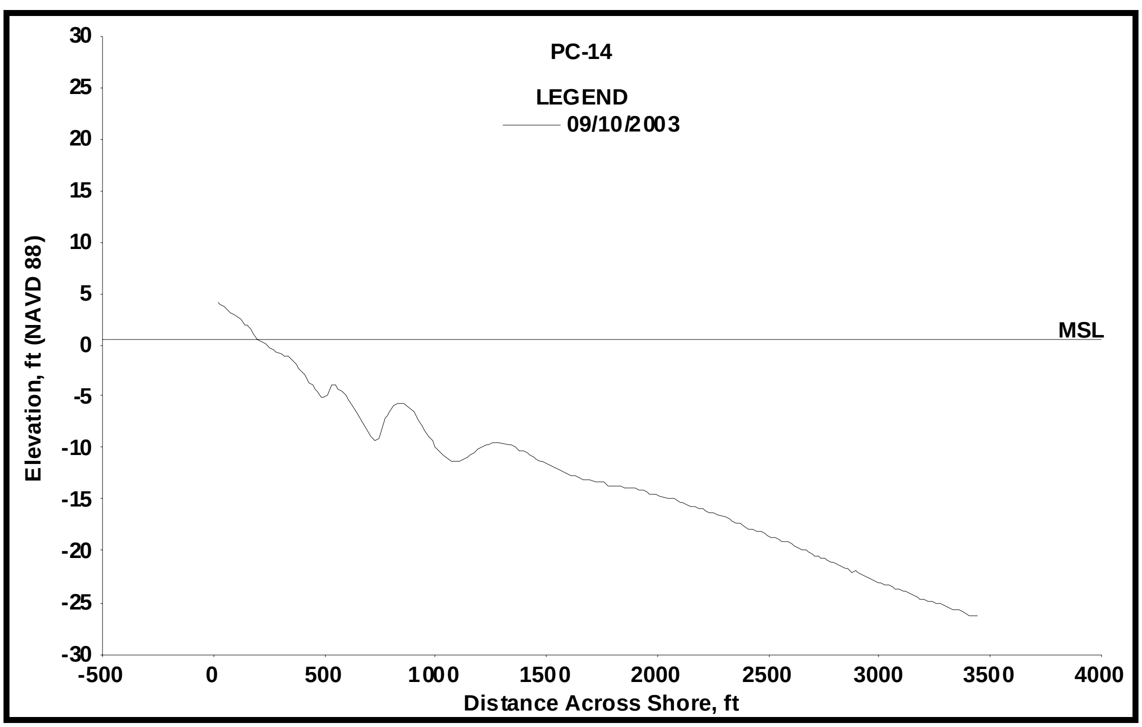
Profile 12a: 09/09/2003



Profile 12b: 09/10/2003



Profile 13: 09/10/2003



Profile 14: 09/10/2003

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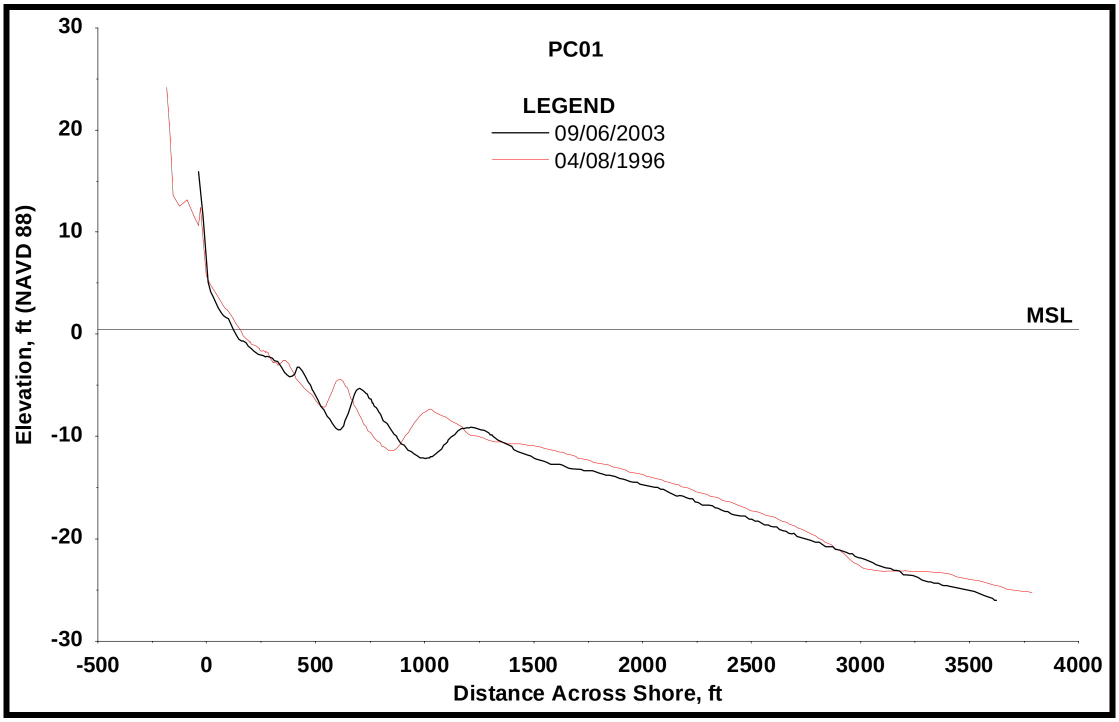
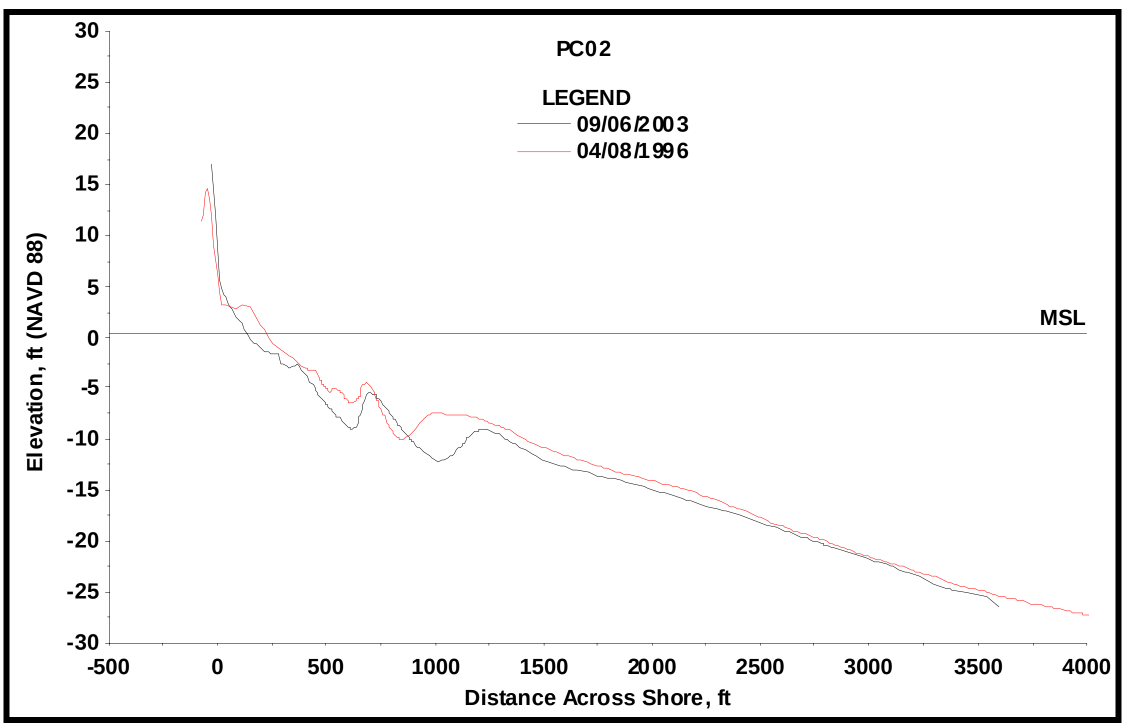
APPENDIX B: Comparison Plots of 1996 and 2003 Profile Surveys

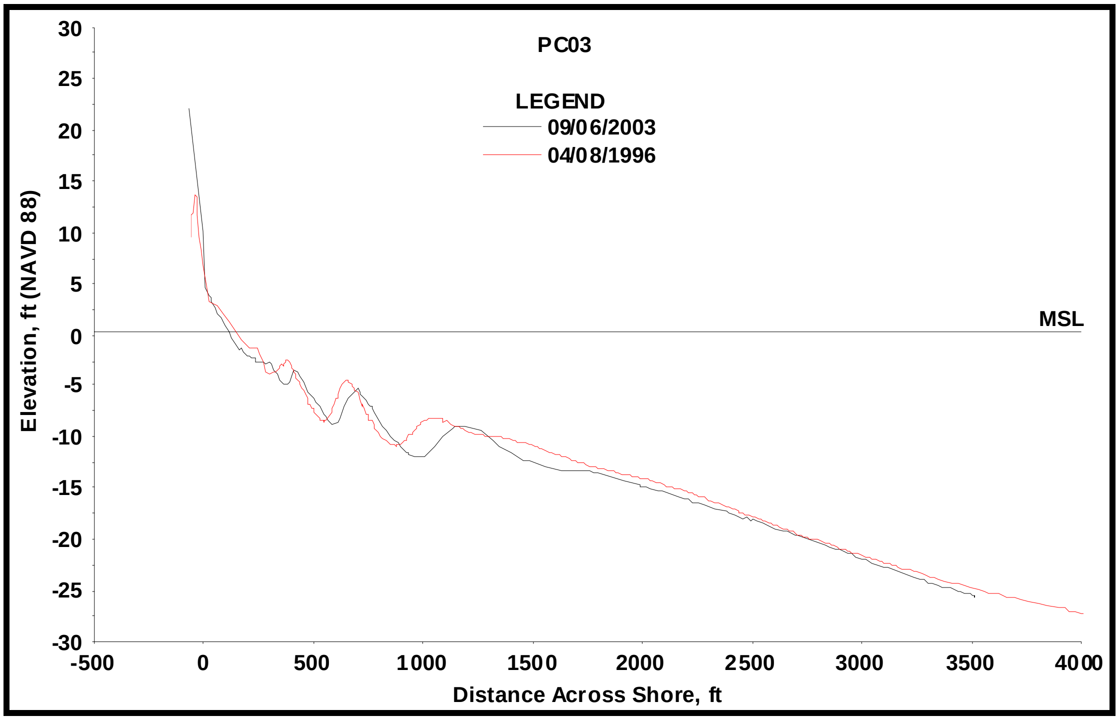
This section presents plots that compare the results from the April 1996 and September 2003 beach survey profiles. The locations of the profiles are shown in Figure 7 in the main text.



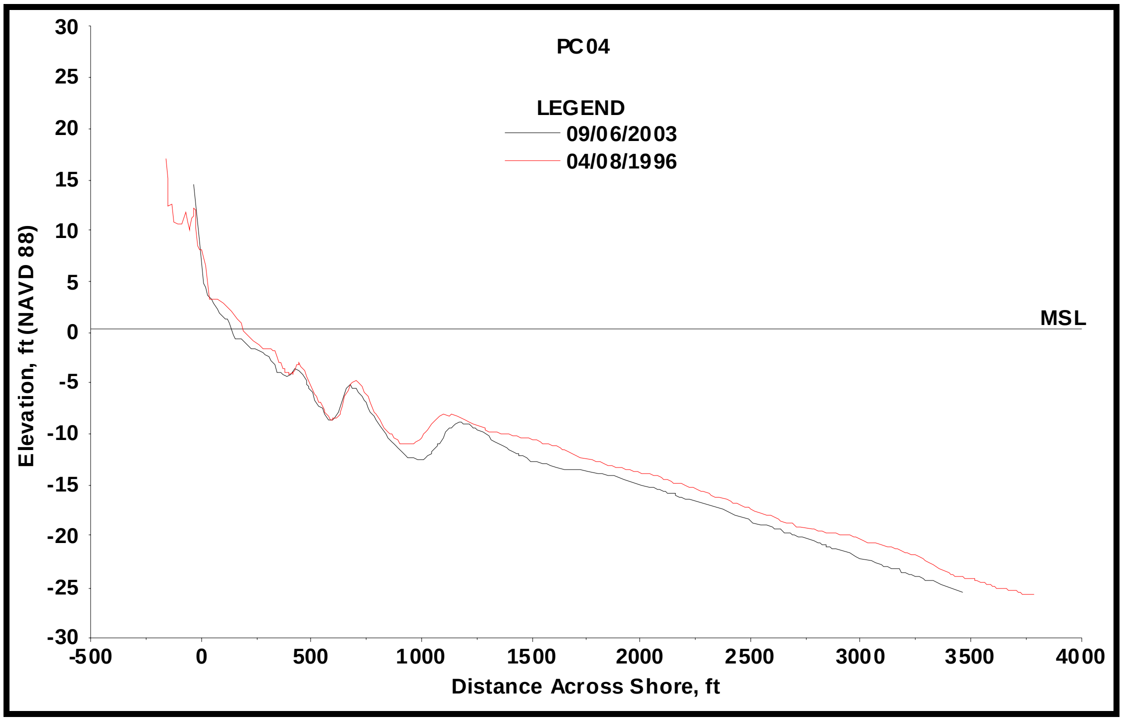
Profile 1: 09/06/2003 and 04/08/1996



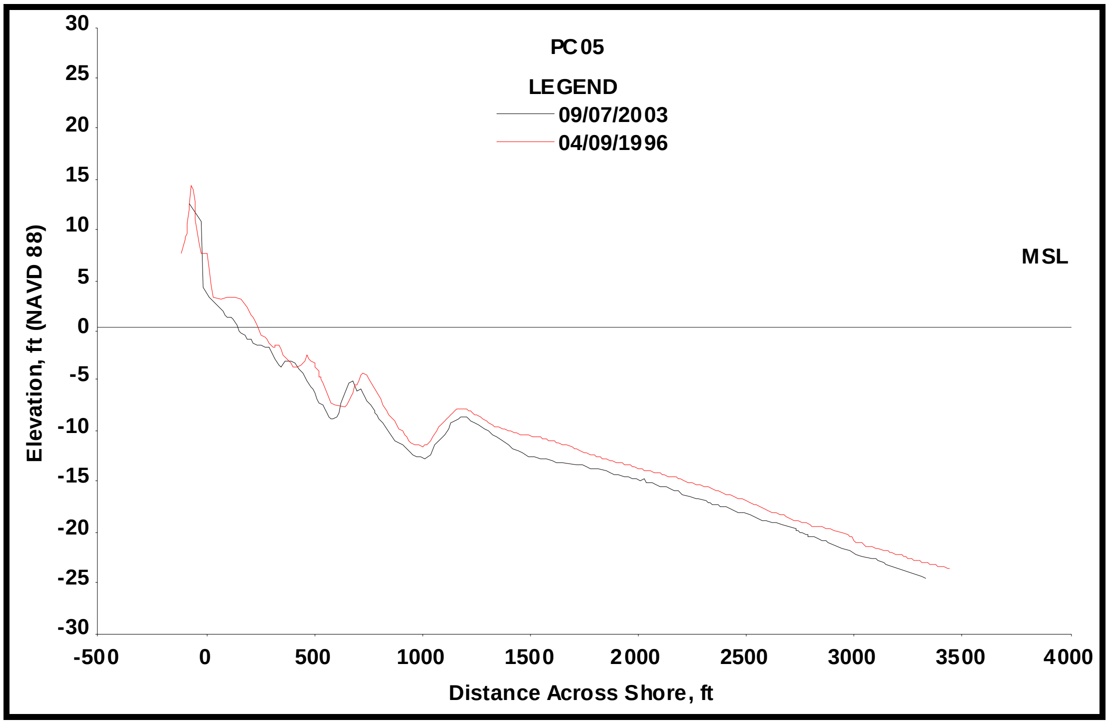
Profile 2: 09/06/2003 and 04/08/1996



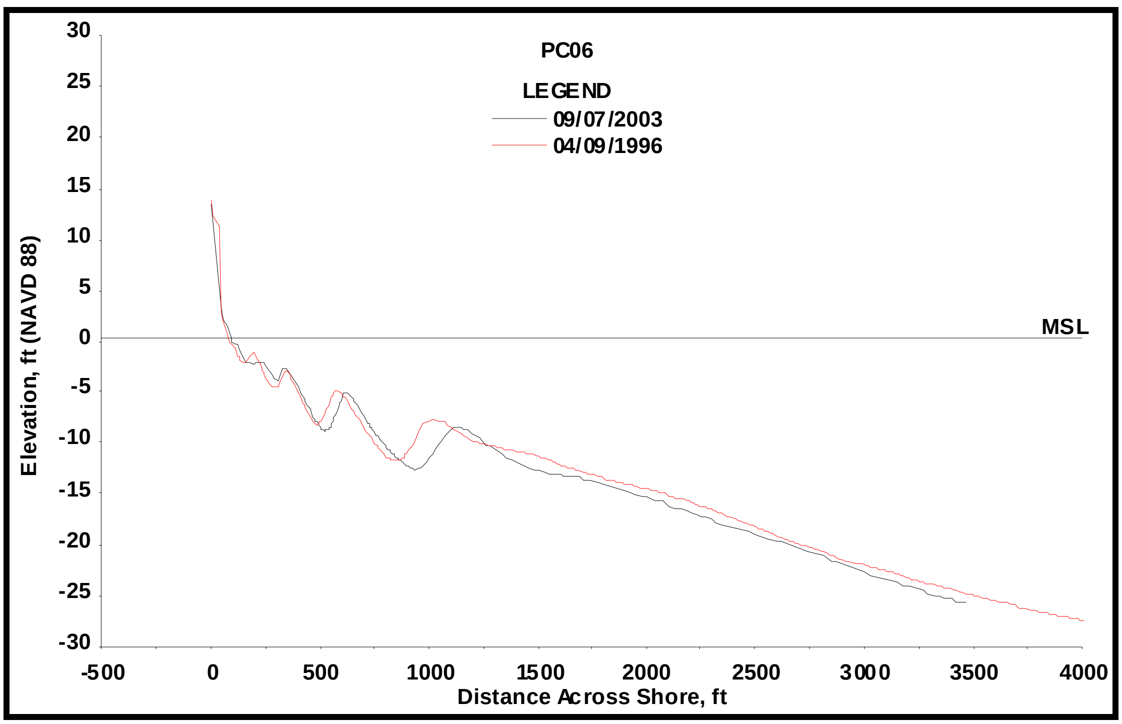
Profile 3: 09/06/2003 and 04/08/1996



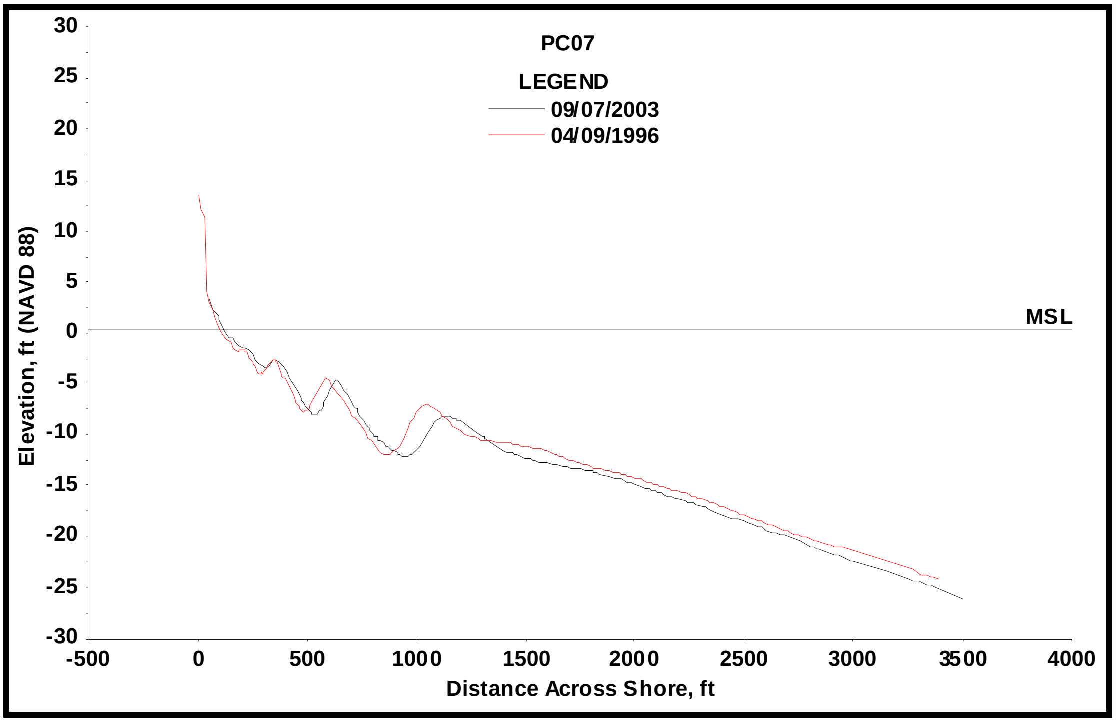
Profile 4: 09/06/2003 and 04/08/1996



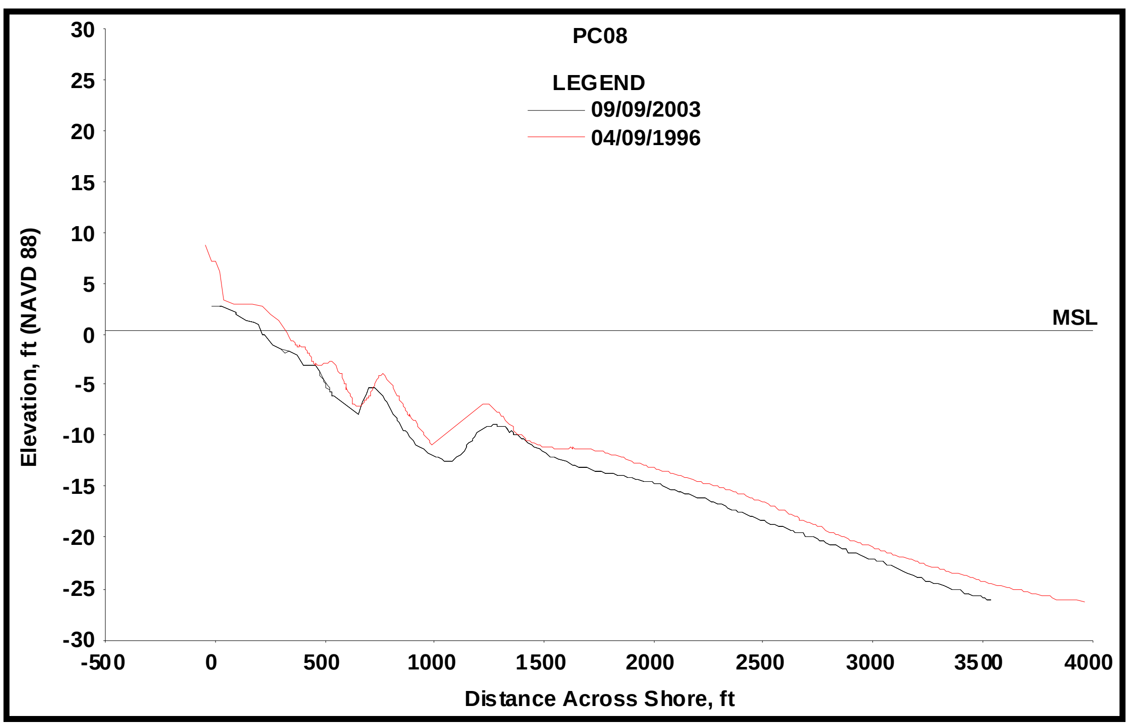
Profile 5: 09/07/2003 and 04/09/1996



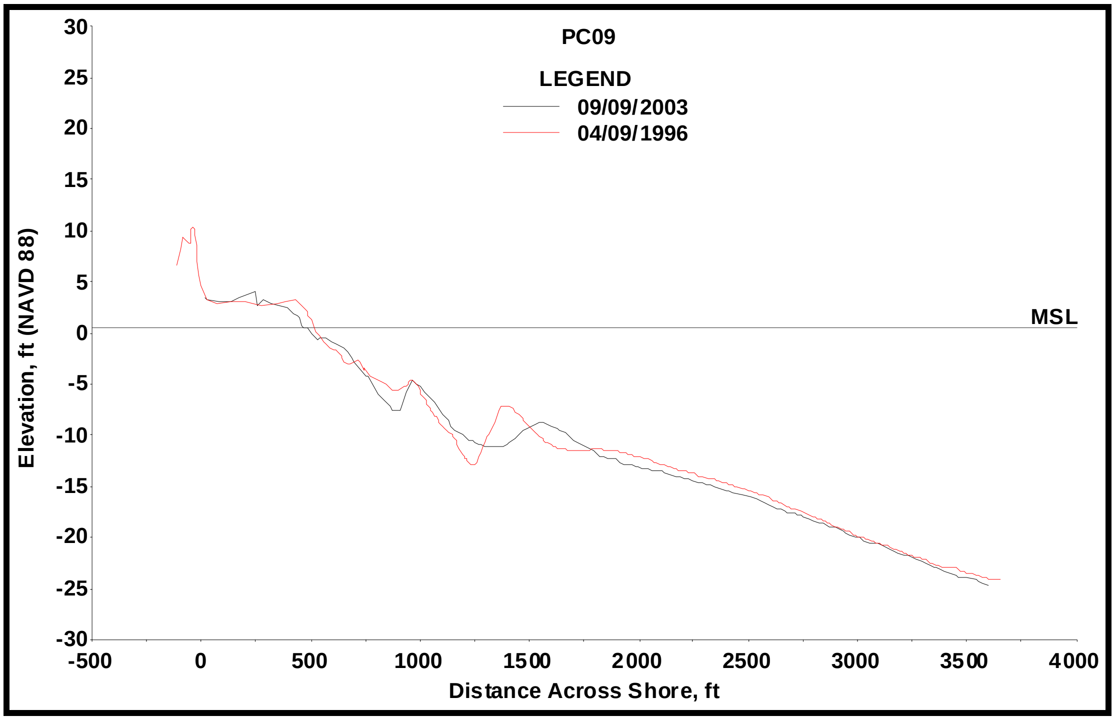
Profile 6: 09/07/2003 and 04/09/1996



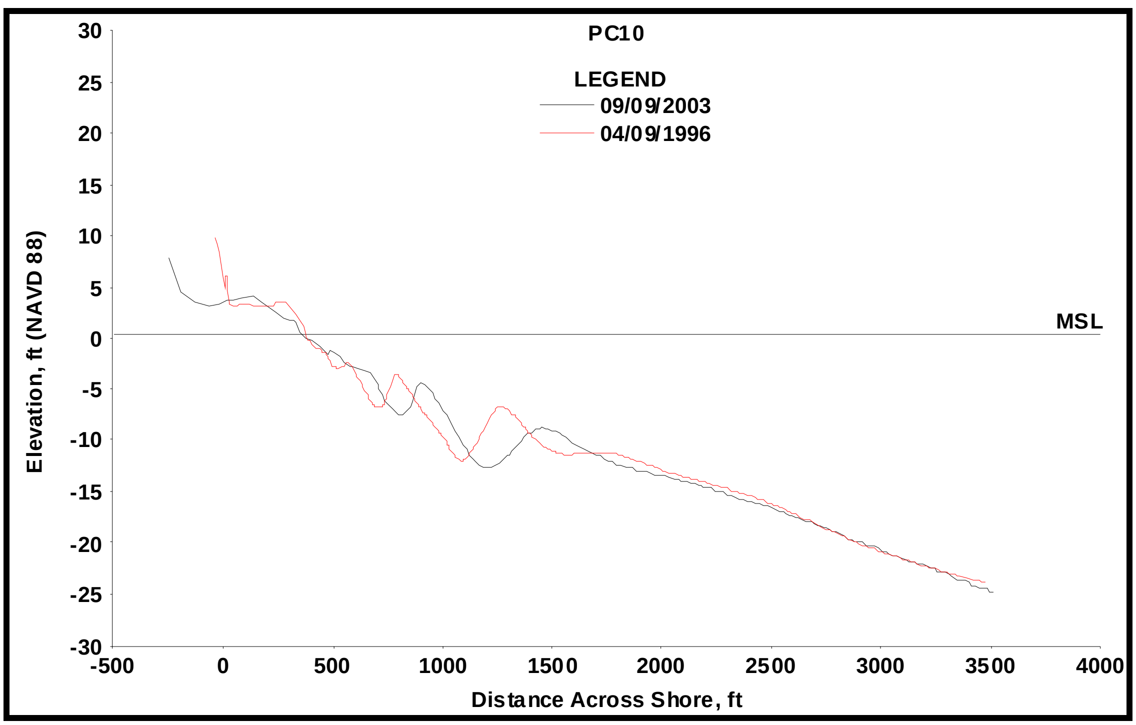
Profile 7: 09/07/2003 and 04/09/1996



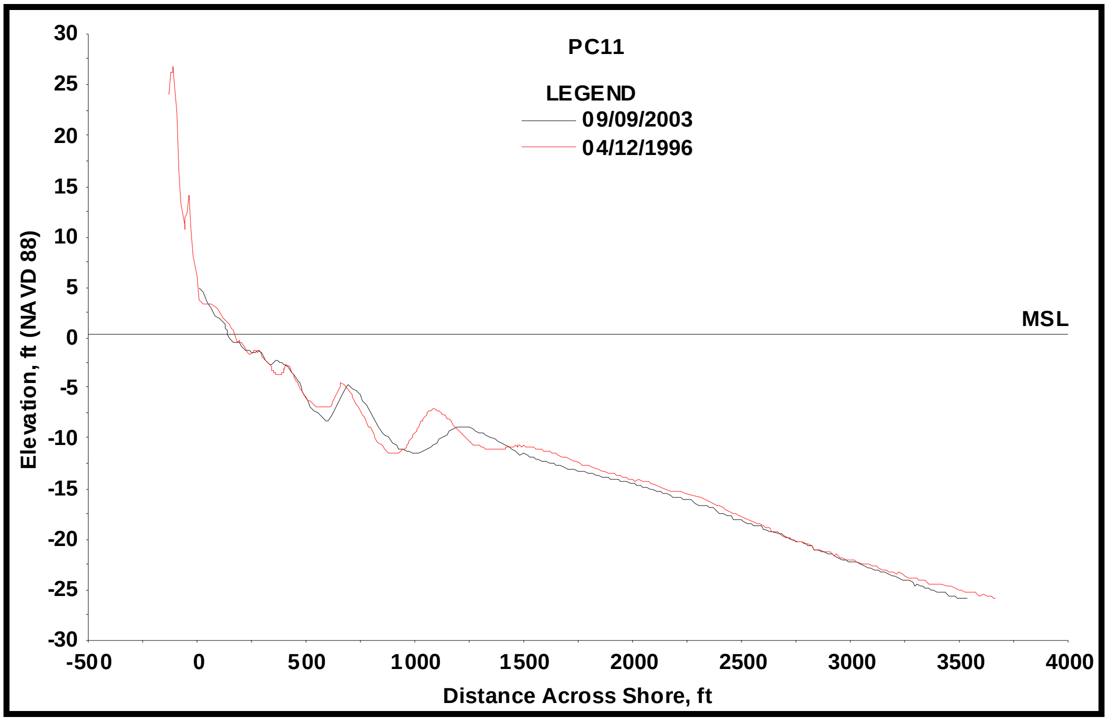
Profile 8: 09/09/2003 and 04/09/1996



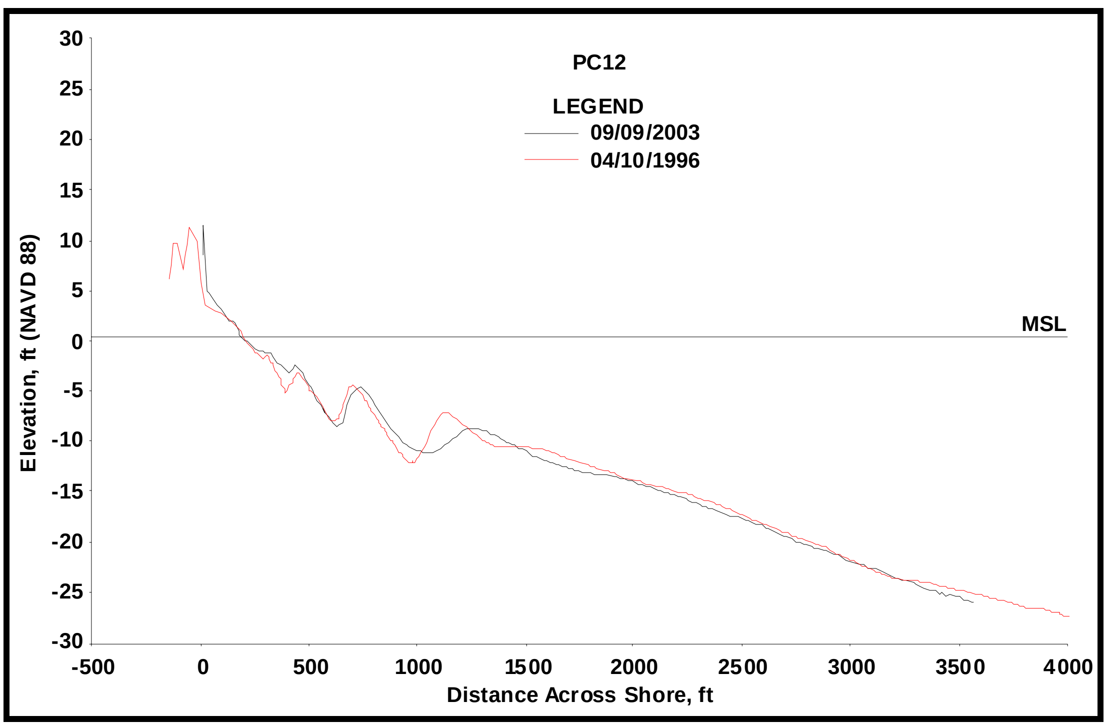
Profile 9: 09/09/2003 and 04/09/1996



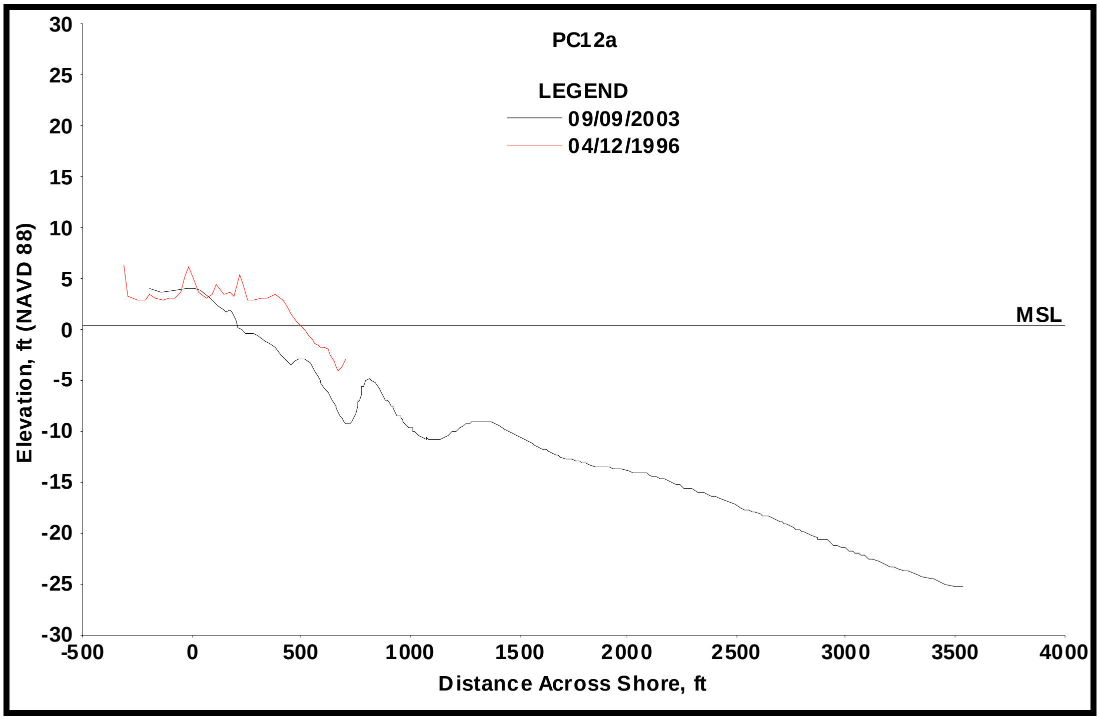
Profile 10: 09/09/2003 and 04/09/1996



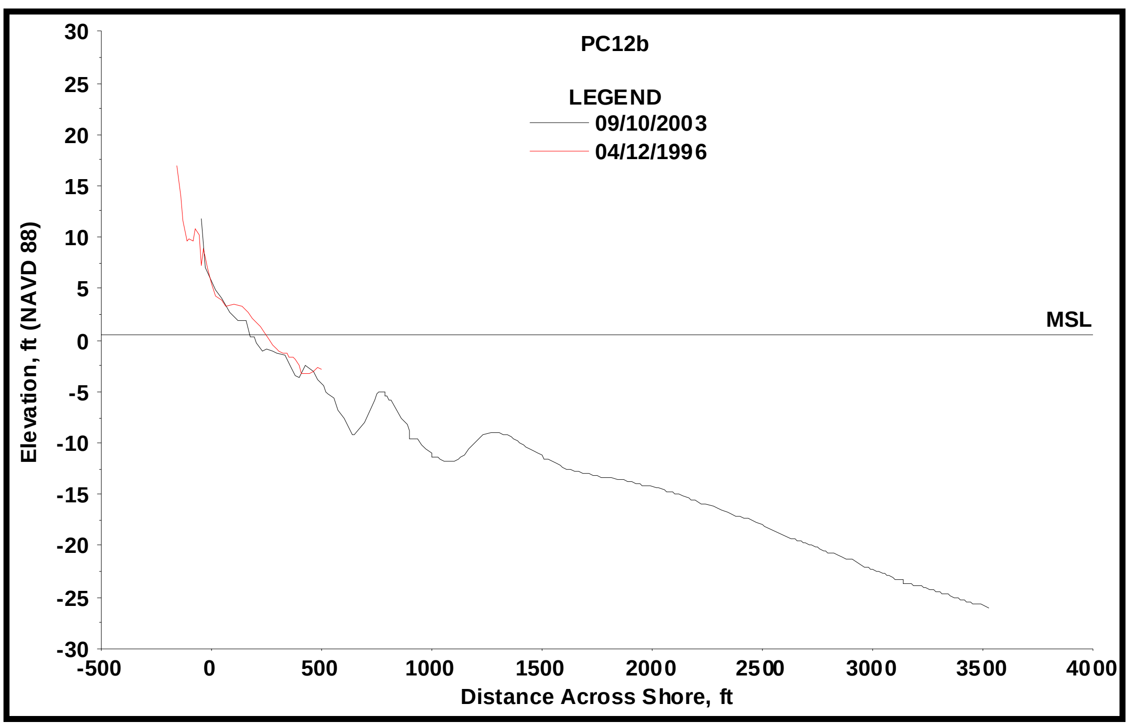
Profile 11: 09/09/2003 and 04/10/1996



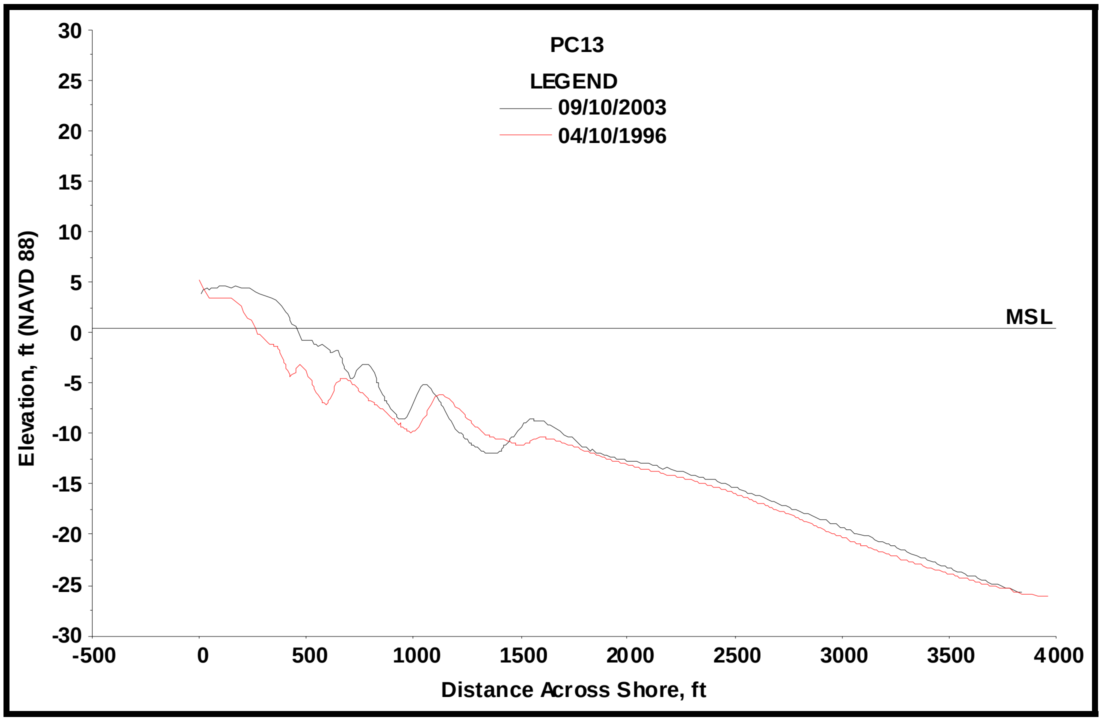
Profile 12: 09/09/2003 and 04/10/1996



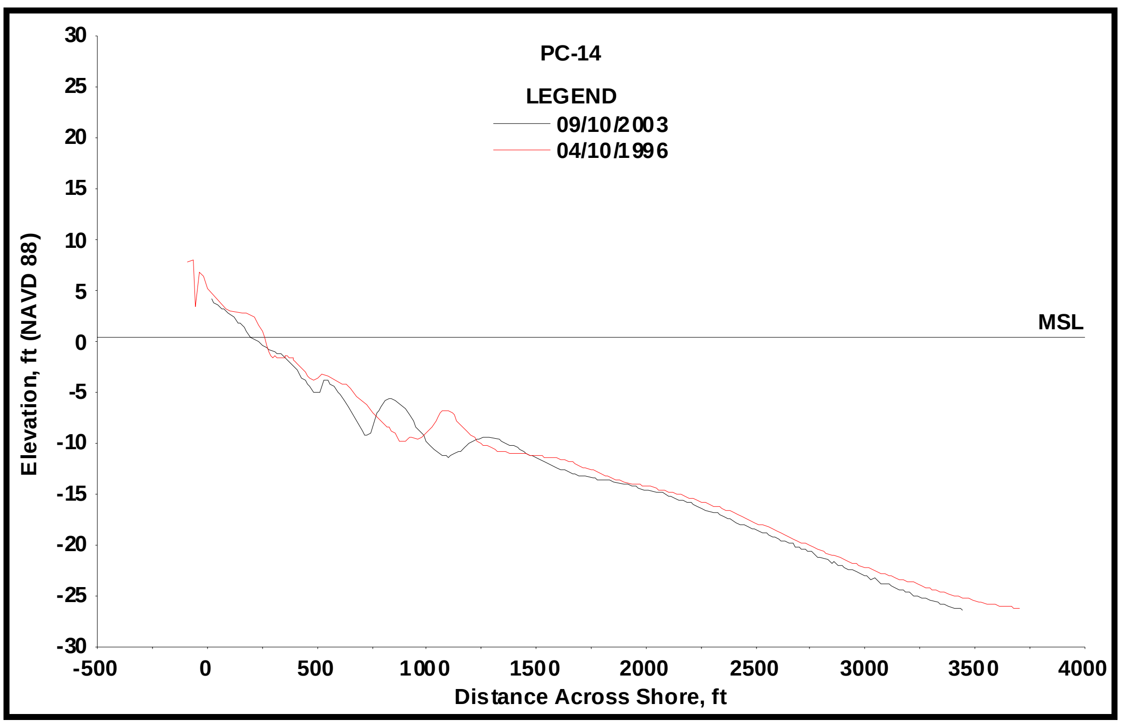
Profile 12a: 09/09/2003 and 04/12/1996



Profile 12b: 09/10/2003 and 04/10/1996



Profile 13: 09/09/2003 and 04/10/1996



Profile 14: 09/10/2003 and 04/10/1996

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APPENDIX C: Sediment grain size statistics for beach and nearshore locations.

This section shows sediment grain size statistics for the following sampling locations; toe of dune (or most landward position of beach as limited by other feature where no dune exists), mid-berm, shoreline, -3 ft, -12 ft, and -24 ft. Sediment samples were processed and analyzed according to standard methods (Mason and Folk, 1958; Folk, 1974) Sediment samples were sieved at 0.25 PHI increments. Coastal Engineering and Design System (CEDAS) software Automated Coastal Engineering System (ACES) was applied to determine sediment grain size statistics from gravimetric data.

Table C1. Median (mm), mode (mm), and inclusive graphic standard deviation (Phi) of grain sizes.

Profile #	Toe of Dune			Mid-Berm			Shoreline			3-ft Depth			12-ft Depth			24-ft Depth		
PC01	0.15	0.125	0.22	0.14	0.125	0.29	0.15	0.125	0.34	0.14	0.125	0.27	0.14	0.125	0.31	0.11	0.074	0.45
PC02	0.15	0.149	0.22	0.15	0.125	0.22	0.15	0.125	0.22	0.14	0.125	0.35	0.14	0.125	0.27	0.13	0.125	0.24
PC03	0.15	0.125	0.22	0.15	0.125	0.24	0.17	0.125	0.66	0.15	0.125	0.35	0.14	0.125	0.23	0.13	0.125	0.69
PC04	0.15	0.125	0.22	0.16	0.149	0.29	0.16	0.149	0.33	0.15	0.125	0.31	0.14	0.125	0.24	0.13	0.125	0.58
PC05	0.15	0.125	0.22	0.14	0.125	0.30	0.16	0.125	0.33	0.15	0.125	0.36	0.14	0.125	0.23	0.13	0.074	0.97
PC06	0.16	0.149	0.30	0.15	0.125	0.28	0.16	0.125	0.36	0.14	0.125	0.29	0.13	0.125	0.52	0.13	0.125	0.54
PC07	0.16	0.149	0.28	0.16	0.125	0.34	0.15	0.125	0.36	0.14	0.125	0.36	0.11	0.088	0.26	0.11	0.074	0.46
PC08	0.15	0.125	0.23	0.15	0.149	0.24	0.16	0.149	0.31	0.15	0.125	0.36	0.14	0.125	0.39	0.14	0.125	0.61
PC09	0.14	0.125	0.22	0.14	0.125	0.36	0.15	0.125	0.47	0.15	0.125	0.34	0.14	0.125	0.63	0.13	0.074	0.59
PC10	0.16	0.149	0.27	0.15	0.149	0.24	0.15	0.125	0.27	0.14	0.125	0.34	0.13	0.125	0.38	0.12	0.125	0.57
PC11	0.15	0.125	0.22	0.16	0.149	0.31	0.16	0.125	0.36	0.14	0.125	0.42	0.13	0.125	0.17	0.14	0.125	0.63
PC12	0.15	0.125	0.22	0.17	0.149	0.34	0.14	0.125	0.30	0.16	0.125	0.39	0.14	0.125	0.46	0.14	0.074	0.62
PC12a	0.15	0.125	0.25	0.14	0.125	0.20	0.15	0.125	0.42	0.14	0.125	0.48	0.15	0.125	0.70	0.15	0.074	0.70
PC12b	0.14	0.125	0.24	0.16	0.125	0.33	0.16	0.125	0.37	0.14	0.125	0.33	0.14	0.125	0.29	0.14	0.125	0.68
PC-13	0.15	0.125	0.23	0.14	0.125	0.21	0.15	0.125	0.31	0.14	0.125	0.21	0.14	0.125	0.38	0.13	0.074	0.69
PC-14	0.14	0.125	0.26	0.16	0.149	0.33	0.15	0.125	0.28	0.14	0.124	0.35	0.14	0.125	0.53	0.12	0.074	0.56