Coastal Protection and Restoration Authority of Louisiana,
Office of Coastal Protection and Restoration

2008 Operations, Maintenance, and Monitoring Report

for

Isles Dernieres Restoration, Phase 0, East Island Project

State Project Number TE-20
Priority Project List 3

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Terrebonne Parish

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2008 Operations, Maintenance, and Monitoring Report
For
Isles Dernieres Restoration, Phase 0, East Island (TE-20) Project

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I. Introduction

East Island is part of the Isles Dernieres barrier island chain and is located along the southern Louisiana coast in Terrebonne Parish at 29^{o} 03' 41" N and 90^{o} 39' 35" W (figure 1). The Isles Dernieres, which separate Terrebonne Bay, Lake Pelto, and Caillou Bay from the Gulf of Mexico, is a 20 mile (32 km) long island arc segmented into four islands: Raccoon Island, Whiskey Island, Trinity Island, and East Island (McBride et al. 1989). Like all of Louisiana's barrier islands, East Island is experiencing island narrowing and land loss as a consequence of a complex interaction among global sea level rise, compactual subsidence, wave and storm processes, inadequate sediment supply, and significant anthropogenic disturbances (Penland et al. 1988, McBride et al. 1989, Penland and Ramsey 1990, List et al. 1997).

The Louisiana deltaic plain is fronted by a series of headlands and barrier islands that were formed as a result of the Mississippi River deltaic cycle. The Isles Dernieres is a barrier island arc transformed from the abandonment of the Caillou headland (part of the Lafourche delta complex), which occurred approximately 500 years B.P. (Frazier 1967, Penland and Boyd 1985). Following deltaic abandonment, headland sand deposits were reworked and deposited longshore forming flanking barriers (Penland et al. 1988). Submergence of the abandoned delta separated the headland from the shoreline forming the barrier island arc. The transgressive island arc cannot keep pace with the high rate of relative sea level rise and will eventually become an inner-shelf shoal (Penland et al. 1988).

Currently, the Isles Dernieres arc is exhibiting some of the highest rates of erosion of any coastal region in the world (Khalil and Lee 2006). Erosional models have estimated that the Isles Dernieres would gradually narrow, fragment, and transgress through time eventually becoming subaqueous sand shoals between 2007 (McBride et al. 1991) and 2019 (Penland et al. 1988) unless restoration efforts are made. Between 1887 and 1988 the average annual rate of land loss was 69.6 ac yr^{-1} (28.2 ha yr^{-1}) while the average rate of shoreline retreat has been estimated between 36.4 – 60.4 ft yr^{-1} (11.1 – 18.4 m yr^{-1}; McBride et al. 1989, McBride et al. 1991). Between 1978 and 1988, shoreline erosion was even as high as 116.6 ft yr^{-1} (47.2 ha yr^{-1}; McBride et al. 1989). East Island has decreased in area from 432.4 acres (175 ha) in 1978 to 212.5 acres (86 ha) in 1988. These conditions have led to the rapid landward migration, termed barrier island rollover, and disintegration of the Isles Dernieres as well as a decrease in the ability of the island chain to protect the adjacent mainland marshes and wetlands from the effects of storm surge, saltwater intrusion, an increased tidal prism, and energetic storm waves (McBride and Byrnes 1997).

TE-20 (East Island) is considered Phase 0 of the Isles Dernieres Restoration Plan. This plan was designed to restore this barrier island in the Isles Dernieres chain in Terrebonne Parish, Louisiana by increasing the elevation and width of the island, closing existing breaches, and restoring back barrier marshes. The project was constructed through the Coastal Wetlands, Planning, Protection, and Restoration Act (CWPPRA, Public Law 101-646, Title III) and is

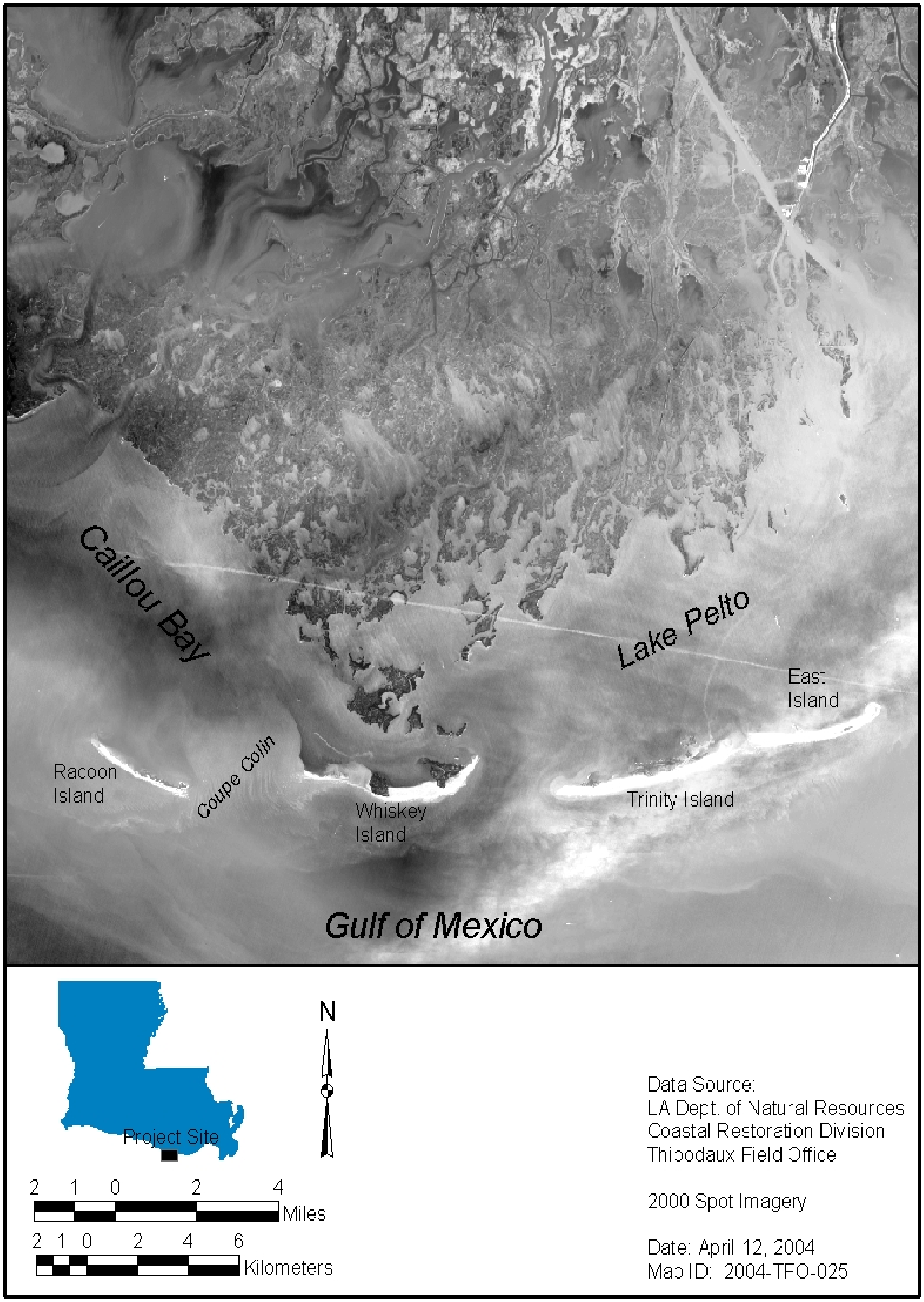


Figure 1. Isles Dernieres islands, Terrebonne Parish, Louisiana.

administered by the U.S. Environmental Protection Agency (EPA) and the Office of Coastal Protection and Restoration of Louisiana (OCPR; formerly the Louisiana Department of Natural Resources, Office of Coastal Restoration and Management). The Isles Dernieres Restoration, Phase 0, East Island (TE-20) project created approximately 242 acres (98 hectares) of dunes and wetland including supratidal (beach, dune, barrier flat) and intertidal (beach, marsh) habitat using sediments dredged from Lake Pelto (figure 2). Sediment fencing was constructed on the gulf side of the dune to trap wind blown sand and to minimize wind-driven export of sediment (figure 3). Sediment fencing was oriented across the width of the island in a southwest to northeast direction. The sediment transferal phase of the construction of the TE-20 project commenced January 19, 1998 and was completed October 31, 1998. Approximately 3.9 million cubic yards (3.0 million m^3) of sediment were dredged from the borrow area just north of the east side of the island and placed on East Island. Target elevations ranged from +2 ft (0.6 m) to +8 ft (2.4 m) North American Vertical Datum of 1988 (NAVD 88). Immediately post-dredging, aerial seeding with *Cynodon dactylon* (Bermuda grass) was conducted.

During the second phase of construction, vegetation was planted between May 26 and June 18, 1999 to stabilize the emplaced sediment on the newly created dune area, in the back-bay area, and on spurs from the dune area across the island to the back-bay area. Hand-planted vegetation included *Spartina patens* (marshhay cordgrass), *Spartina alterniflora* (smooth cordgrass), and *Panicum amarum* (bitter panicum). In total, 12,075 *S. alterniflora*, 5,431 *S. patens*, and 5,431 *P. amarum* were planted. The first vegetation sampling was conducted August 26 and 31, 1999 and additional vegetation sampling occurred September 18, 2001 and September 16, 2003.

II. Maintenance Activity

Over the past decade, numerous barrier island and headlands projects have been or are being restored by the state and their federal partners through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) and other funding sources (Lindquist and Martin, 2007). Unfortunately, scheduled maintenance of these projects has not been incorporated into their design or funding (Lindquist and Martin, 2007). To account for the programmatic maintenance needs of the barrier islands and headlands, the state has implemented the Barrier Island Maintenance Program (BIMP) through House Bill 429, Act No. 407, outlining the process by which the OCPR would annually develop a priority list of projects to be submitted to the House and Senate Committee on Natural Resources (Lindquist and Martin 2007). These projects would be funded by the Barrier Island Stabilization and Preservation Fund established to provide appropriations, donations, grants and other monies for the program. BIMP was created to coordinate and fund restoration barrier shorelines in Louisiana and formulate a much needed component of maintenance planning for existing projects without funding (Lindquist and Martin 2007). With the implementation of the BIMP, the state has also begun

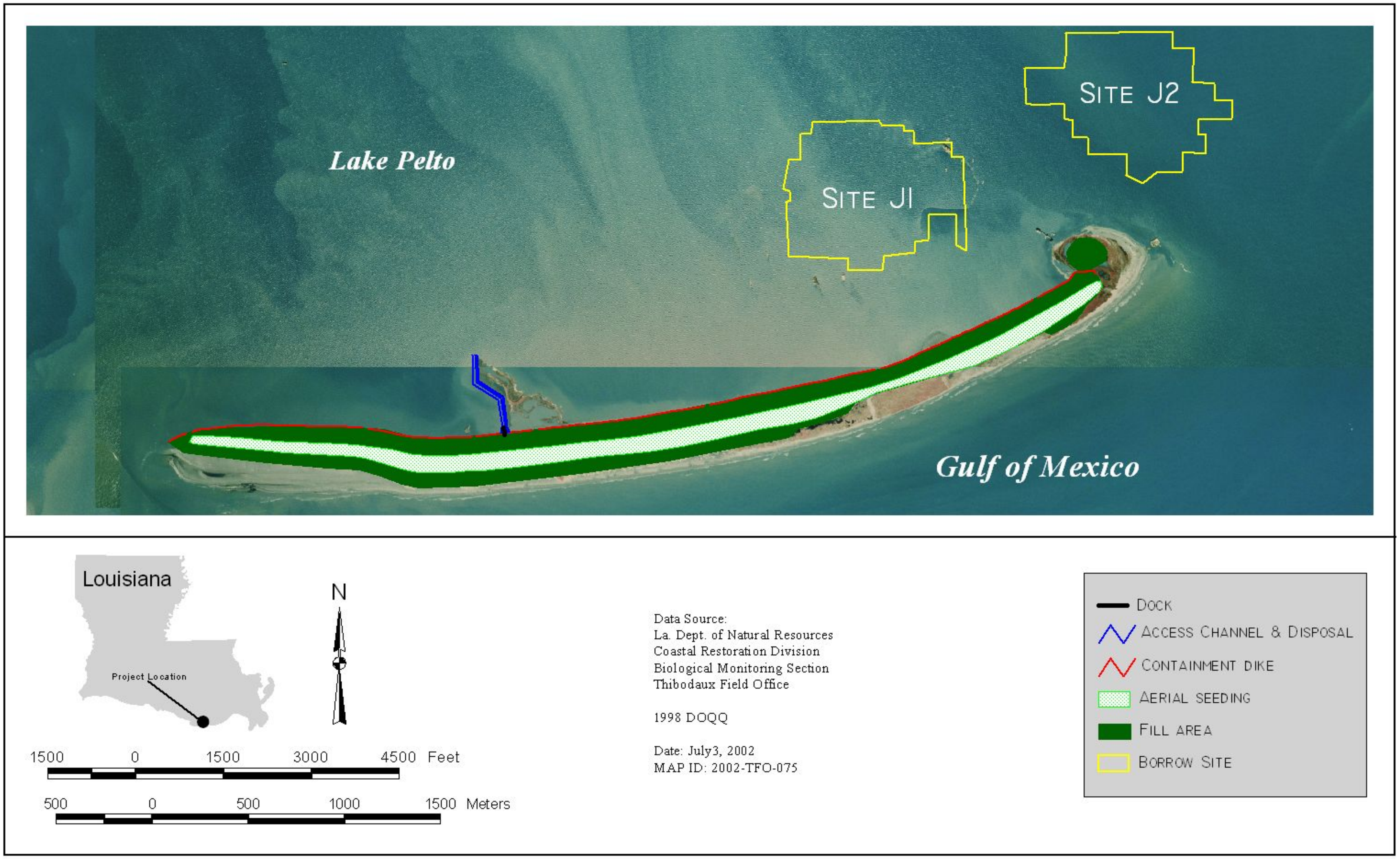


Figure 2. Isles Dernieres Restoration, Phase 0, East Island (TE-20) project area showing fill areas, aerial seeding sites, and borrow sites.

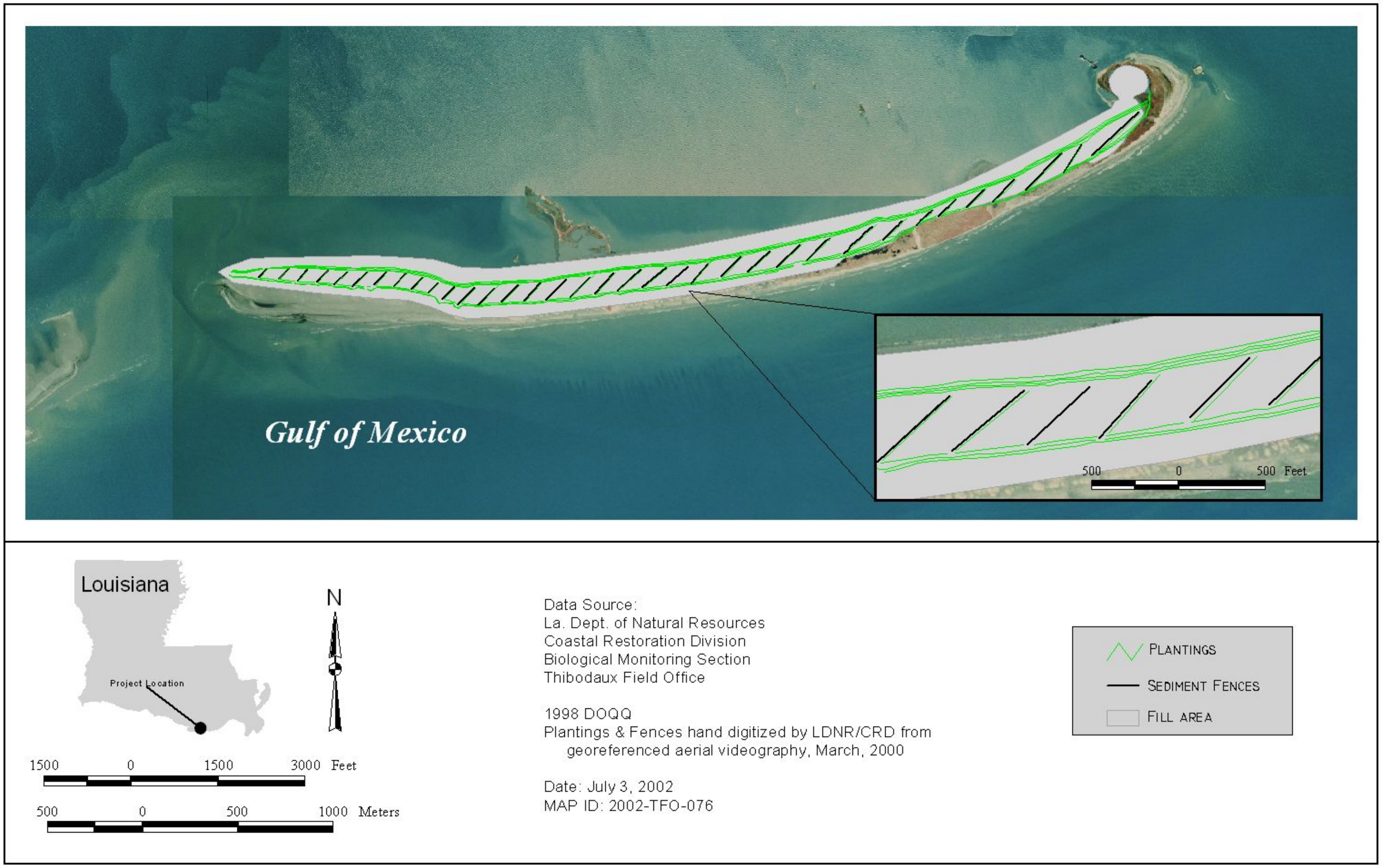


Figure 3. Location of fill area, orientation and location of sediment fences, and position of vegetation plantings for the Isles Dernieres, Phase 0, East Island (TE-20) project.

performing annual inspections of barrier island projects constructed under the CWPPRA program.

The most recent scheduled annual inspection of Isles Dernieres Restoration, Phase 0, East Island (TE-20) project was completed on September 11, 2007. This inspection included the visual observations of the entire island features and collection of GPS points along established stations from the existing shoreline to the back barrier marsh. While finalizing the 2008 Operation, Maintenance and Monitoring (OM&M) report, Hurricanes Gustav and Ike severely impacted southern Louisiana, including the barrier island chain in Terrebonne Parish. As a result of these storms, CWPPRA authorized the Storm Recovery Contingency Fund to perform post-storm inspections of all CWPPRA projects. The post-storm inspection of Isles Dernieres Restoration, Phase 0, East Island (TE-20) project was performed on October 30, 2008 and was attended by OCPR and Louisiana Department of Wildlife and Fisheries (LDWF) representatives. With the completion of the damage assessments and reports, recent up-to-date information such as general observations, photos, deficiencies, recommendations and estimated costs for repairs were obtained that will assist in estimating shoreline erosion and calculating volume changes along the island over the past year and pre- and post-storm. Committed to providing the most recent data in the OM&M reports, we have incorporated the data and subsequent analysis obtained from the 2007 annual inspection and 2008 damage assessment into this OM&M report.

On October 30, 2008 a damage assessment was conducted by representatives of the OCPR and the LDWF. Participants included Darin Lee, Daniel Dearmond, and Laurie Rodrigue with the OCPR and Michael Carloss with LDWF. The assessment began at approximately 1:00 pm and proceeded from the western end of the project. Some locations of the shoreline were established with GPS during the 2007 inspection. These locations were revisited during this assessment and new positions obtained at approximately the same stations along the shoreline as well as at several additional locations. This information along with as-built surveys will allow us to determine the shoreline change over the past year and with the Barrier Island Comprehensive Monitoring (BICM) Program shoreline change data determine any impacts from the hurricanes.

Below are general observations made during the damage assessment, photos of deficiencies and recommendations and costs for possible corrective actions:

Observations of structure features which sustained damage:
Overall, the island showed shoreline erosion as the only damage. No breaches were observed, but the lack of marsh behind the island did not facilitate roll back of the dune. The eastern end was the only area that showed severe overwash with almost 3000 ft of complete template removal from station 79+00 to station 109+00. Also, vegetation was salt burned, but these features are natural and should recover with rains and time.

Figure 4. 2008 Shoreline positions obtained during the post-Ike assessment along with the 2007 inspection data and the BICM 2005 shoreline at the Isles Dernieres Restoration, Phase 0, East Island (TE-20) project.

The most severe shoreline erosion occurred on the eastern portion of the area from station 79+00 to 109+00, with less erosion on the western end of the project (figure 4). The average erosion measured since the 2007 inspection was approximately -57.1 ft. BICM data shows an average erosion rate of -16.4 ft for this portion of the coast in the last decade (1990's to 2005) and -114.5 ft of erosion between 2004 and 2005 (Hurricanes Katrina and Rita). Removing the short-term erosion rate from that measured gives us an erosion rate of -40.7 ft. This is conservative since the BICM short-term erosion rate includes the 2005 hurricanes within it, which increases the average significantly. However, this also confirms that these storms caused erosion that approached or exceeded Hurricanes Katrina and Rita in 2005.

Repairs of hurricane impacts to the dune and beach features of the CWPPRA project would be completed through hydraulic dredging of appropriate sediment to replace that lost through shoreline erosion. With approximately 180 ft^2 of sediment removed from 5,900 ft of beach, we would need to replace 39,000 cu yd of sediment. Additionally the complete removal of the project template for 3,000 ft would require an additional 305,555 cu yd of sediment for a total project quantity of approximately 350,000 yd^3.

Estimated Project Budget:

Construction:			
Mobilization and Demobilization: Lump Sum		$3,000,000	
Containment Dikes: 3,500 linear ft. $10.00/ft		$ 35,000	
Hydraulic Dredging: (350,000 yd^3) $9.00/ yd^3		$3,150,000	
Sand Fencing: (6,000 linear ft.) $15.00/ft		$ 90,000	
Surveying: Lump Sum		$ 150,000	
Construction Costs:		$6,425,000	
Contingency (25%)		$1,606,250	
Total Construction plus Contingency:			$8,031,250
Professional Services:			
Engineering and Design:	$482,625		
Surveying:	$ 75,000		
Construction Admin:	$ 50,000		
Inspection:	$143,000		
Total professions Services:			$ 750,625
Total Estimated Project Budget:			**$8,781,875**

III. Operation Activity

This project has no operations and maintenance budget and no operations are required.

IV. Monitoring Activity

a. Monitoring Goals

The objectives for the Isles Dernieres Restoration, Phase 0, East Island (TE-20) project were to restore the coastal dunes of East Island and reduce loss of sediment as well as enhance the physical stability of East Island by utilizing hand planted vegetation.

The following goals will contribute to the evaluation of the above objectives:

1. Increase the height and width of the eastern and central section of East Island and close breaches using dredged sediments.

2. Reduce loss of sediment through vegetative plantings therefore increasing the stability of the island.

b. Monitoring Elements

Monitoring elements per the July 23, 1998 monitoring plan have been altered due to changes of the islands morphology as it relates to the constructed features. New programs were able to support data collection efforts. The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

Elevation

Topographic and bathymetric surveys were employed to document elevation and volume changes inside the Isles Dernieres Restoration, Phase 0, East Island (TE-20) project fill area. Pre-construction (1997) and as-built (1998) elevation data were collected using traditional cross sectional survey methods. Subsequent post-construction topographic surveys were conducted using Light Detection and Ranging (LiDAR) procedures (Brock et al. 2002). These post-construction surveys were performed in 2000 (John Chance Land Surveys, LTD), 2001 (USGS), 2002 (USGS), and 2006 (USGS). The latter survey and a separate bathymetric survey were funded through the BICM program in 2006 (Troutman et al. 2003). The bathymetric survey (USGS) recorded subaqueous elevations in the shoreface, inlet, and bay regions surrounding East Island. The 2006 LiDAR and bathymetric surveys were joined to form a single continuous elevation contour of this barrier island system. All survey data were established using or adjusted to tie in with the Louisiana Coastal Zone

(LCZ) GPS Network. The 2001 and 2002 LiDAR data were not applied to the following analysis because these surveys were not filtered for vegetation; however, data results for these two time periods were published in the 2004 Operations, Maintanence, and Monitoring for Isles Dernieres Restoration, Phase 0, East Island by West and Dearmond (2004). 2000 and 2006 LiDAR data were filtered for vegetation and present a more accurate illustration of island topography.

The 1997, 1998, 2000, and 2006 survey data were re-projected horizontally and vertically to the UTM NAD83 coordinate system and the NAVD 88 vertical datum in meters using Corpscon® software. The re-projected data were imported into ArcView® GIS software for surface interpolation. Triangulated irregular network models (TIN) were produced from the point data sets. Next, the TIN models were converted to grid models (2.0 m^2 cell size), and the spatial distribution of elevations were mapped. The grid models were clipped to the TE-20 fill area polygon to estimate elevation and volume changes within the fill area.

Elevation changes from 1997-1998, 1998-2000, 2000-2006 and 1998-2006 were calculated by subtracting the corresponding grid models using the LIDAR Data Handler extension of ArcView® GIS. After the elevation change grid models were generated, the spatial distribution of elevation changes in the TE-20 fill area were mapped in half meter elevation classes. Lastly, volume changes in the fill area were calculated in cubic meters (m^3) using the Cut/Fill Calculator function of the LIDAR Data Handler extension of ArcView® GIS. Note, these elevation and volume calculations are valid only for the extent of the survey area.

Shoreline Change

The use of ArcMap™, data collected as part of the as-built survey which defined the fill area, detailed field notes and the coordinates associated with the random numbers along vegetation transects allowed measurement of shoreline erosion from project completion (late summer 1998) to October 2007. These measurements are only as accurate as the information collected through the surveying of the project features at the end of construction and the accuracy of the Trimble GeoXT GPS unit (sub-meter). The calculated shoreline change was measured using the ESRI® ArcMap™ shapefile created from the survey data and the first random point with vegetation along the transect from the gulf side of the project area and the last point encountered with the presence of vegetation along the transect on the bay side. The distance was measured in ESRI® ArcMap™ at a scale of 1:1,200.

Vegetation

<u>1999-2003 Sampling</u>

Species composition and percent cover of vegetation were determined in 1999, 2001 and 2003 using the Braun-Blanquet method (Mueller-Dombois and Ellenberg 1974;

Folse and West 2005). The purpose of the initial sampling scheme was to sample the planted and unplanted areas to monitor planting success. The vegetation data collected for the time interval from 1999 to 2003 were analyzed and described in West and Dearmond (2004).

2007 Sampling

In October of 2007, emergent vegetation was sampled using the Braun-Blanquet method (Mueller-Dombois and Ellenberg 1974; Folse and West 2005). Previously sampled vegetation stations were superimposed on the 2005 Digital Orthophoto Quarter Quadrangle (DOQQ) photography and determined that bay and gulfside stations had been consumed by erosion on the beach and bay sides of the island (figure 5). This observation was confirmed during the operations and maintenance inspection trip for barrier islands which took place on September 10, 2007. Because previously established stations were no longer accessible, a new sampling scheme was developed which would allow for future sampling, if necessary. The new sampling scheme catalogued the species found on the island, but did not sample to monitor planting success. Using the existing BICM bathymetric survey lines and ESRI® ArcMap™ software, lines (transects) were extended across the island. These transects were spaced 1500 feet apart (figure 6). Coordinates were generated every two (2) meters along each transect and assigned a numerical value to facilitate the random selection process when establishing stations in the field. Files generated in ArcMap™ were then transferred to a DGPS with sub-meter accuracy.

On sampling day, transects were located by a team of two field personnel using the Trimble GeoXT unit. Five stations per transect were randomly chosen in the three (3) different regions of the transect. On the September 2007 trip, it was determined that the project had 3 different geomorphic regions: upslope, platform and marsh. On East Island, the upslope region consisted of the area closest to the Gulf of Mexico, where the sand/water interface begins, rising upward in elevation until the constructed platform begins. The platform region is the highest elevation in the center of the island that is relatively consistent in elevation. The marsh region begins as the platform decreases in elevation as it nears the bay side of the island. Each region has a unique composition of emergent vegetation. When a transect was located, the team identified the first point at the edge of the vegetation in the upslope region, then walked through the upslope region until it transitioned into the platform region, where an additional point was collected. The team continued until the transition from platform to marsh and collected a point. All three regions did not exist along all transects. The team then decided how to divide the number of stations per region and then randomly selected the stations in each. Stations were then marked for the sampling teams with a PVC pole. Two additional teams sampled alternating plots along transects for efficiency. Plots were oriented in a North-South direction. Species in 4 m^2 plots were recorded,

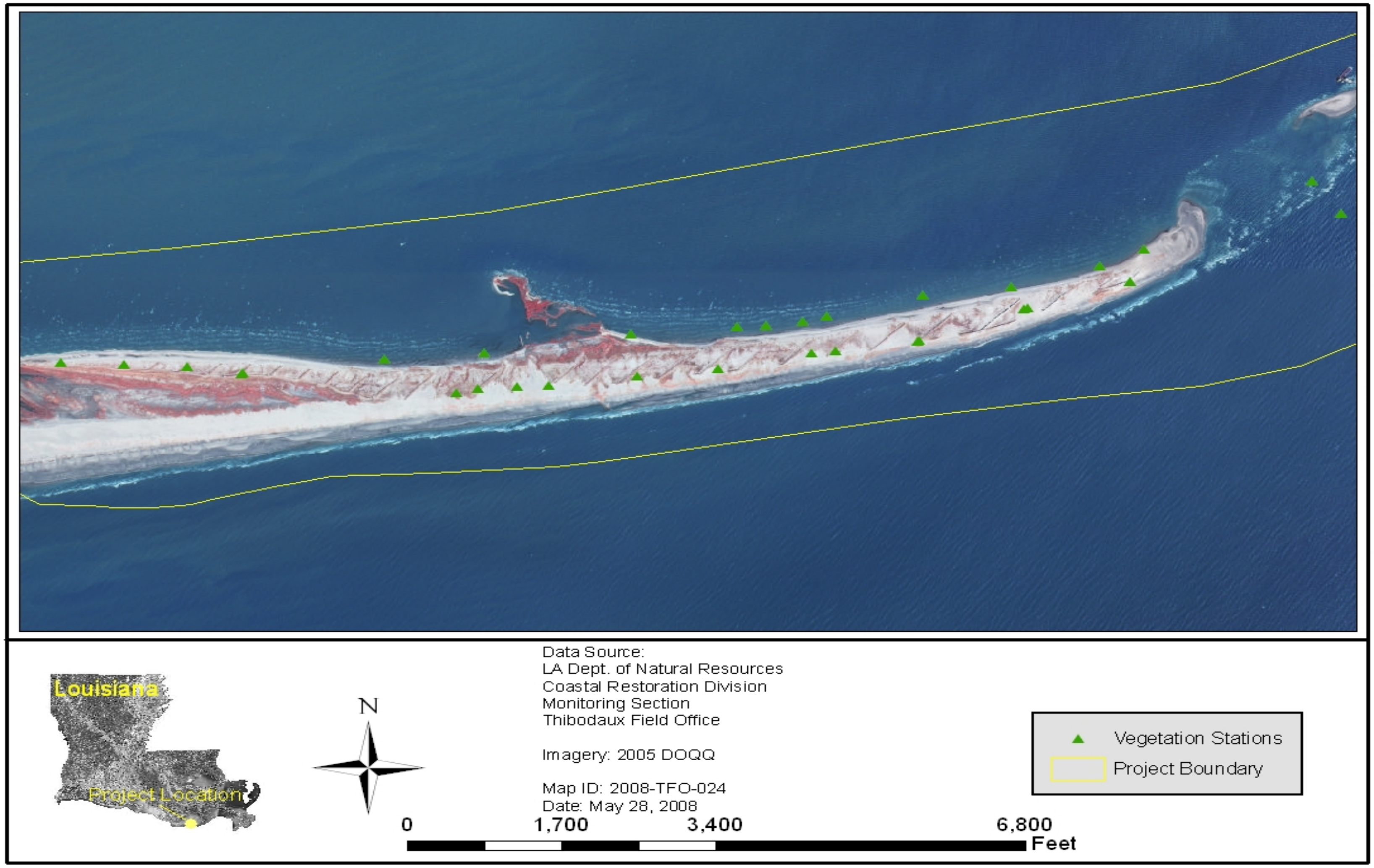


Figure 5. Vegetation sampling stations established prior to 2007 consumed by erosion at Isles Dernieres Restoration, Phase0, East Island (TE-20) project.

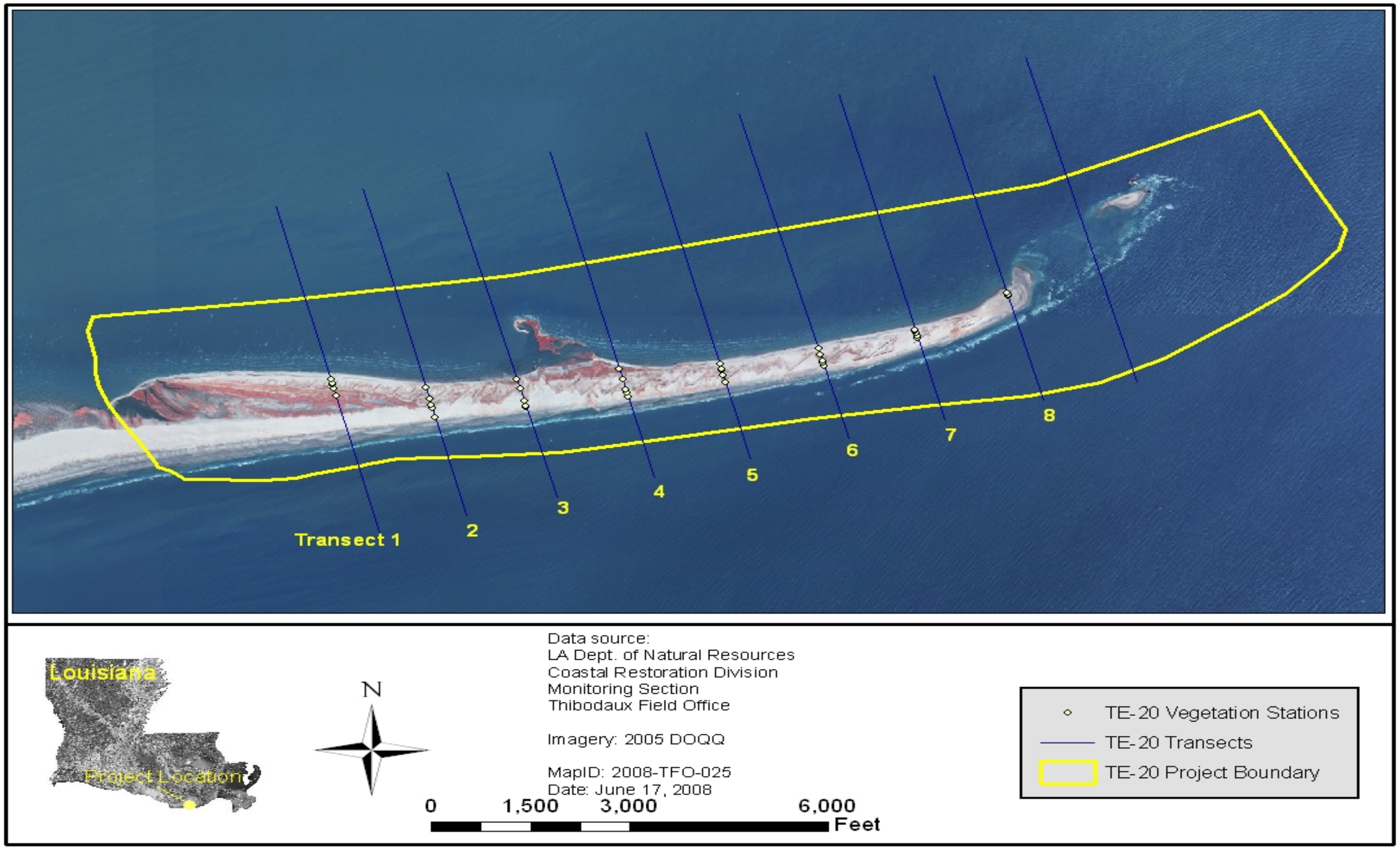


Figure 6. Vegetation transects and plots for the 2007 sampling scheme at Isles Dernieres Restoration, Phase 0, East Island (TE-20) project.

and visual estimates of percent cover for the total plot and individual species were made. Cover classes used were: solitary, <1%, 1-5%, 6-25%, 26-50%, 51-75%, and 76-100%. Vegetation outside of each plot but within 15 feet were also identified and recorded.

Based on time and budget constraints, it was determined that five (5) stations per transect would be the maximum sample size possible. The 5 stations per transect were divided amongst the regions based on the length of the region. Table 1 provides the number of stations per region for transects 1-8. A total of 38 stations were sampled. Only 3 stations were sampled along transect 8 because of the narrowness of the island and consistent bare sand that was observed along the transect.

Table 1. Number of stations per region for each sampled transect.

Transect	Number of Upslope Stations	Number of Platform Stations	Number of Marsh Stations
1	1	3	1
2	2	3	0
3	2	2	1
4	1	3	1
5	1	3	1
6	1	3	1
7	0	3	2
8	0	3	0
Total	8	23	7

The 2007 data were grouped by region and by transect to determine the relative mean percent cover for each species. Bare ground was included as a separate species. The relative mean percent cover was calculated by summing all the individual percent cover values for each species for the region or transect depending on the analysis. Then the percent cover for each individual species is divided by the summation of the all species and multiplied by 100. This gives the relative percent cover for each species. When each relative percent cover for each species is summed the total is 100 percent. The data analysis was generated using SAS software. Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

Habitat Mapping

Habitat mapping has been determined for East Island for 1996, 2002, 2004 and 2005 through the BICM program. The goal of BICM's habitat change analysis is to classify and compare the habitat types present along Louisiana's sandy shorelines for the four time periods. The habitat mapping was completed by the University of New Orleans Ponchartrain Institute for Environmental Sciences (UNO/PIES).

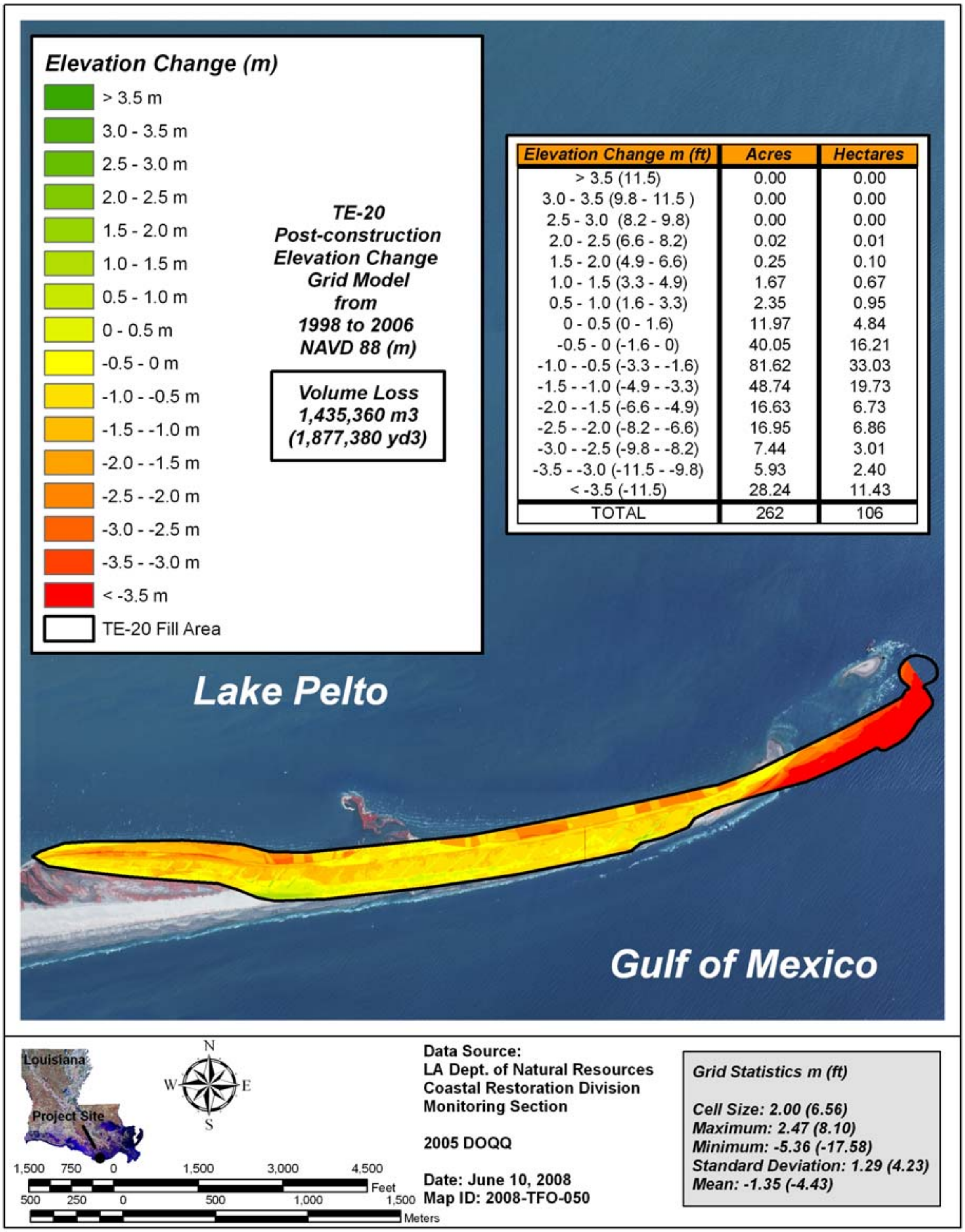
Habitat mapping consisted of six steps to acquire the final product. Briefly, these steps included: (1) Mosaicking which created a complete image of the shoreline / island to be classified, (2) Clipping, which removed the surrounding water from the image, (3) Creating Signatures, which defines the spectral values of each habitat class, (4) Supervised Classification, which is the classification of the mosaic based on collected signature or Unsupervised Classification partitions the mosaic into a user defined number of spectral classes, (5) Manual Cleaning, which is the final differentiation between habitat classes, and (6) Final Classified Image. These steps utilize Erdas Imagine version 9.1 software and ArcGIS version 9.2 software. More detailed methods are found in Fearnley et al (2009).

c. Preliminary Monitoring Results and Discussion

Elevation

The Isles Dernieres Restoration, Phase 0, East Island (TE-20) project has experienced reductions in volume and shoreline erosion since construction was completed in 1998. Elevation change and volume distributions for the TE-20 fill area are shown in figure 7 (1998-2006). Elevation change and volume distributions for 1997-1998, 1998-2000, and 2000-2006 are provided in Appendix B. Approximately, 2,456,608 yd^3 (1,878,212 m^3) of sediment were deposited during construction in 1998. In the post-construction period, sediment volume in the fill area decreased by 22% from 1998 to 2000 and 35% from 2000 to 2006. The total sediment volume loss in the fill area from 1998 to 2006 was approximately 1,793,893 yd^3 (1,371,530 m^3), a 73% reduction in volume.

Storm and longshore transport induced shoreline erosion appear to be major factors producing this large volume change in the fill area. Barras (2006) has shown that a substantial portion of the shoreline erosion in the TE-20 fill area was probably caused during the 2005 hurricane season. The shoreline transgressed an estimated 2500 ft (762 m) to the west leaving 50 acres (20 ha) of the fill area subaqueous. In addition, West and Dearmond (2004) and Georgiou et al. (2005) reported volume losses on East Island after the passage of Tropical Storm Isidore and Hurricane Lilli in 2002. Also illustrated are shoreline erosion and volume reductions on the bay side of the island. Cold fronts have been postulated as the primary force driving shoreline erosion on the bayside of Louisiana’s barrier islands (Dingler and Reiss 1990; Boyd and Penland 1981; Georgiou et al. 2005). Moreover, East Island is particularly susceptible to bayside shoreline erosion due to the small amount of supporting back barrier marshes. In addition to the storm generated shoreline erosion, the westward drifting longshore transport (Stone and Zhang 2001; Georgiou et al. 2005; Peyronnin 1962) probably intensified the change in shoreline position. Although not shown, downdrift sediments from East Island have partially filled in the New Cut Inlet.



Elevation Change m (ft)	Acres	Hectares
> 3.5 (11.5)	0.00	0.00
3.0 - 3.5 (9.8 - 11.5)	0.00	0.00
2.5 - 3.0 (8.2 - 9.8)	0.00	0.00
2.0 - 2.5 (6.6 - 8.2)	0.02	0.01
1.5 - 2.0 (4.9 - 6.6)	0.25	0.10
1.0 - 1.5 (3.3 - 4.9)	1.67	0.67
0.5 - 1.0 (1.6 - 3.3)	2.35	0.95
0 - 0.5 (0 - 1.6)	11.97	4.84
-0.5 - 0 (-1.6 - 0)	40.05	16.21
-1.0 - -0.5 (-3.3 - -1.6)	81.62	33.03
-1.5 - -1.0 (-4.9 - -3.3)	48.74	19.73
-2.0 - -1.5 (-6.6 - -4.9)	16.63	6.73
-2.5 - -2.0 (-8.2 - -6.6)	16.95	6.86
-3.0 - -2.5 (-9.8 - -8.2)	7.44	3.01
-3.5 - -3.0 (-11.5 - -9.8)	5.93	2.40
< -3.5 (-11.5)	28.24	11.43
TOTAL	262	106

Figure 7. Elevation change and volume distributions for the fill area at Isles Dernieres Restoration, Phase 0, East Island (TE-20) project.

Elevation grid model maps for the 1997, 1998, 2000, and 2006 surveys are featured in Appendix C. The pre-construction (1997) elevation grid model shows a minimum elevation of -3.48 ft (–1.06 m) and a maximum elevation of 3.74 ft (1.14 m). The as-built (1998) model shows a minimum elevation of 0.10 ft (0.03) m and a maximum elevation of 10.47 ft (3.19 m). The 2006 elevation grid model shows a minimum elevation of -9.12 ft (-2.78 m) and a maximum elevation of 14.76 ft (4.50 m).

Shoreline Change

Table 2 provides shoreline change data for transects 3-8 and the average of the six transects that were collected using the as-built survey data and the field collected data. Transects 1 and 2 are influenced by the addition of sediment from another project, New Cut Dune and Marsh Restoration (TE-37); therefore, data is not present. Because no GPS points were taken at the water's edge for transects 1 and 2 during 2007 vegetation sampling, quantification of erosion/accretion distance is not possible. Shoreline change rates for transects 3 and 4 may have been altered by sediment addition at TE-37.

Table 2. Gulf side and bay side shoreline change and average rate of shoreline change for the Isles Dernieres Restoration, Phase 0, East Island (TE-20) project area.

	Gulf Side	Bay Side	Gulf Side	Bay Side
Transect	Shoreline Change: As-Built to Oct. 2007 (Feet)	Shoreline Change: As-Built to Oct. 2007 (Feet)	Avg. Rate of Shoreline Change: As-Built to Oct. 2007 (Feet per year)	Avg. Rate of Shoreline Change: As-Built to Oct. 2007 (Feet per year)
3	-25	-190	-3.1	-23.75
4	-40	-55	-5	-6.9
5	-125	-270	-15.6	-33.75
6	-130	-270	-16.25	-33.75
7	-130	-210	-16.25	-26.25
8	-110	-150	-13.75	-18.75
Average	-93	-190	-12	-24

As a part of the BICM, shoreline change analysis was performed along East Island as well as the entire Louisiana coastal shoreline. Documents show the rate of shoreline change on East Island in average feet per year for four (4) different time periods. Data is shown in table 3. The 2004-2005 rate is associated with the passing of Hurricanes Katrina and Rita. The shoreline change values in table 2 appear to be within the accuracy of information published through the BICM program.

Average shoreline change for the Isles Dernieres was derived from BICM documents by combining the average shoreline change in feet per year of the 4 islands in the chain, Raccoon Island, Whiskey Island, Trinity Island and East Island and then dividing by four (4). Data is shown in table 3. Again, the 2004-2005 rate is associated with the passing of Hurricanes Katrina and Rita. Shoreline change rates for East Island is less than those of the Isles Dernieres combined.

Table 3. Shoreline change rate (feet per year) comparison for different period ranges between East Island and the Isles Dernieres island chain.

	1800's-2005	1920-2005	1990's-2005	2004-2005
East Island	-19.2	-18.7	-16.4	-114.5
Isles Dernieres	-34.1	-34	-32.9	-124.3

Vegetation

As vegetation becomes established on barrier islands, distinct vegetative regions may form (Hester et al. 2005). The vegetation in the upslope or dune region assists sand collection and dune formation, which in turn allows the swale (the platform region of TE-20) to form. The swale region, or platform in this project, is a less stressful habitat for vegetation than the upslope or dune habitat, therefore more diverse in species content (Hester et al. 2005) as seen on the constructed platform region of East Island. Back barrier marshes may have two (2) zones of vegetation, high and low marsh, in which environmental stressors can further limit vegetative diversity in an already specialized plant community. On East Island, the high marsh region contained the least number of species.

The upslope region contained 20 different plant species, including bare ground (figure 8). The platform region showed the most diversity with 25 total species and the marsh region contained 15 total species, both regions including bare ground. Only 2 of the 3 originally planted species were found during vegetation sampling on East Island in 2007, *Spartina patens* and *Panicum amarum*. *Spartina alterniflora* was not identified in any of the plots. The relative mean percent cover of *Spartina patens* in the upslope region was 50.1, 3.7 on the platform and 19.1 in the marsh. The relative mean percent cover of *Panicum amarum* was 12.1 on the upslope, 7.98 on the platform and 5.5 in the marsh region. Other species frequently found included *Eragrostis secundiflora*, *Phyla nodiflora* and *Strophostyles helvula* (figure 8).

The relative mean percent cover per transect refers to the percent cover of an individual species, measured in five plots, across an entire transect, through the 3 different regions of East Island. At the time of sampling, Transect 2 illustrated the most diversity with 19 species (figure 9). Transect 8 contained the most bare ground of all transects at 99.7 percent, because of its location and elevation. This transect is at the end of East Island and seems to be overwashed frequently due to its low elevation.

A total of forty (40) species were identified in or within 15 feet of the vegetation sampling plots on East Island.

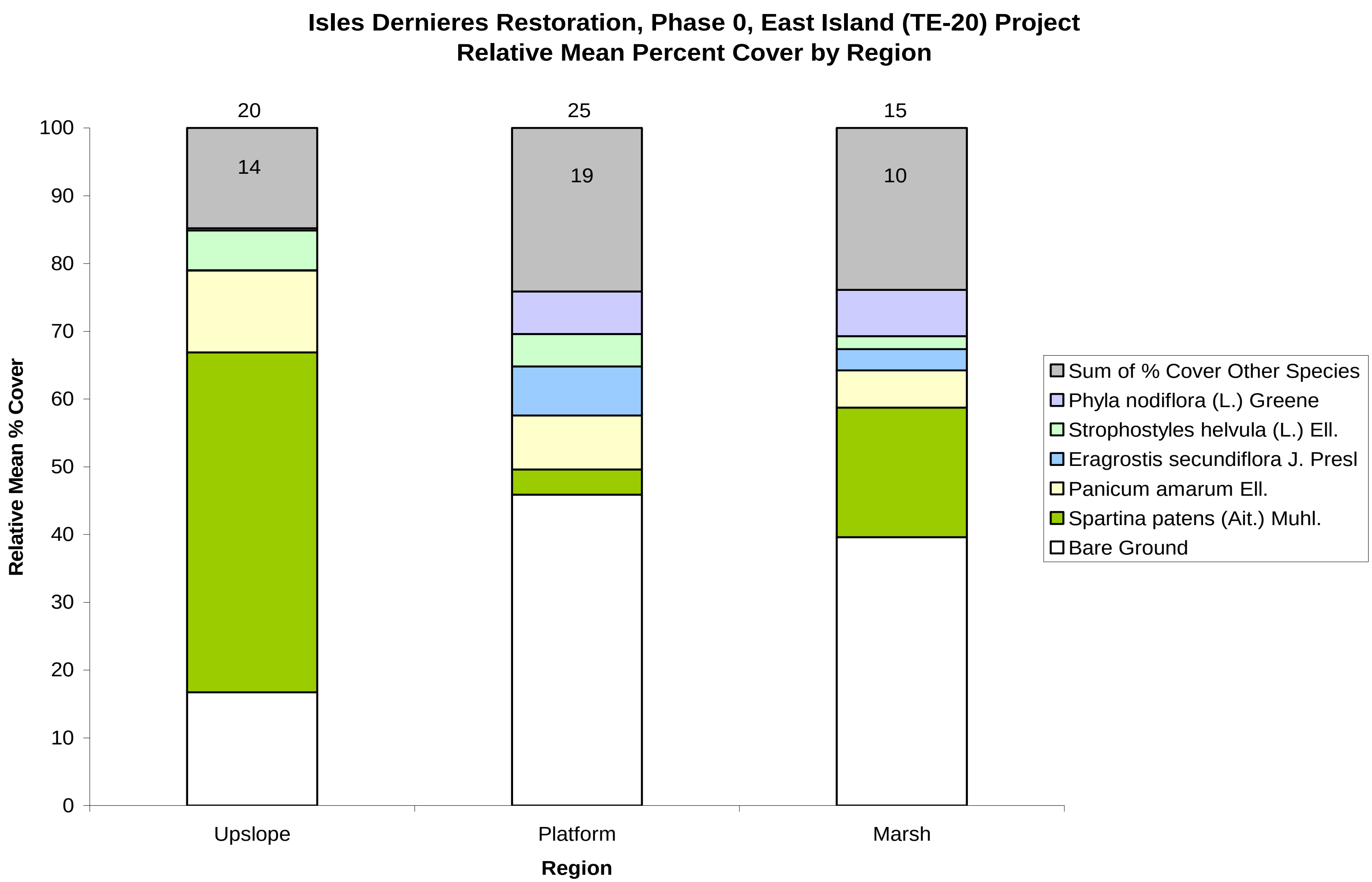


Figure 8. Isles Dernieres Restoration, Phase 0, East Island (TE-20) Project Relative Mean Percent Cover of Emergent Vegetation by Region.

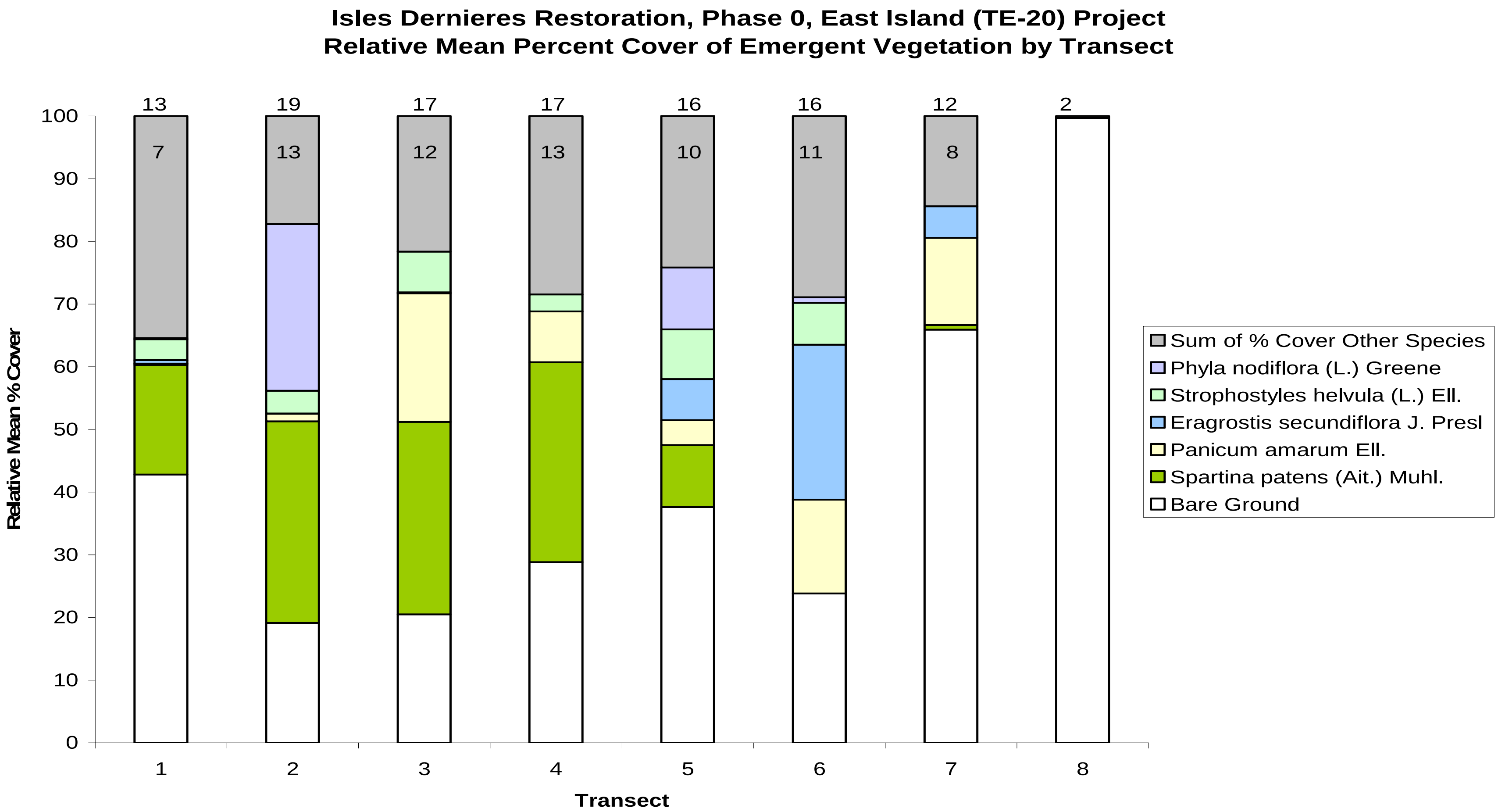


Figure 9. Relative mean percent cover of emergent vegetation by transect in October 2007 showing the number of species per category and the total number of species found.

Table 4 illustrates the number of species found in, or both inside and within 15 feet of vegetation plots for all years sampled. This table also shows the total number of species found on East Island each year vegetation was sampled. The total number of species is the number found in the plots, both in the plots and within 15 feet of a plot and species found outside, but within 15 feet of a plot.

Table 4. Number of plant species found inside all stations and the total number of plant species found including outside the stations sampled by year.

	1999	2001	2003	2007
In	5	10	13	32
Total	14	18	18	40

Habitat Mapping

The Barrier Island Comprehensive Monitoring (BICM) program funded habitat classification and change analysis for four (4) years of photography (1996, 2000, 2004, and 2005). This analysis was for East Island, not specific to the TE-20 project boundary. The habitat classes used for classification included: water, intertidal flat, marsh, barrier vegetation, bare land, beach, rip rap, and structure. This particular island had no rip rap or structures classified in any of the 4 time periods. Table 5 summarizes the acres of each habitat class for each time period.

Table 5. BICM Habitat Mapping Analysis: East Island Habitat Classification in Acres for 1996, 2002, 2004, and 2005.

Habitat Classes	1996	2002	2004	2005
Water	2339	2104	2183	2198
Intertidal Flat	66	205	191	109
Marsh	40	9	52	22
Barrier Vegetation	16	26	54	9
Bare Land	1	199	31	71
Beach	136	55	87	189
Rip Rap	0	0	0	0
Structure	0	0	0	0

Figures for each time period showing the habitat classes are in Appendix D. The TE-20 project area is very distinctive when comparing the 1996 and 2002 figures. It is represented by the 199 acres of bare land with some barrier vegetation classification and beach along the gulf side. Both the gulf side and bay side show some intertidal marsh areas. Although vegetative composition and cover was not collected in the same year as the photography of 2002, vegetative composition and cover was collected in 2001 and 2003. Results from those sampling periods provided bare land between 65 and 81 percent during the 2001 sampling period and 50 to 100 percent during the 2003 sampling period depending on the region sampled (West and Dearmond 2004). These two sampling efforts support the classification of the project area for 2002. Unfortunately, there was no other vegetative data collection between 2003 and 2005 to compare / support the habitat classification efforts.

Figures illustrating the habitat change classification for 1996 to 2002, 2002 to 2004, 2004 to 2005, and 1996 to 2005 are presented in Appendix E. Data from those figures are presented in table 6 for all time periods. The most dramatic transformation in the project area between the 2004 and 2005 periods is the region that was classified as beach in 2004, near the eastern tip of the island, that has been mostly converted to open water as a result of the 2005 hurricanes. Habitat mapping has not been conducted on any photography after 2005; consequently; there are not supporting data sets for the impacts of the 2008 hurricanes.

Table 6. BICM Habitat Change Classification Analysis: East Island for the time periods of 1996 to 2002, 2002 to 2004, and 2004 to 2005.

Habitat Change Class (To - From)	2002 - 1996 Acreages	2004 - 2002 Acreages	2005 - 2004 Acreages
water - water	2050	2092	2111
unchanged land	30	158	116
intertidal flat - water	148	9	52
marsh - water	2	0	4
barrier vegetation - water	8	0	0
bare land - water	96	0	1
beach - water	35	4	16
water - intertidal flat	6	76	42
water - marsh	9	1	9
water - barrier vegetation	4	3	6
water - bare land	0	7	1
water - beach	35	6	32
water - structure	0	0	0
intertidal flat - marsh	3	2	5
intertidal flat - barrier vegetation	2	6	2
intertidal flat - bare land	0	48	0
intertidal flat - beach	41	28	12
marsh - intertidal flat	1	9	7
marsh - barrier vegetation	1	14	0
marsh - bare land	0	21	0
marsh - beach	1	2	0
barrier vegetation - intertidal flat	5	0	1
barrier vegetation - marsh	3	0	1
barrier vegetation - bare land	0	51	1
barrier vegetation - beach	8	0	0
bare land - intertidal flat	40	0	10
bare land - marsh	17	0	6
bare land - barrier vegetation	6	0	32
bare land - beach	39	0	1
beach - intertidal flat	4	21	93
beach - marsh	2	0	22
beach - barrier vegetation	2	1	9
beach - bare land	0	42	8

V. Conclusions

a. Project Effectiveness

Sediment placed on the island in 1998 as part of project construction increased the height and width of the entire island, accomplishing the project goals. Since construction, the island has experienced several tropical systems which have accelerated erosion of the sediment. As of the 2008 hurricanes, the project's construction template has lost approximately 3,000 linear feet on the eastern portion of the island from survey stations 79+00 to 109+00 associated with the as-built drawings. The central and western sections of the island have experienced shoreline erosion, but not to the extent of the eastern section. This can be attributed to the east/west longshore transport and the influence of wave action as the storms affect the coastline.

The vegetative cover ranged from 50 – 80% in the 2007 sampling event which took place 2 years post-Hurricanes Katrina and Rita. The diversity of species observed was also the greatest since the start of sampling the vegetative community in 1999. The spread of the planted species, natural succession of the plant community, and the installation of sediment fences have demonstrated capture of the wind-blown sediments; particularly in the central and western portions of the island. Elevation models show the sediment fences as having the highest elevation on the island. As areas between the fences decrease slightly in elevation, the fencing captures the sediment resulting in linear features the same direction as the fencing.

b. Recommended Improvements

The O&M plan should define critical limits for the project area. Once these critical limits are reached, discussions within the CWPPRA and restoration community should commence on how to replenish the sediment that migrated from the project area.

Allocation of funding for maintenance of barrier island restoration projects was not considered due to the expense involved with replenishment of dredged material over the life expectancy of the project. Claims for FEMA assistance resulting from extensive or catastrophic damage to barrier islands from tropical storms and hurricanes are ineligible because there is no scheduled maintenance. Based on monitoring activity of the Isles Dernieres, it has been documented that these barrier islands are experiencing significant land loss due to barrier island rollover and island narrowing resulting from tropical and winter storm events. Therefore, it is recommended that maintenance funds be provided for the implementation of an inspection and maintenance program for assessment and replacement of dredged sediment and sand fencing necessary to maintain the integrity of these islands. The implementation of a maintenance program for barrier island projects would enable these projects to qualify for assistance under the Federal Emergency Management Program.

New projects should include a marsh component along with the gulfside restoration efforts. It has been noted that as the project area and other island's project areas get overwashed, the marsh platform on the bayside captures the sand from the gulfside. This helps to keep the dredged material on the island and conserves elevation for the next event that occurs. The marsh component keeps the dredged material in the barrier island system much longer. Also, back barrier marshes minimize the effects of winter storms.

Monitoring should include the entire island system, not just the project area as outlined during the project planning stages. Construction may not directly affect regions outside of the project area. However, through time and natural processes, the dredged materials migrate outside of the project area. Monitoring only the project area causes difficulty in analyzing how much material or benefit the entire island has received.

c. Lessons Learned

Barrier islands are often exposed to storm events resulting in substantial over-wash and breaching. It is important that a continuous dune of sufficient height and width is maintained on these islands to combat these processes. Sediment fencing has proven to be an effective technique in rebuilding dunes by capturing wind blown sediment and is less costly than periodically replenishing sediment by hydraulic dredge. We have learned from past projects that orienting the sediment fencing parallel to the shore face and perpendicular to the predominant wind direction has maximized the potential for maintaining a viable dune section.

The combined use of dredged sediment, sand fencing, and vegetative plantings are plausible ways to create quasi-stabilization and prolong the lives of barrier islands. The construction of sand fencing as well as vegetative planting should occur as soon as possible after the placement of dredged sediment to minimize loss. A different vegetative planting design must be determined to allow vegetative colonization quickly in order to maximize sediment stabilization.

The original vegetation sampling set up was such that plots were established along original plantings. This pattern placed most plots near the gulfside or bayside of East Island. Most original plots are now open water, due to the migration of the island. The original set up was not conducive to a 20 year monitoring period, because of the ephemeral nature of barrier islands. In future situations, it may be more feasible to establish plots along transects as was done in the 2007 vegetation sampling season. The coordinates of the transects will not change, and the transects could be extended as the island migrates. Individual plots along transects may have to be reestablished to compensate for island migration or erosion, but with the 2007 method statistical comparisons will be possible throughout the life of the project.

Lessons learned from the initial percent survival sampling include a need for flexibility in sampling method in case the actual plantings do not match the intended plantings (cf. Townson et al. *Unpublished*). This need for flexibility can include resizing plots or increasing the number of the plots established.

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Appendix A

Photos from Damage Assessment Field Trip

BICM oblique aerial photos of East Island Dock in 2005 (post-Katrina and Rita) and 2007. (Photos courtesy of UNO/PIES)

OCPR oblique aerial photos of east Island Dock on September 24, 2008 (post-Ike).

BICM oblique aerial photos of East Island near station 79+00 in 2007 (post-Katrina and Rita) and 2007. (Photos courtesy of UNO/PIES)

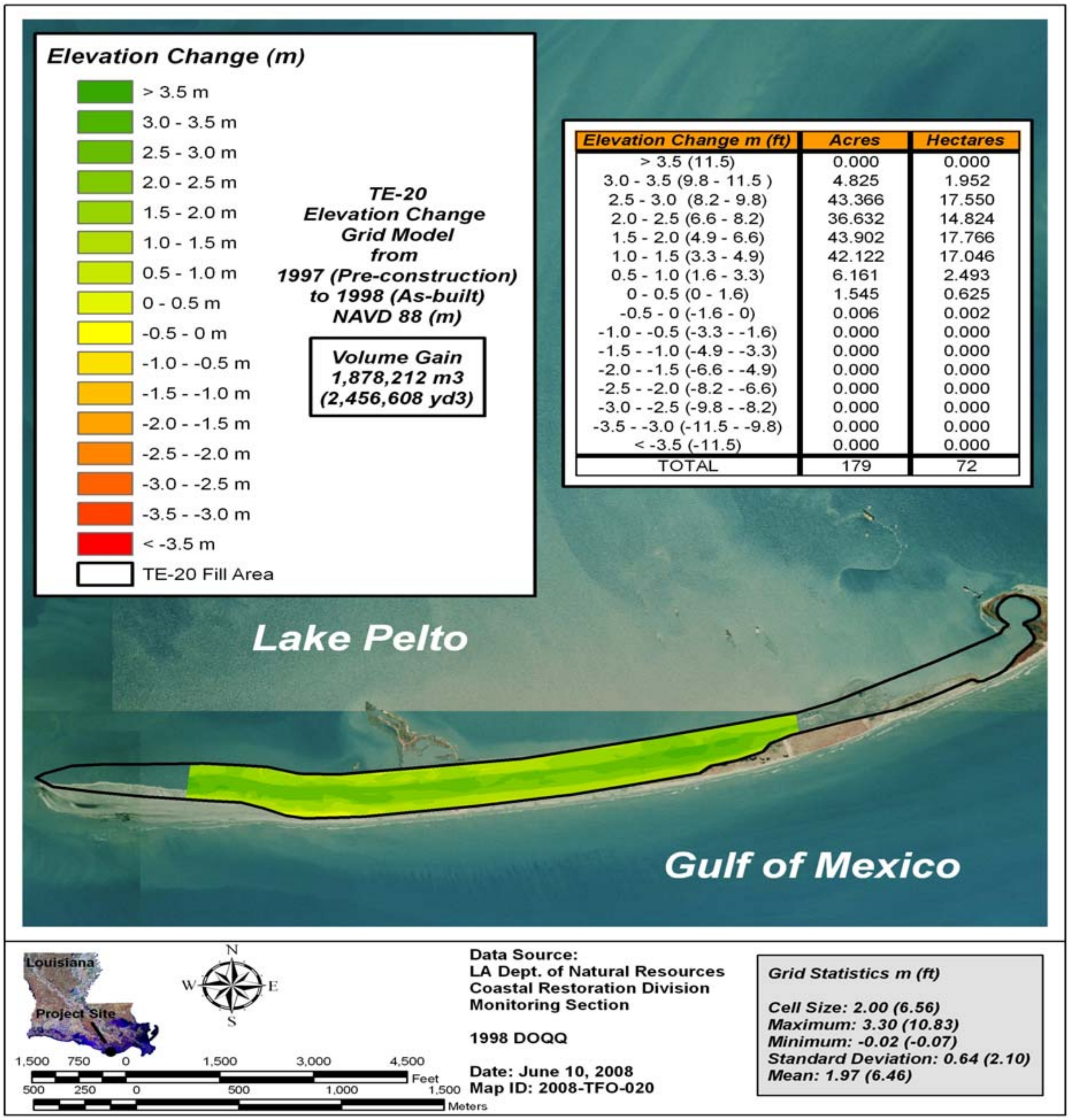
OCPR oblique aerial photos of East Island near station 79+00 on September 24, 2008 (post-Ike).

Photo from bay shoreline along East Island looking east at Sta. 79+00. (The back of dune on the east end of island can be seen in the photo).

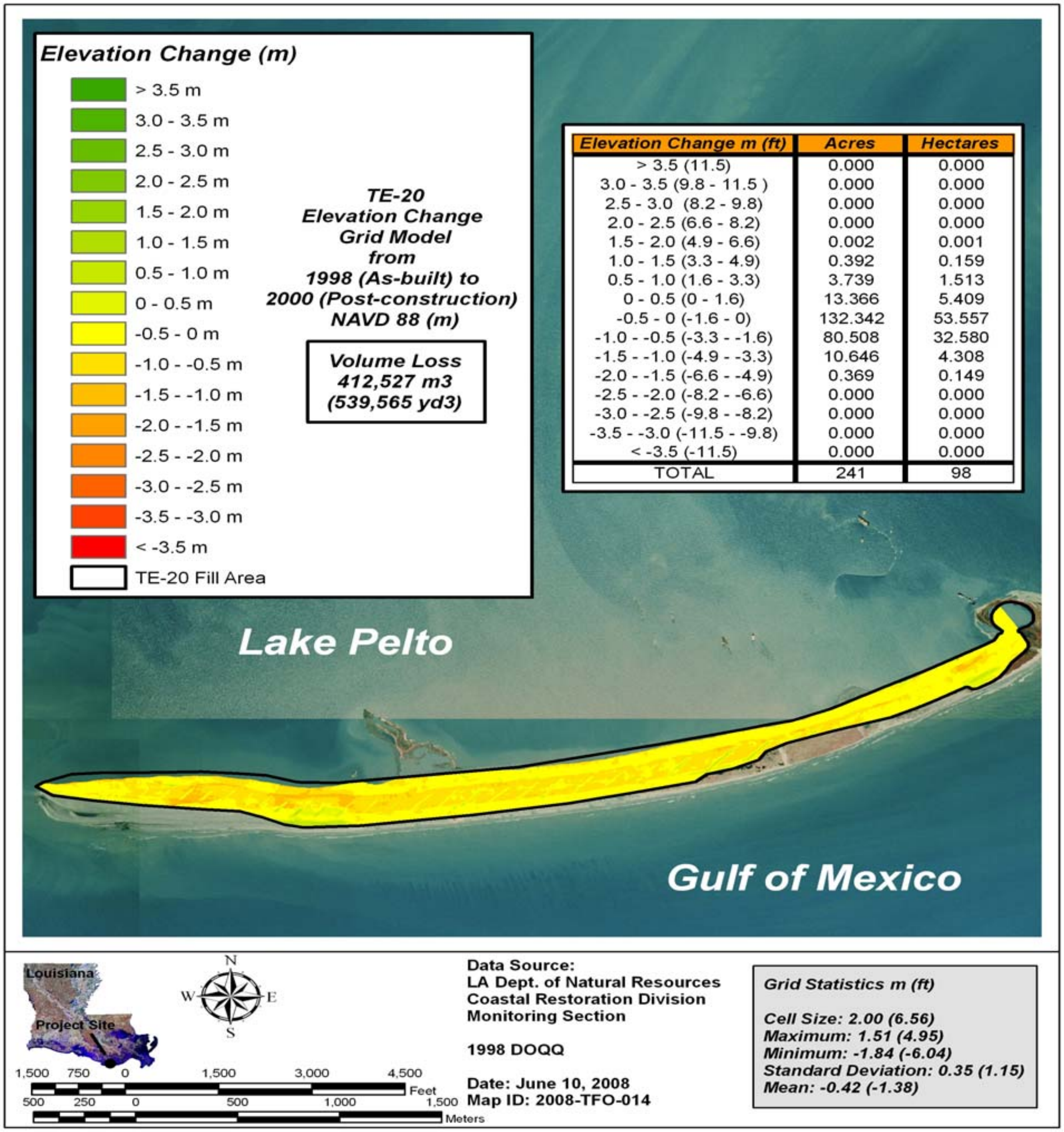
OCPR photos of East Island near station 79+00 looking east on September 24, 2008 (post-Ike).

Appendix B

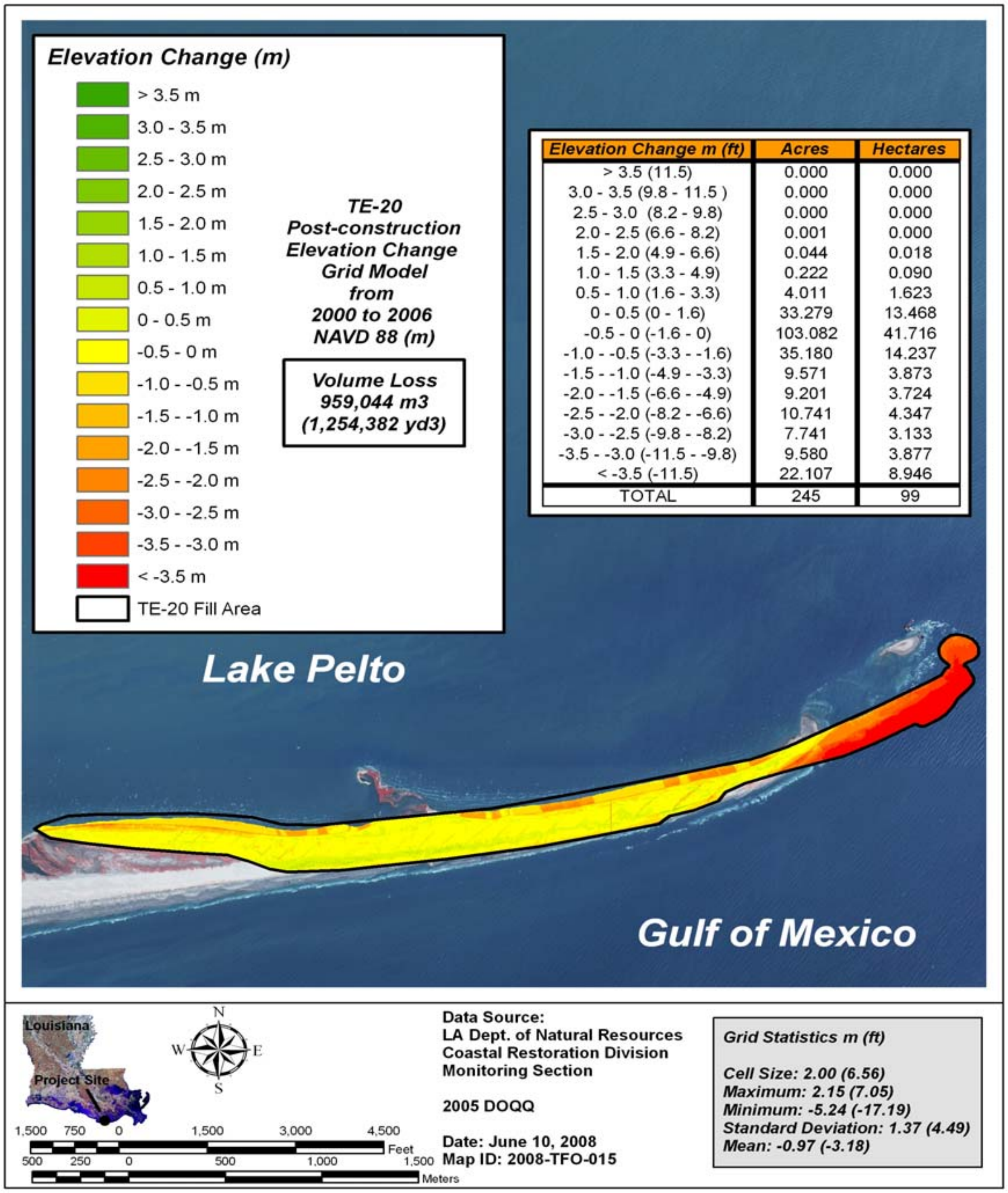
Elevation Change Models



Elevation and volume change model from pre-construction (1997) to as built (1998) at the Isles Dernieres Restoration East Island (TE-20) project.



Elevation and volume change grid model from as-built (1998) to post-construction (2000) at the Isles Dernieres Restoration East Island (TE-20) project.

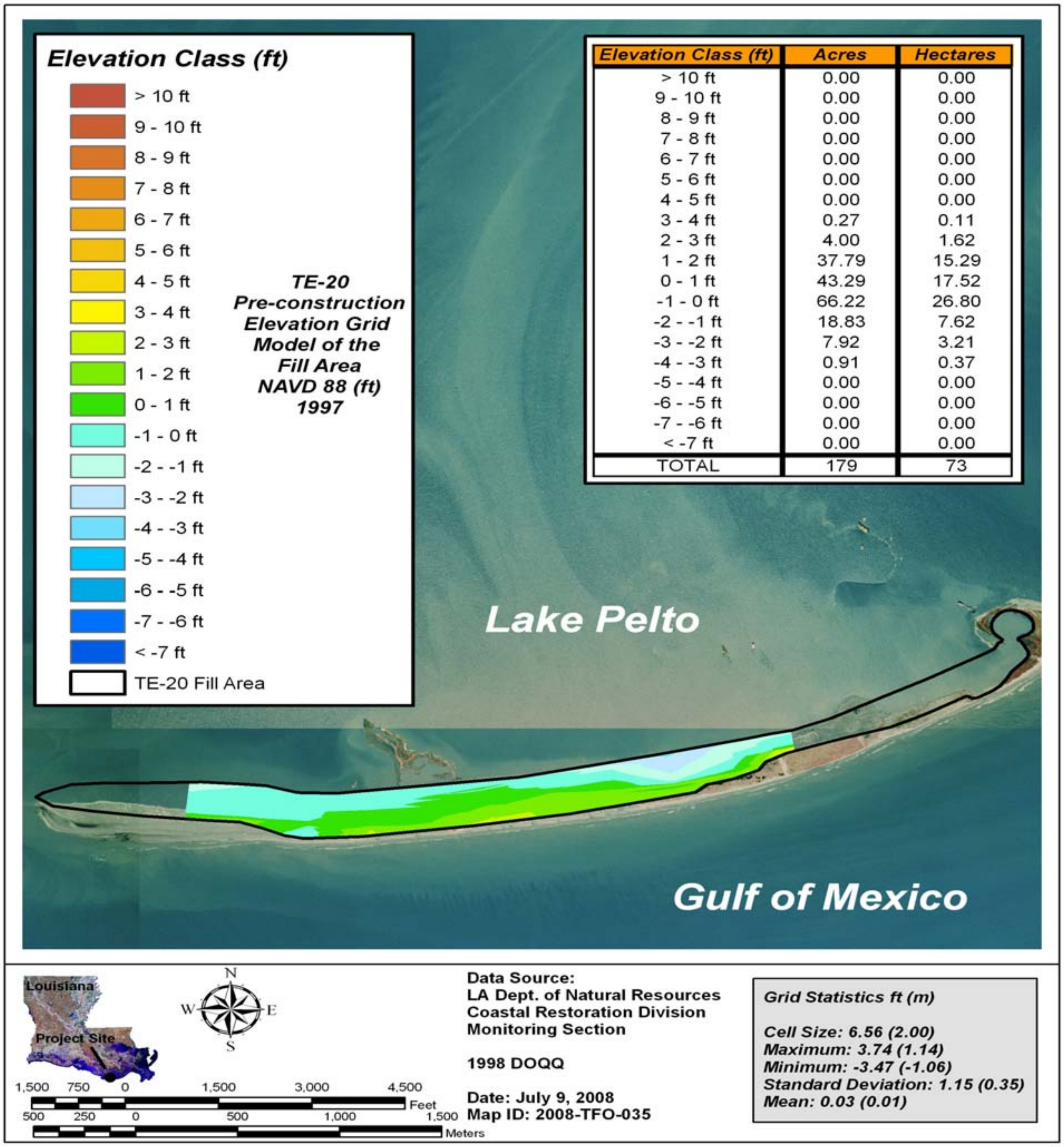


Elevation Change m (ft)	Acres	Hectares
> 3.5 (11.5)	0.000	0.000
3.0 - 3.5 (9.8 - 11.5)	0.000	0.000
2.5 - 3.0 (8.2 - 9.8)	0.000	0.000
2.0 - 2.5 (6.6 - 8.2)	0.001	0.000
1.5 - 2.0 (4.9 - 6.6)	0.044	0.018
1.0 - 1.5 (3.3 - 4.9)	0.222	0.090
0.5 - 1.0 (1.6 - 3.3)	4.011	1.623
0 - 0.5 (0 - 1.6)	33.279	13.468
-0.5 - 0 (-1.6 - 0)	103.082	41.716
-1.0 - -0.5 (-3.3 - -1.6)	35.180	14.237
-1.5 - -1.0 (-4.9 - -3.3)	9.571	3.873
-2.0 - -1.5 (-6.6 - -4.9)	9.201	3.724
-2.5 - -2.0 (-8.2 - -6.6)	10.741	4.347
-3.0 - -2.5 (-9.8 - -8.2)	7.741	3.133
-3.5 - -3.0 (-11.5 - -9.8)	9.580	3.877
< -3.5 (-11.5)	22.107	8.946
TOTAL	245	99

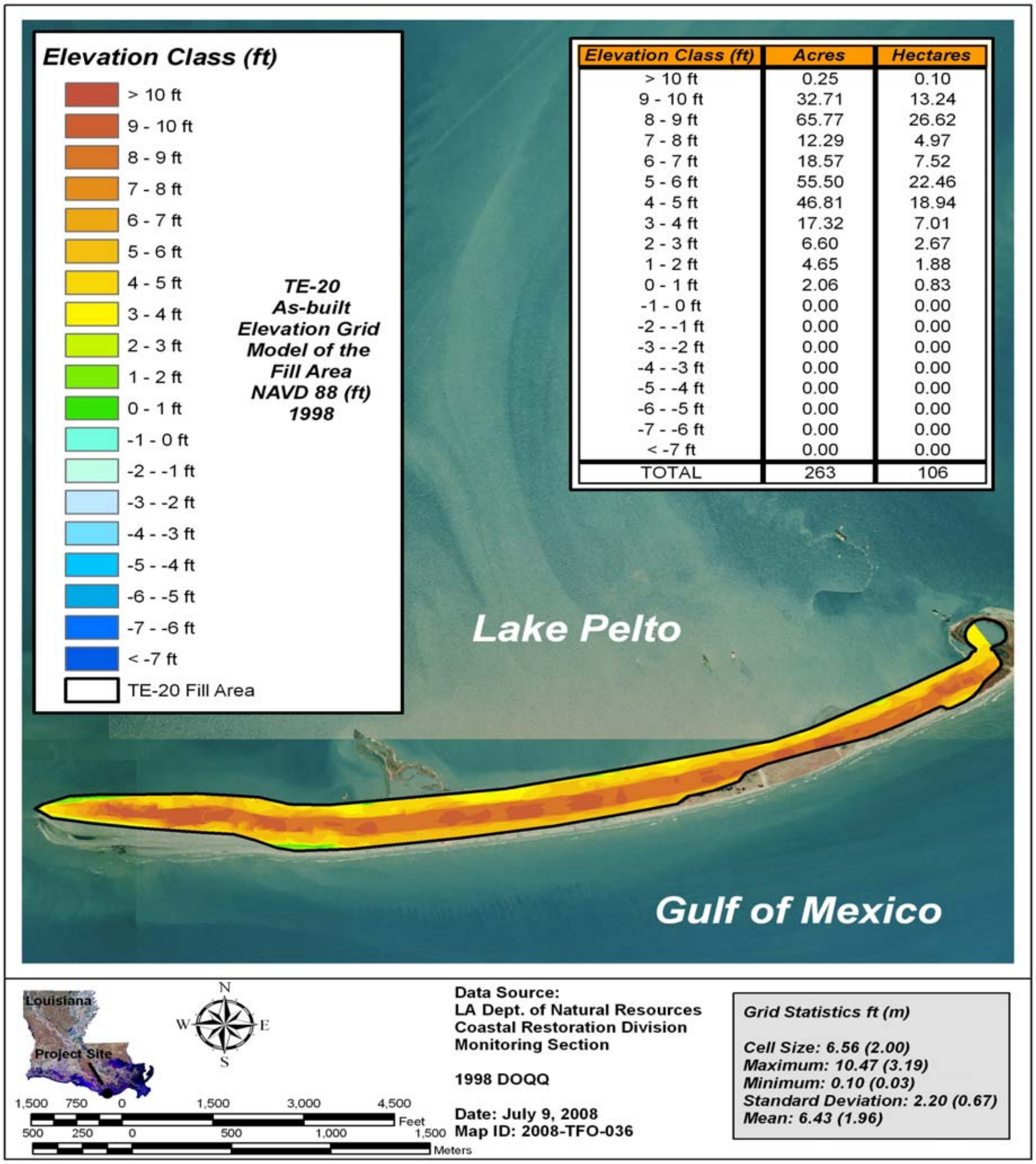
Post-construction elevation and volume change grid model from 2000 to 2006 at the Isles Dernieres Restoration East Island (TE-20) project.

Appendix C

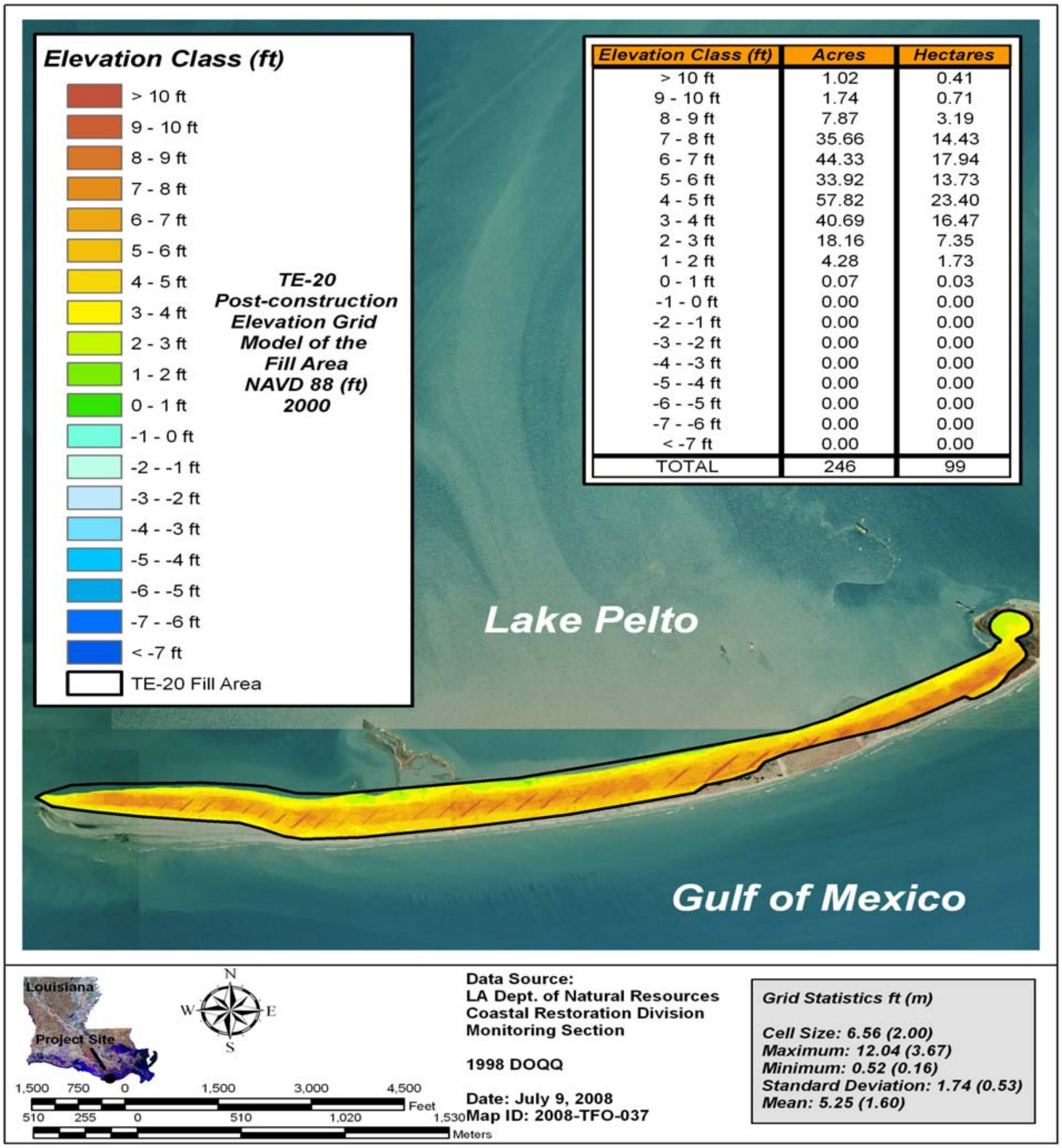
Elevation Grid Models



Pre-construction (1997) elevation grid model at the Isles Dernieres Restoration East Island (TE-20) project.

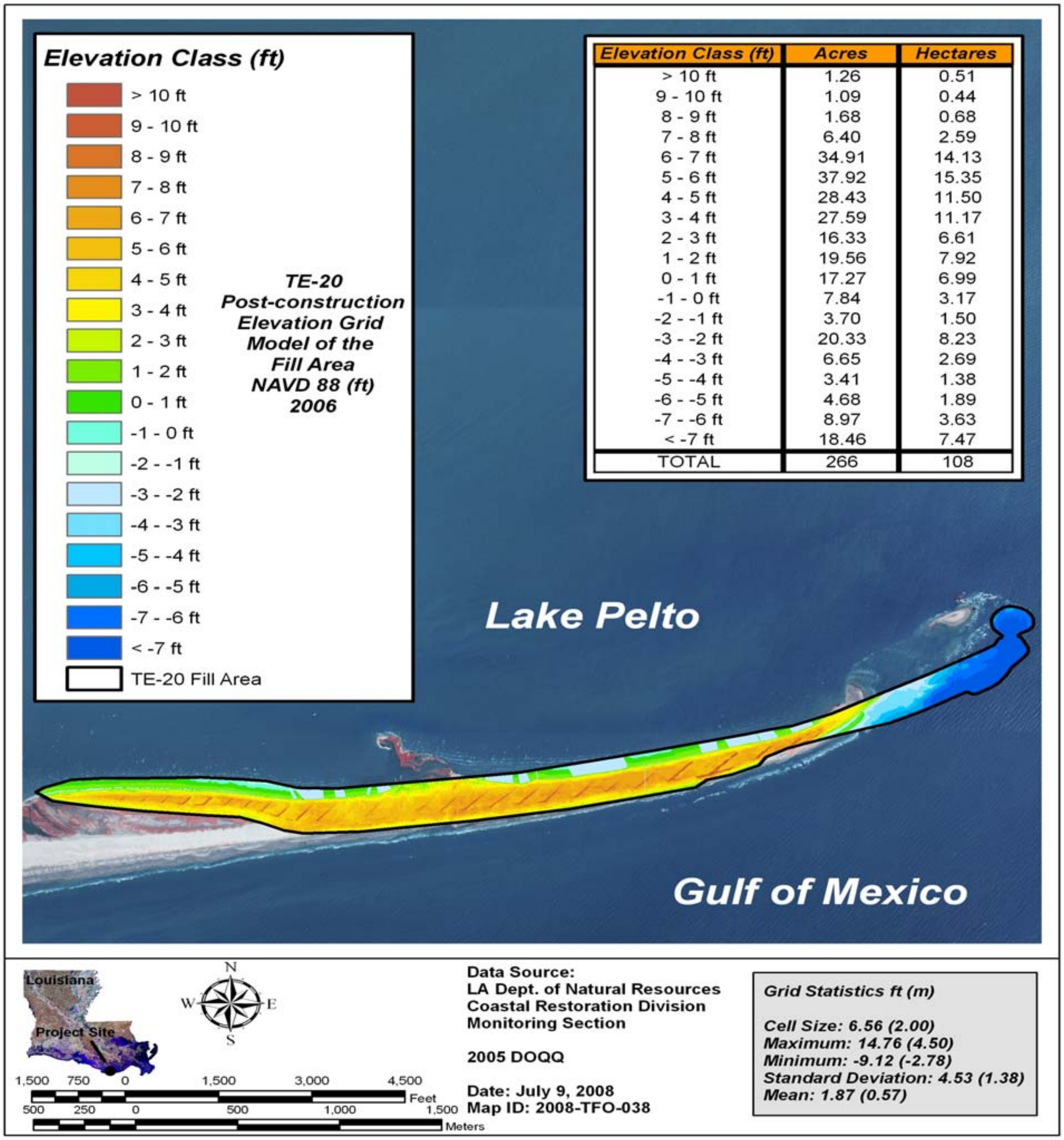


As-built (1998) elevation grid model at the Isles Dernieres Restoration East Island (TE-20) project.



Elevation Class (ft)	Acres	Hectares
> 10 ft	1.02	0.41
9 - 10 ft	1.74	0.71
8 - 9 ft	7.87	3.19
7 - 8 ft	35.66	14.43
6 - 7 ft	44.33	17.94
5 - 6 ft	33.92	13.73
4 - 5 ft	57.82	23.40
3 - 4 ft	40.69	16.47
2 - 3 ft	18.16	7.35
1 - 2 ft	4.28	1.73
0 - 1 ft	0.07	0.03
-1 - 0 ft	0.00	0.00
-2 - -1 ft	0.00	0.00
-3 - -2 ft	0.00	0.00
-4 - -3 ft	0.00	0.00
-5 - -4 ft	0.00	0.00
-6 - -5 ft	0.00	0.00
-7 - -6 ft	0.00	0.00
< -7 ft	0.00	0.00
TOTAL	246	99

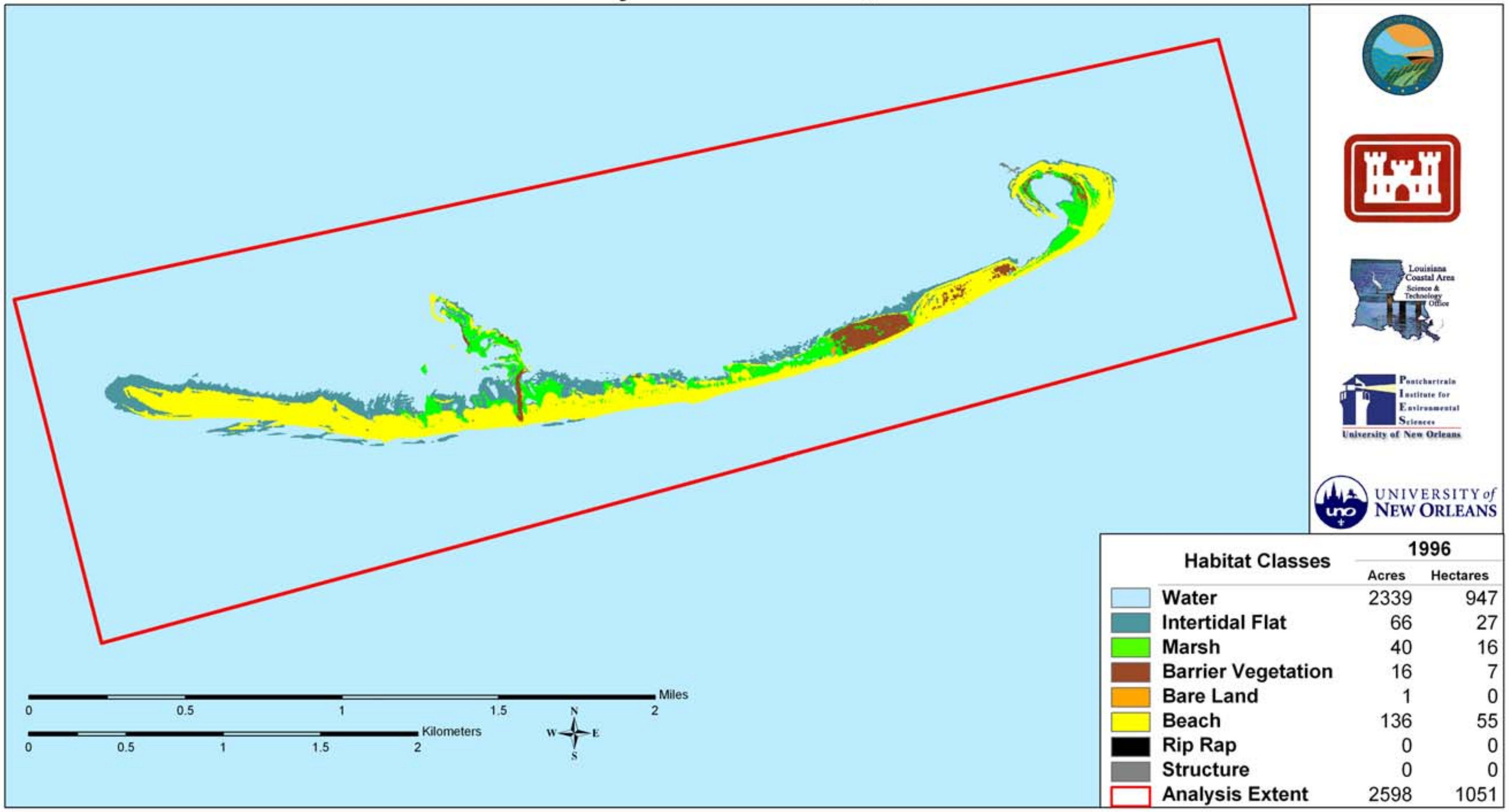
Post-construction (2000) elevation grid model at the Isles Dernieres Restoration East Island (TE-20) project.



Post-construction (2006) elevation grid model at the Isles Dernieres Restoration East Island (TE-20) project.

Appendix D

Habitat Classification Maps

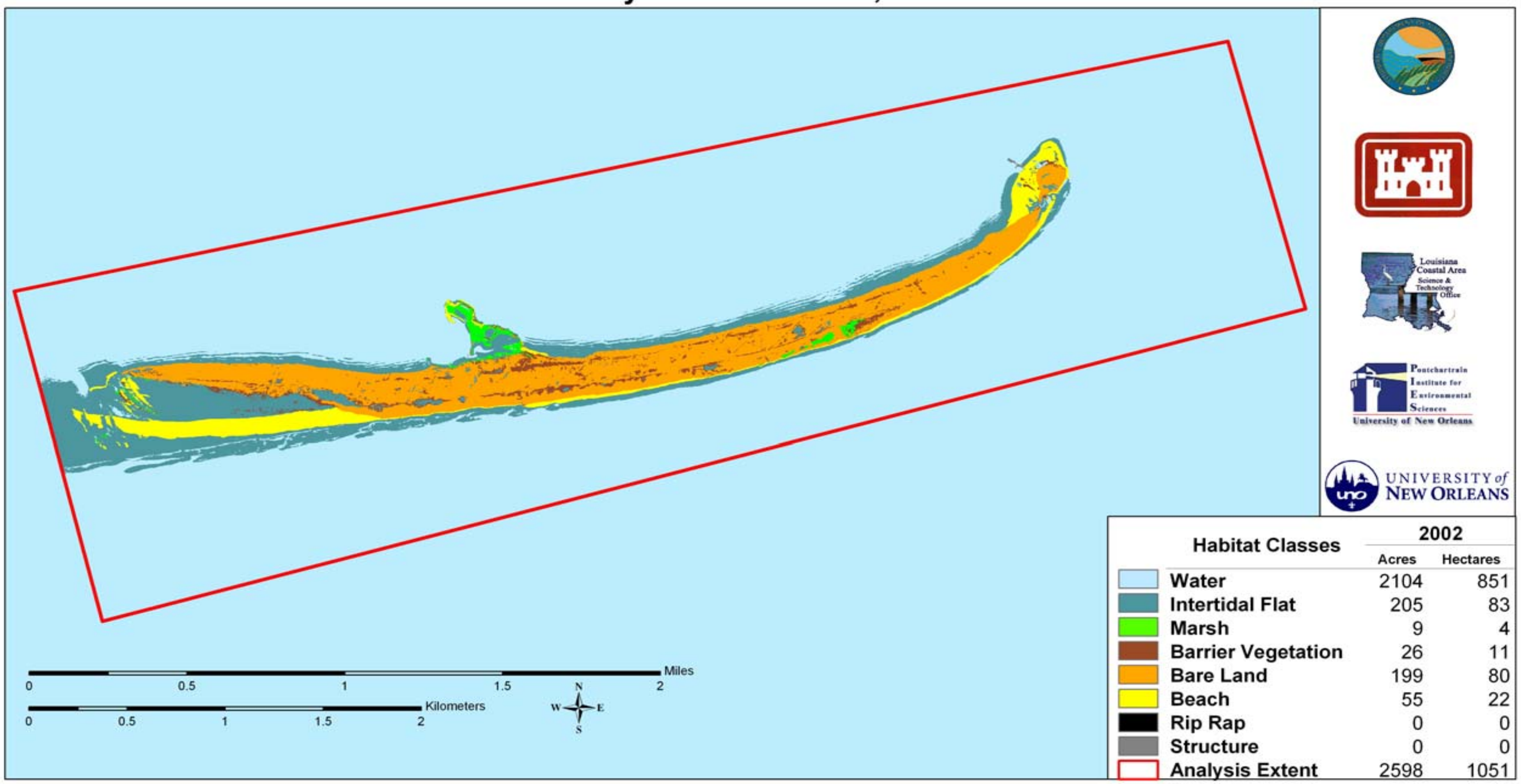


Habitat Classes	1996 Acres	1996 Hectares
Water	2339	947
Intertidal Flat	66	27
Marsh	40	16
Barrier Vegetation	16	7
Bare Land	1	0
Beach	136	55
Rip Rap	0	0
Structure	0	0
Analysis Extent	2598	1051

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. From west to east, the western Chenier Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island in the south to Hewes Point in the north.

Funding for this project was provided by the LCA Science and Technology Program, a partnership between the Louisiana Department of Natural Resources (LDNR) and the US Army Corps of Engineers (USACE), through LDNR Interagency Agreement No. 2512-06-06. All work was completed by staff at the University of New Orleans - Pontchartrain Institute for Environmental Sciences.

BICM Habitat Analysis: East Island, Teche delta - 2002



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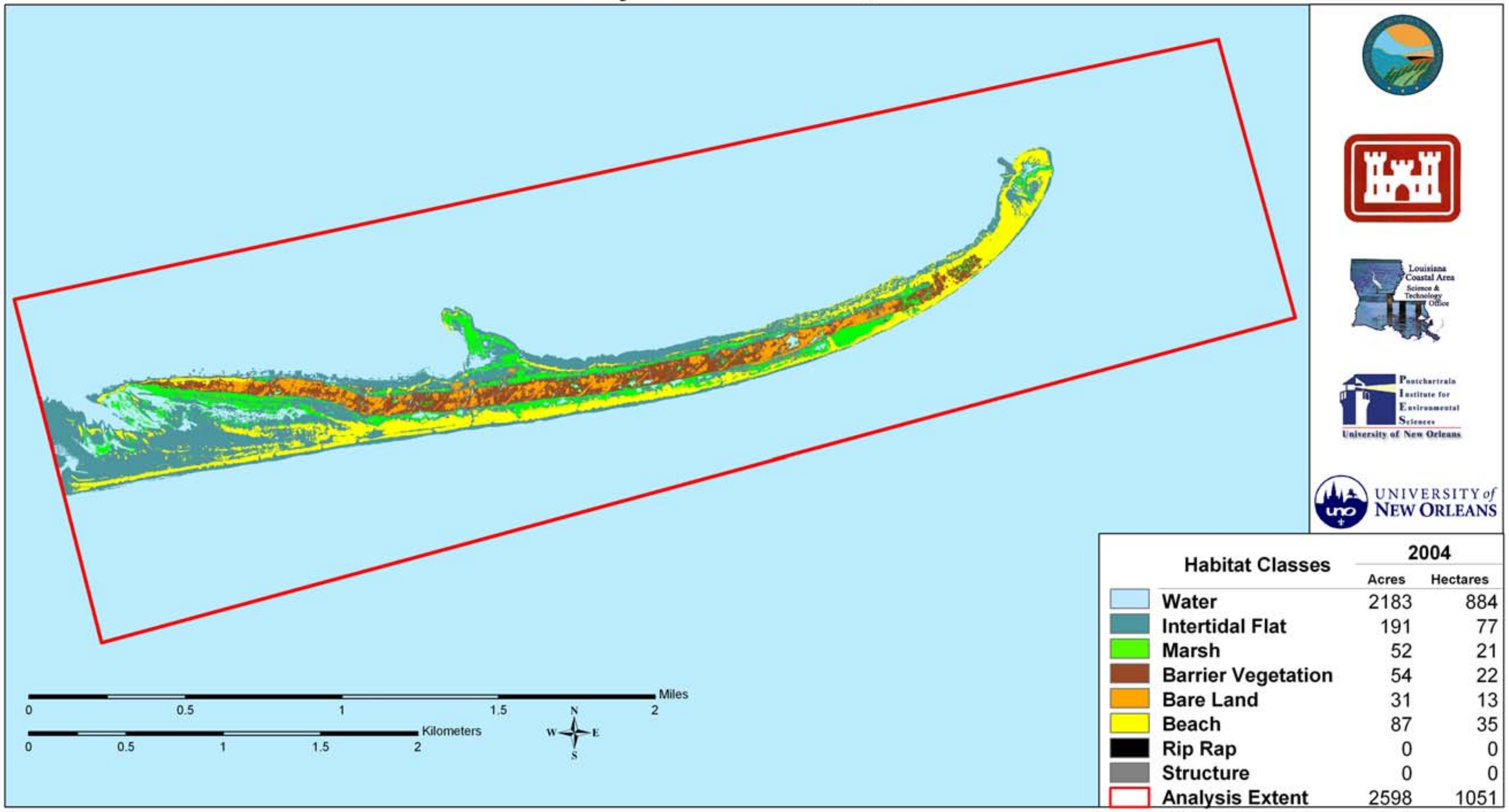
BICM Habitat Analysis: East Island, Teche delta - 2004



Habitat Classes	2004 Acres	2004 Hectares
Water	2183	884
Intertidal Flat	191	77
Marsh	52	21
Barrier Vegetation	54	22
Bare Land	31	13
Beach	87	35
Rip Rap	0	0
Structure	0	0
Analysis Extent	2598	1051

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. From west to east, the western Chenier Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island in the south to Hewes Point in the north.

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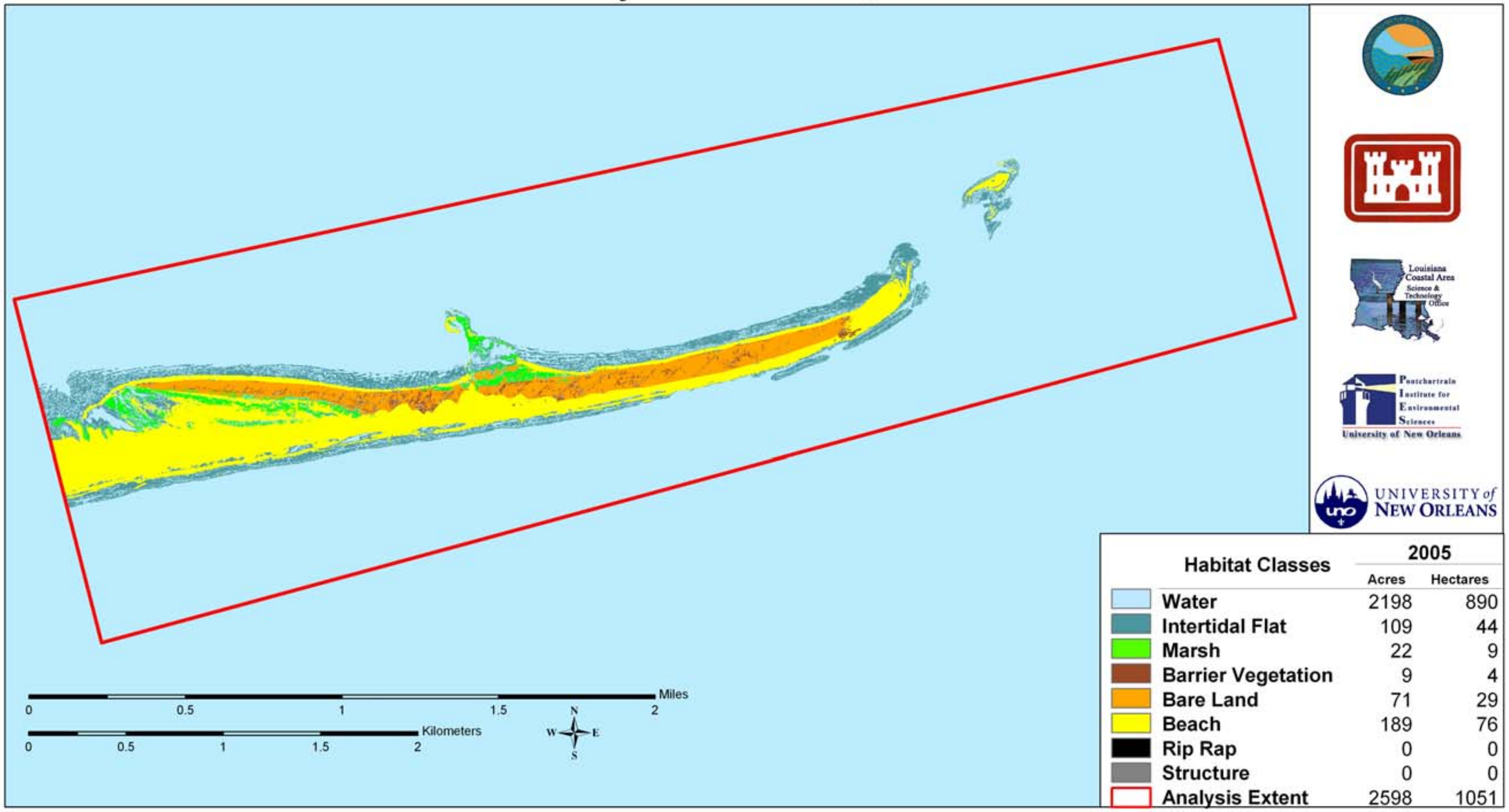
BICM Habitat Analysis: East Island, Teche delta - 2005



Habitat Classes	2005 Acres	2005 Hectares
Water	2198	890
Intertidal Flat	109	44
Marsh	22	9
Barrier Vegetation	9	4
Bare Land	71	29
Beach	189	76
Rip Rap	0	0
Structure	0	0
Analysis Extent	2598	1051

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. From west to east, the western Chenier Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island in the south to Hewes Point in the north.

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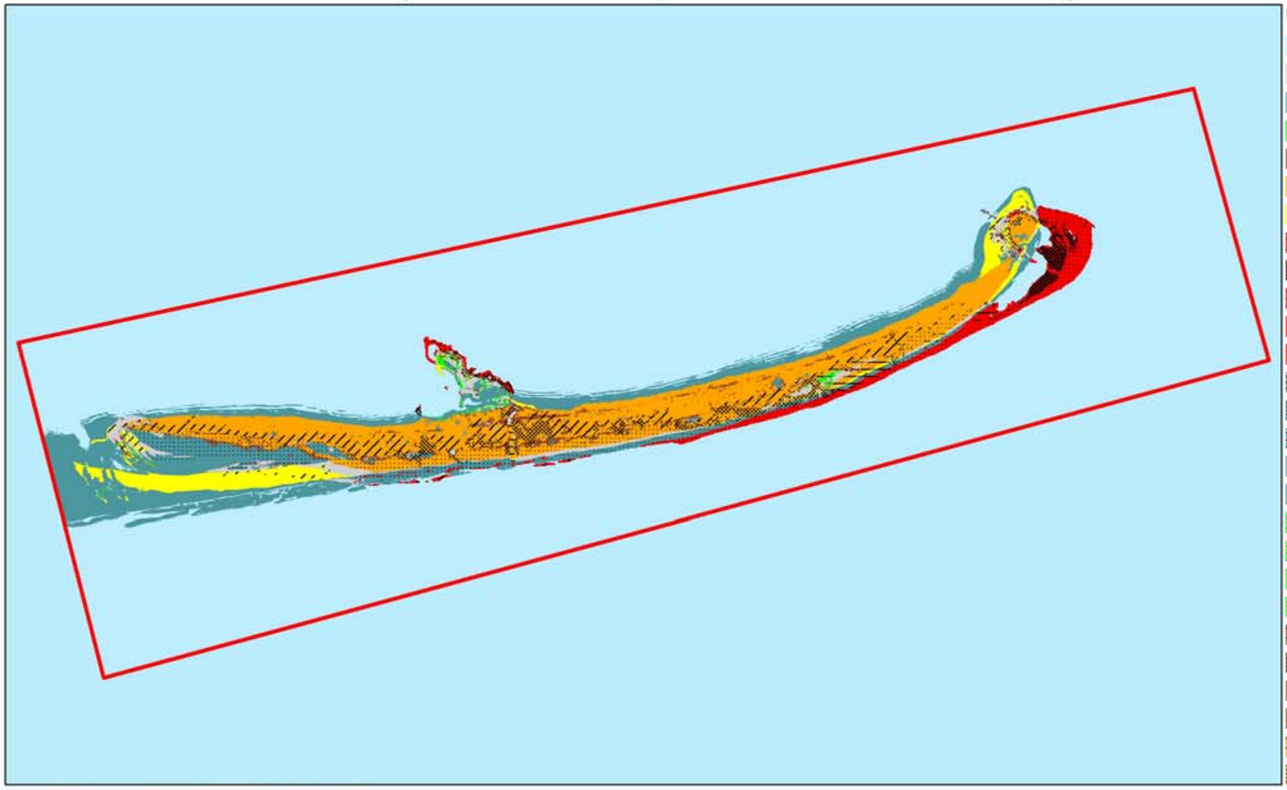
Appendix E

Habitat Change Maps

BICM Habitat Analysis: East Island, Teche delta Habitat Change Classification - 2002 from 1996



Legend (2002 from 1996)	Acreages	Hectares
water from water	2050	830
unchanged land	30	12
intertidal flat from water	148	60
marsh from water	2	1
barrier vegetation from water	8	3
bare land from water	96	39
beach from water	35	14
water from intertidal flat	6	2
water from marsh	9	4
water from barrier vegetation	4	1
water from bare land	0	0
water from beach	35	14
water from structure	0	0
intertidal flat from marsh	3	1
intertidal flat from barrier vegetation	2	1
intertidal flat from bare land	0	0
intertidal flat from beach	41	17
marsh from intertidal flat	1	0
marsh from barrier vegetation	1	0
marsh from bare land	0	0
marsh from beach	1	0
barrier vegetation from intertidal flat	5	2
barrier vegetation from marsh	3	1
barrier vegetation from bare land	0	0
barrier vegetation from beach	8	3
bare land from intertidal flat	40	16
bare land from marsh	17	7
bare land from barrier vegetation	6	2
bare land from beach	39	16
beach from intertidal flat	4	2
beach from marsh	2	1
beach from barrier vegetation	2	1
beach from bare land	0	0
rip rap to rip rap	0	0
structure to structure	0	0
anlaysis extent	2599	1052

Miles: 0 0.25 0.5 0.75 1
Kilometers: 0 0.25 0.5 0.75 1

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. The western Cheneir Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island to Hewes Point.

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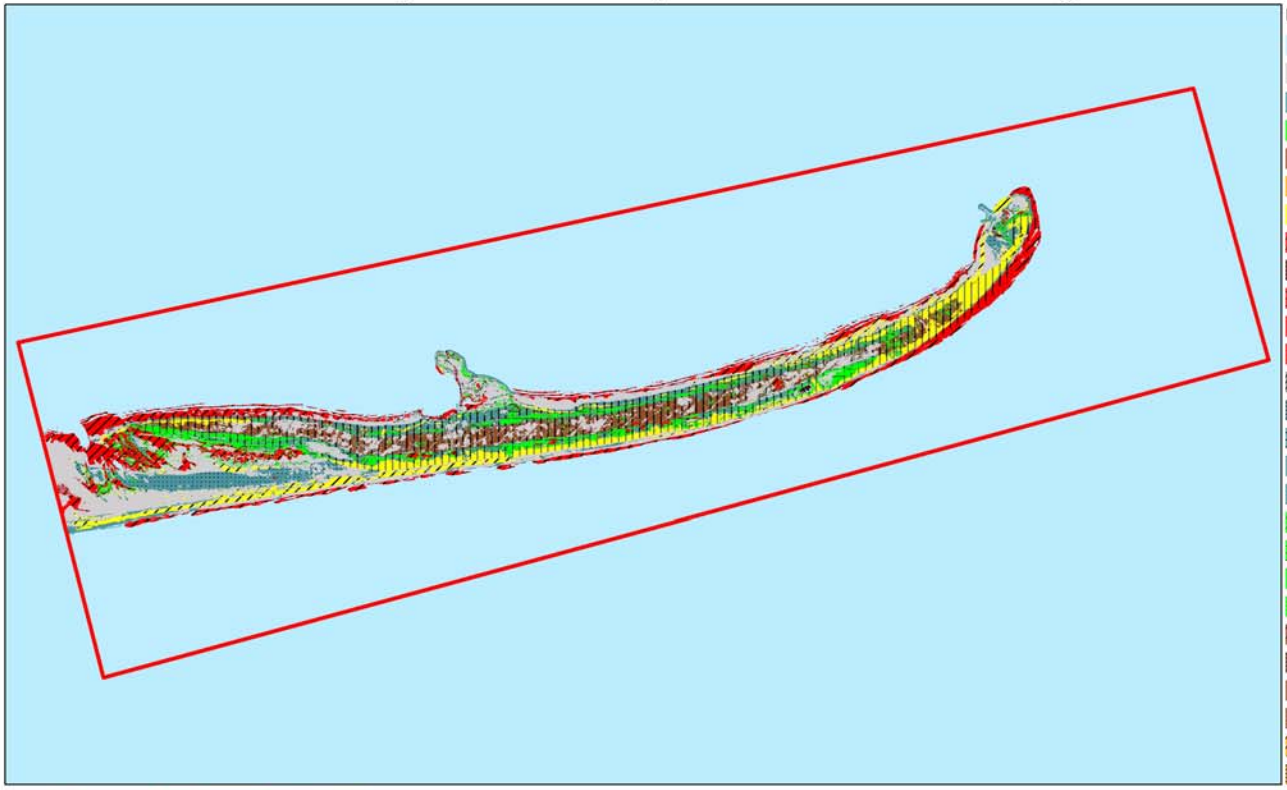
BICM Habitat Analysis: East Island, Teche delta Habitat Change Classification - 2004 from 2002



Legend (2004 from 2002)	Acreages	Hectares
water from water	2092	847
unchanged land	158	64
intertidal flat from water	9	4
marsh from water	0	0
barrier vegetation from water	0	0
bare land from water	0	0
beach from water	4	1
water from intertidal flat	76	31
water from marsh	1	0
water from barrier vegetation	3	1
water from bare land	7	3
water from beach	6	2
water from structure	0	0
intertidal flat from marsh	2	1
intertidal flat from barrier vegetation	6	3
intertidal flat from bare land	48	19
intertidal flat from beach	28	11
marsh from intertidal flat	9	4
marsh from barrier vegetation	14	6
marsh from bare land	21	9
marsh from beach	2	1
barrier vegetation from intertidal flat	0	0
barrier vegetation from marsh	0	0
barrier vegetation from bare land	51	21
barrier vegetation from beach	0	0
bare land from intertidal flat	0	0
bare land from marsh	0	0
bare land from barrier vegetation	0	0
bare land from beach	0	0
beach from intertidal flat	21	8
beach from marsh	0	0
beach from barrier vegetation	1	0
beach from bare land	42	17
rip rap to rip rap	0	0
structure to structure	0	0
anlaysis extent	2599	1052

Miles: 0 0.25 0.5 0.75 1

Kilometers: 0 0.25 0.5 0.75 1

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. The western Cheneir Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island to Hewes Point.

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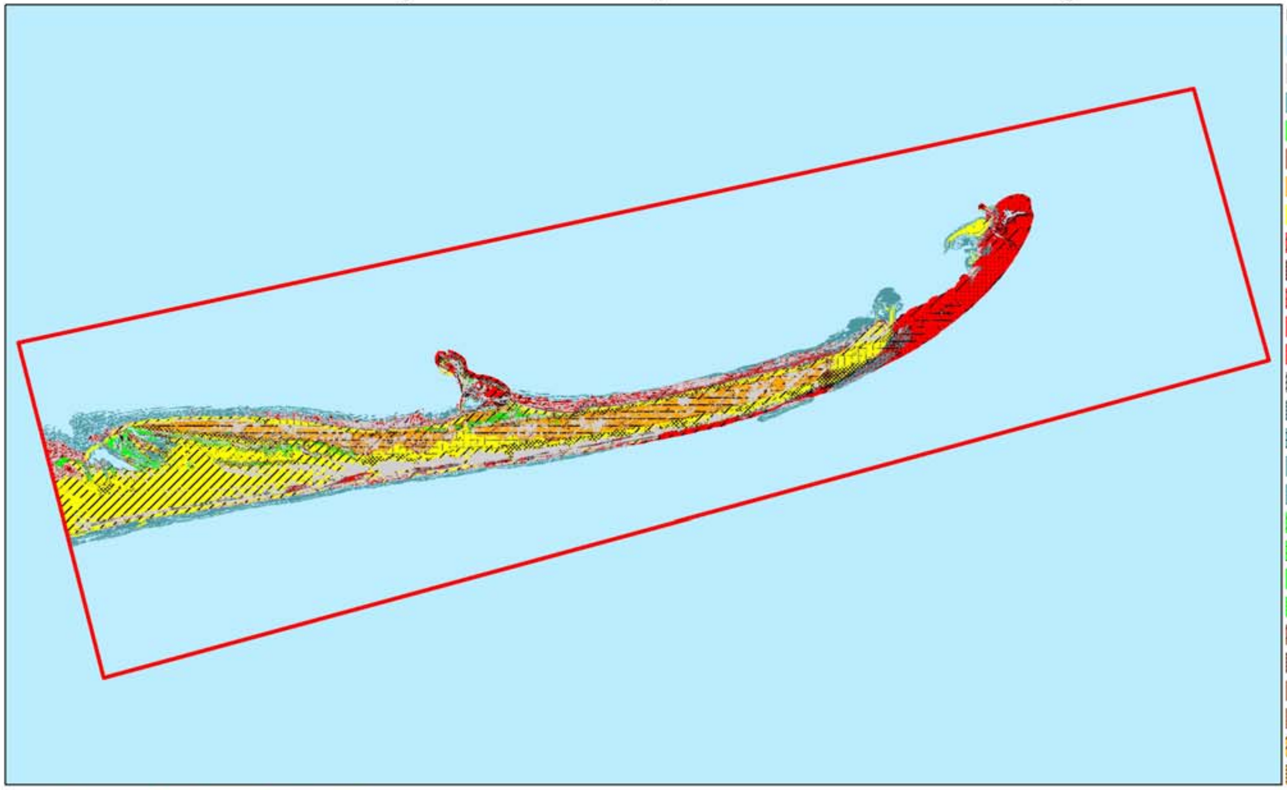
BICM Habitat Analysis: East Island, Teche delta Habitat Change Classification - 2005 from 2004



Legend (2005 from 2004)	Acreages	Hectares
water from water	2111	854
unchanged land	116	47
intertidal flat from water	52	21
marsh from water	4	2
barrier vegetation from water	0	0
bare land from water	1	1
beach from water	16	6
water from intertidal flat	42	17
water from marsh	9	3
water from barrier vegetation	6	2
water from bare land	1	0
water from beach	32	13
water from structure	0	0
intertidal flat from marsh	5	2
intertidal flat from barrier vegetation	2	1
intertidal flat from bare land	0	0
intertidal flat from beach	12	5
marsh from intertidal flat	7	3
marsh from barrier vegetation	0	0
marsh from bare land	0	0
marsh from beach	0	0
barrier vegetation from intertidal flat	1	0
barrier vegetation from marsh	1	1
barrier vegetation from bare land	1	1
barrier vegetation from beach	0	0
bare land from intertidal flat	10	4
bare land from marsh	6	2
bare land from barrier vegetation	32	13
bare land from beach	1	0
beach from intertidal flat	93	38
beach from marsh	22	9
beach from barrier vegetation	9	3
beach from bare land	8	3
rip rap to rip rap	0	0
structure to structure	0	0
anlaysis extent	2599	1052

Miles: 0, 0.25, 0.5, 0.75, 1
Kilometers: 0, 0.3, 0.6, 0.9, 1.2

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. The western Cheneir Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island to Hewes Point.

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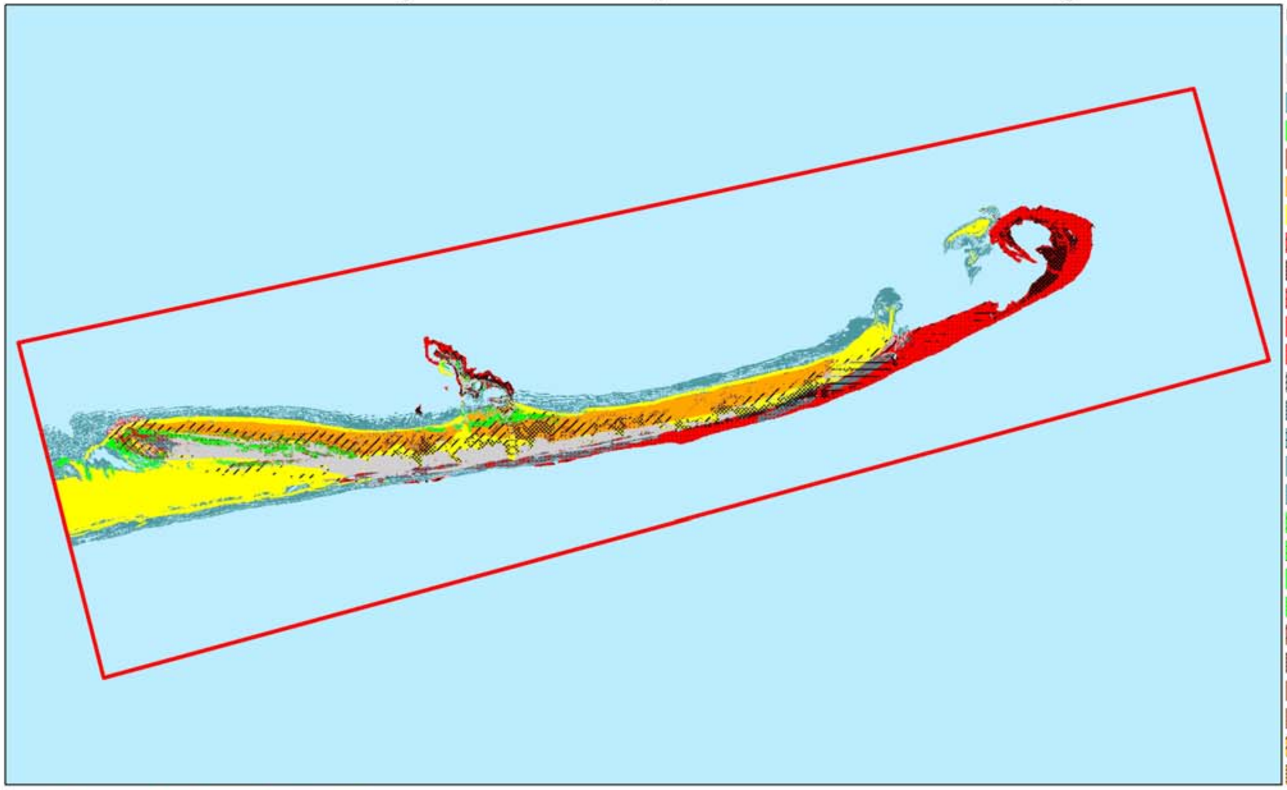
BICM Habitat Analysis: East Island, Teche delta Habitat Change Classification - 2005 from 1996



Legend (2005 from 1996)	Acreages	Hectares
water from water	2101	850
unchanged land	61	25
intertidal flat from water	86	35
marsh from water	6	3
barrier vegetation from water	4	2
bare land from water	36	15
beach from water	107	43
water from intertidal flat	14	6
water from marsh	16	6
water from barrier vegetation	8	3
water from bare land	0	0
water from beach	59	24
water from structure	0	0
intertidal flat from marsh	3	1
intertidal flat from barrier vegetation	3	1
intertidal flat from bare land	0	0
intertidal flat from beach	12	5
marsh from intertidal flat	5	2
marsh from barrier vegetation	0	0
marsh from bare land	0	0
marsh from beach	8	3
barrier vegetation from intertidal flat	3	1
barrier vegetation from marsh	1	0
barrier vegetation from bare land	0	0
barrier vegetation from beach	1	0
bare land from intertidal flat	23	9
bare land from marsh	6	3
bare land from barrier vegetation	1	0
bare land from beach	5	2
beach from intertidal flat	16	6
beach from marsh	10	4
beach from barrier vegetation	3	1
beach from bare land	0	0
rip rap to rip rap	0	0
structure to structure	0	0
anlaysis extent	2599	1052

The goal of the Habitat Analysis portion of the Barrier Island Comprehensive Monitoring (BICM) program is to classify the habitat types present along five delta regions in Louisiana for the time periods 1996/98, 2001/02, 2004, and 2005 and make comparisons between each time period. The western Cheneir Plain extends from Sabine Pass to the Lower Mud Lake Entrance in western Louisiana; the Teche delta extends from Raccoon Point to Wine Island Pass; the Lafourche delta extends from Cat Island Pass to Quatre Bayou Pass; the Modern delta extends from Quatre Bayou Pass to Sandy Point; and the Chandeleur Islands extend from Breton Island to Hewes Point.

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