MR-06
Channel Armor Gap Crevasse
Summary Data and Graphics

May 5, 2003

Rodrigue, D. 2003. *MR-06 Channel Armor Gap Crevasse Summary Data and Graphics. Louisiana Department of Natural Resources, Coastal Restoration Division, Baton Rouge, LA. 29pp.*

MR-06 Channel Armor Gap Crevasse

Project Overview

- The Channel Armor Gap Crevasse (MR-06) project is located in the Mississippi River Delta, south of Venice in Plaquemines Parish, Louisiana. It lies on the left descending bank of the main river channel, at river mile 4.7 above Head of Passes (figure 1).
- The project outfall area, Mary Bowers Pond, is located adjacent to the Mississippi River channel and Main Passes, within the boundary of the Delta National Wildlife Refuge. The project area consists of 1,567 acres.
- A crevasse was dug in October 1997 from an existing gap in the Mississippi River levee.
- The crevasse created a more efficient route that allows more river sediments to enter the outfall area at a faster rate than before its construction, therefore allowing a higher rate of sediment accretion in the outfall area.
- Crevasses promote infilling of shallow interdistributary ponds with sediment-laden river water and eventually create subaerial land (or deltaic splays) that becomes colonized with marsh vegetation (figure 2).
- Over the 20-yr life of the project, this crevasse is expected to create approximately 1,000 ac (405 ha) of emergent marsh.

MR-06 Channel Armor Gap Crevasse

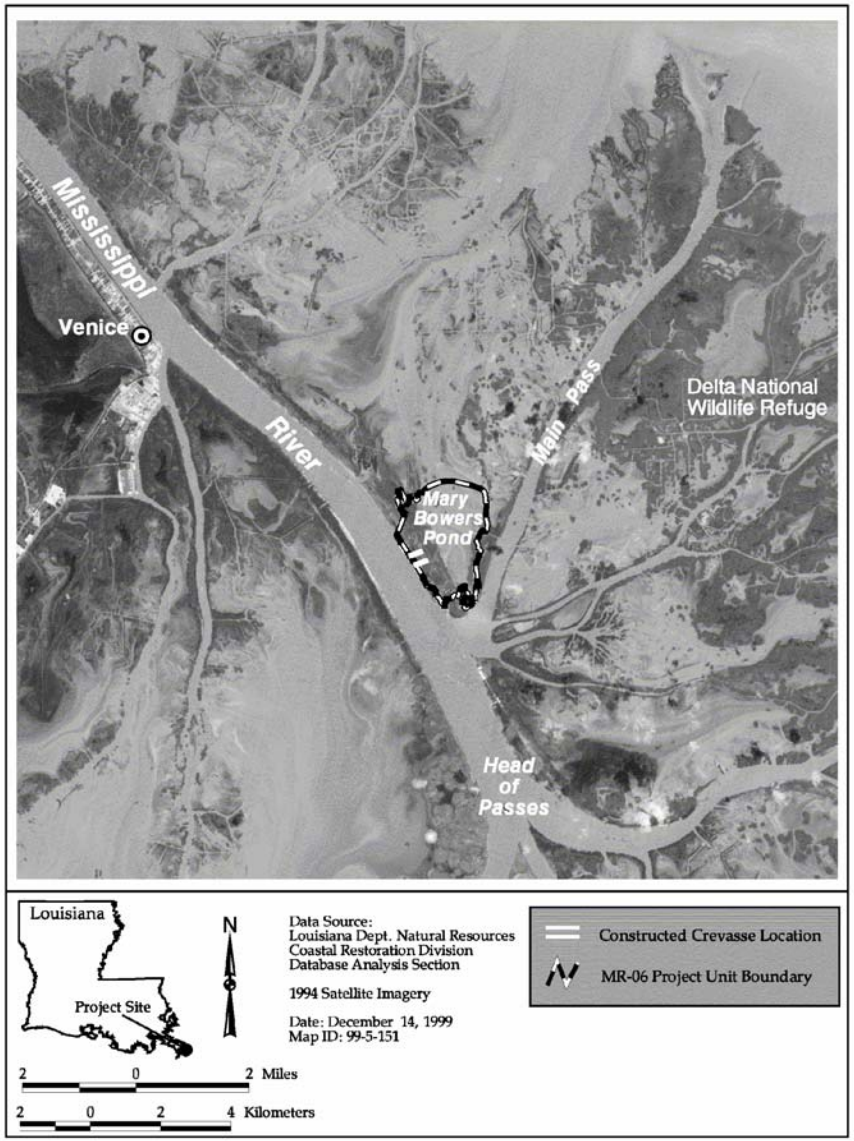

Figure 1. Channel Armor Gap Crevasse (MR-06) project location.

MR-06 Channel Armor Gap Crevasse

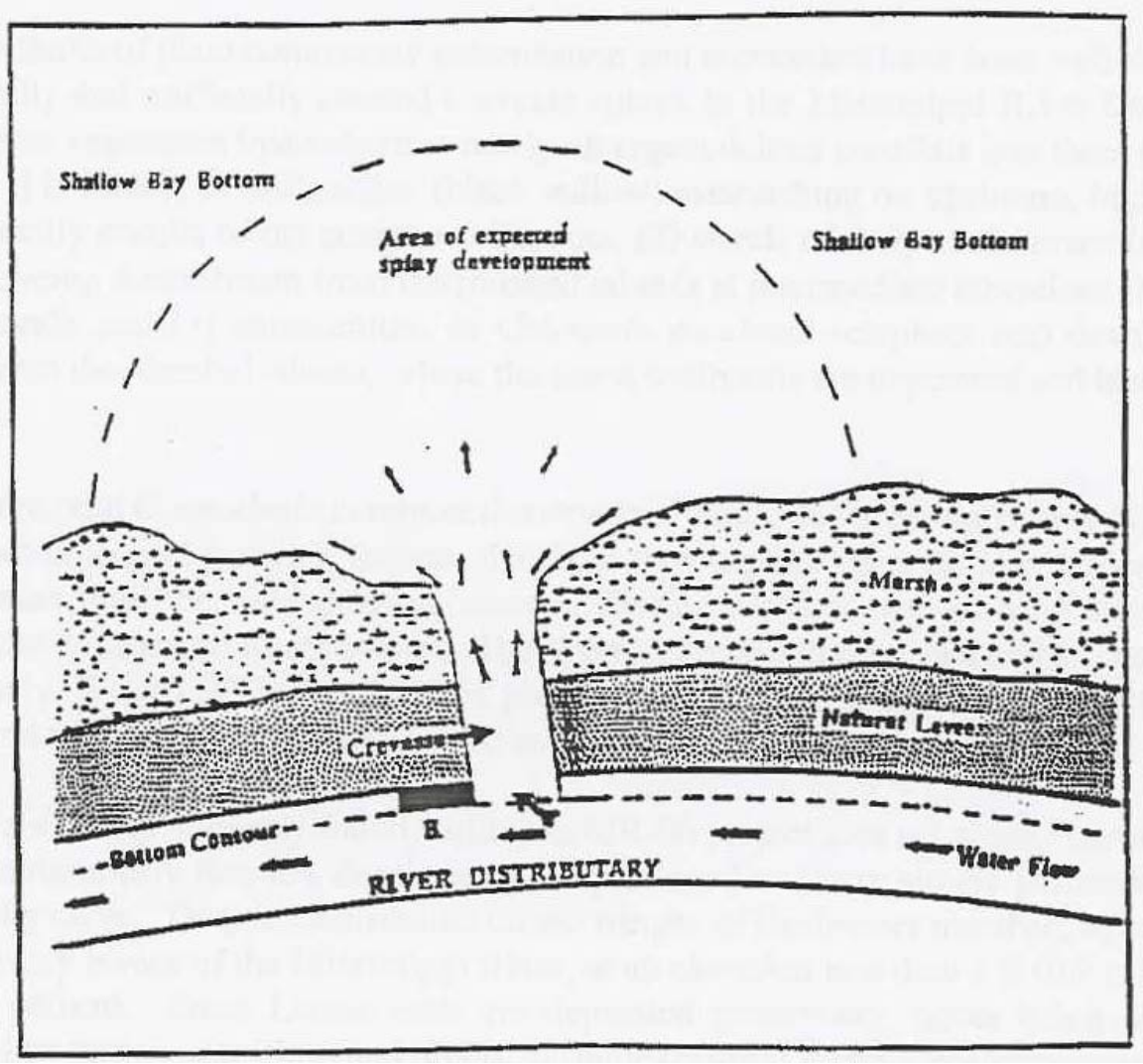

Figure 2. Schematic diagram of the artificial crevasse splay construction through a controlled breach of a distributary channel levee.

MR-06 Channel Armor Gap Crevasse

Project Features

- The natural gap in the Mississippi River channel bank armor was enlarged to a length of 3,400 ft (1,036 m), a bottom width of 80 ft (24 m), a top width of 130 ft (40 m), and a minimum depth of –4.0 ft (-1.2 m) NGVD.
- The crevasse channel is estimated to allow an average flow of 2,400 cfs (68 cms) to enter the outfall area.
- Approximately 70,000 yd^3 (53,522 m^3) of material was excavated from the outfall channel.
- The dredged material was deposited in a non-continuous fashion adjacent to the channel at an elevation not exceeding +4.0 ft (1.2 m) above existing surface elevations with several 50 ft wide gaps.

MR-06 Channel Armor Gap Crevasse

Reference Area

- A formal reference area was not selected, following the justification set forth in Steyer et al. (1995).
- As an informal reference, aerial photography taken throughout the entire Mississippi River delta will be utilized to evaluate temporal changes in open-water areas that have not been influenced by other crevasse splays.
- Additionally, results from other sediment diversion projects will serve for comparison and aid in evaluating the effectiveness of this project.

MR-06 Channel Armor Gap Crevasse

Project Objective

- Create emergent freshwater wetland habitats typical to the area in a shallow, open-water pond by diverting sediment-laden water from the Mississippi River.

Specific Goals

- Create an efficient crevasse channel by enlarging an existing gap in the Mississippi River bank.
- Increase mean elevation within the receiving bay, Mary Bowers Pond.
- Increase the mean percent cover of emergent wetland vegetation in the receiving bay.

MR-06 Channel Armor Gap Crevasse

Monitoring Elements

Water Discharge and Suspended Sediments

Water discharge and suspended sediments will be measured to determine changes in discharge over time and to determine the relationship of these two variables within the crevasse channel. Both variables will be measured along transects at the mouth and end of the crevasse channel. Velocity (used to calculate discharge) will be measured with a hand-held velocity meter at numerous intervals along each transect and depth-integrated to establish a ratings curve. Suspended sediment concentration (used to calculate sediment load) will be measured with a point sampler at five even intervals along each transect and at five depths along a vertical profile for each sample location. Data will be collected immediately after construction, once per month during the first post-construction year (1998), and twice per year during high and low river stages (spring and fall) for 1999-2003, 2007, and 2016.

Habitat Mapping

Color-infrared aerial photography (1:12,000 scale) will be obtained and analyzed to determine land:water ratios, and habitat classifications. Aerial photographs will be scanned at 300 pixels per inch and georectified with ground control data collected with a differential global positioning system capable of sub-meter accuracy. Individual georectified frames will then be mosaicked to produce a single image of the project area. To determine habitat types and their distributions, the photomosaic will be photointerpreted and classified to the subclass level using the National Wetlands Inventory classification system. For the land/water analysis, all areas characterized by emergent vegetation, wetland forest, or scrub-shrub will be classified as land, while open water, aquatic beds, and non-vegetated mud flats will be classified as water. Photography was obtained for pre-construction (1996), and postconstruction (2001). Photography will also be obtained in 2007, and 2016.

MR-06 Channel Armor Gap Crevasse

Monitoring Elements

Sediment Elevation

Elevation, reported in North American Vertical Datum of 1988 (NAVD), will be surveyed in the receiving bay on November 25, 1997 to determine preconstruction elevation in the project area, and October 16, 2001 to determine postconstruction elevation. Elevation will also be surveyed in 2007.

Vegetation

Plant species composition, percent cover, and relative abundance will be evaluated to document vegetation succession on the newly created crevasse splay and to ground-truth aerial photograph interpretations. Vegetation surveys will follow the Braun-Blanquet method. Data will be collected at the same sample stations established for elevation measurements whenever possible. Transects will be established once the splay islands become subaerial, at locations where all major plant communities will be intersected. Sample stations along each transect will be established to represent the major plant communities of interest (*S. nigra*, *S. deltarum*, mixed marsh, pioneer marsh, and *Sagittaria* spp.), with at least five plots in each community. Additional transects and sample stations will be established over time as new land is created. Annual vegetation surveys began on October 16, 2001, after the first subaerial crevasse splay formed, and will continue through 2011.

MR-06 Channel Armor Gap Crevasse

Water Discharge and Suspended Sediments

- Pursuant to a CWPPRA Task Force decision on April 14, 1998, the original monitoring plan was reduced in scope due to budgetary constraints.
- Discharge and suspended sediment sampling, scheduled for monitoring from 1999-2008, was changed to only include 1999-2003.
- The revised monitoring plan called for only two samples per year for the remaining years, one during high river stage and one during low river stage.
- Because of these changes, it was determined that relatively little useful information would be derived from future monitoring of these two variables and that funds could be better used to address the vegetation and elevation goals of this project.
- Monitoring of suspended sediment and discharge was dropped, and the monitoring plan was revised to include vegetation sampling on a yearly basis for ten consecutive years with concurrent elevation surveys conducted by LDNR/CRD personnel.
- Water discharge through the crevasse peaked in May, then decreased through the summer and early fall of 1998 (figure 3).
- Except for October 1998, suspended sediment load followed a similar trend as water discharge.
- Over all sample dates average discharge and suspended sediment load were higher at the mouth [2,151 ± 509 cfs (61 ± 14 cms) and 965 ± 212 metric tons/day] than at the end [1,337 ± 327 cfs (38 ± 9 cms) and 547 metric tons/day] of the crevasse.

MR-06 Channel Armor Gap Crevasse

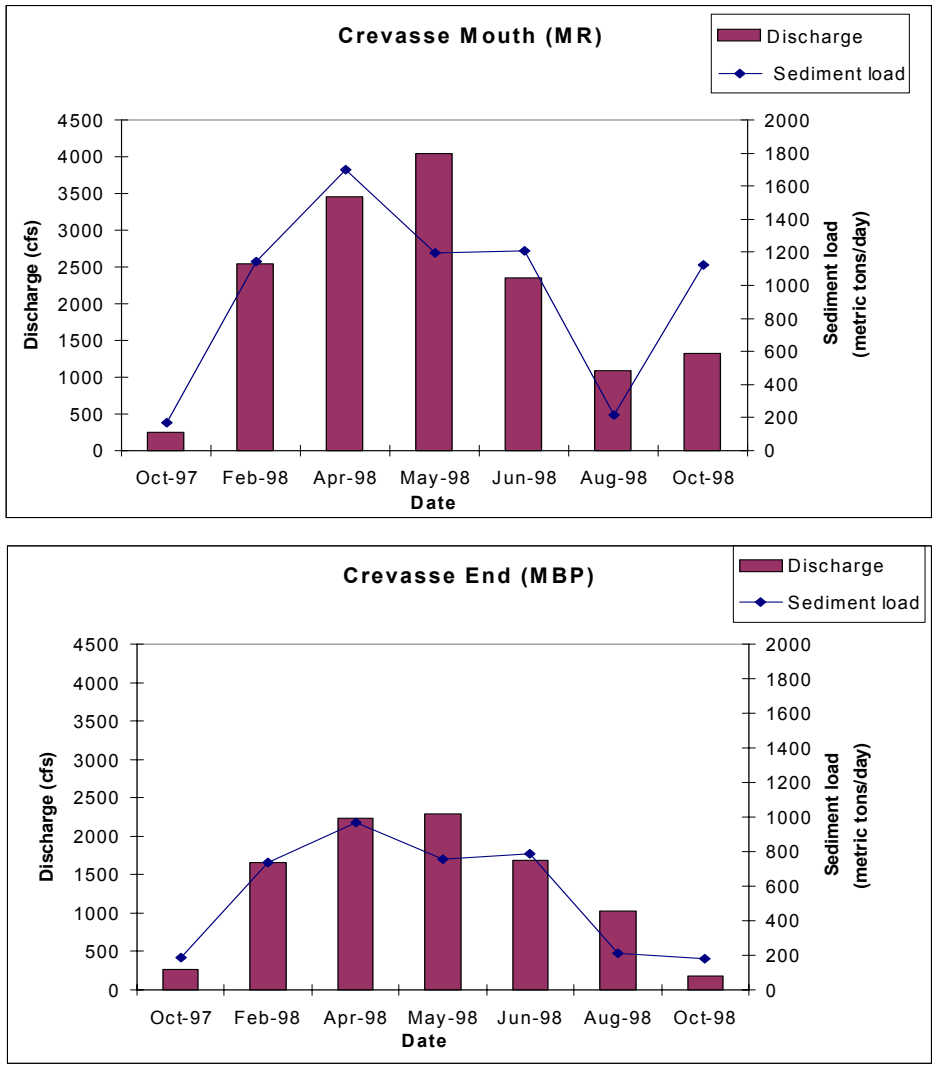

Figure 3. Water discharge and suspended sediment load at the mouth and end of the MR-06 project crevasse from October 1997 to October 1998. Abbreviations are as follows: MR = Mississippi River and MBP = Mary Bowers Pond.

MR-06 Channel Armor Gap Crevasse

Habitat Mapping

- Results from the 1996 land/water analysis indicated that 476 ac (193 ha) of the project area were land, and 1,091 ac (442 ha) were open water, a ratio of 30 % land to 70 % open water (figure 4).
- The 2001 land/water analysis results showed that 526 ac (213 ha) of the project area were land, and 1,038 (420 ha) were open water, a ratio of 34 % land and 66 % open water (figure 5).
- Habitat did not significantly change between 1996 preconstruction and 2001 postconstruction habitat analyses (figures 6 and 7).
- Significant subaerial land formation has not yet occurred, although mean sediment elevation has increased (see sediment elevation survey results).
- This crevasse is still in the beginning of the progradational phase of development, which is characterized by subaqueous infilling of the receiving bay and establishment of major flow channels.

MR-06 Channel Armor Gap Crevasse

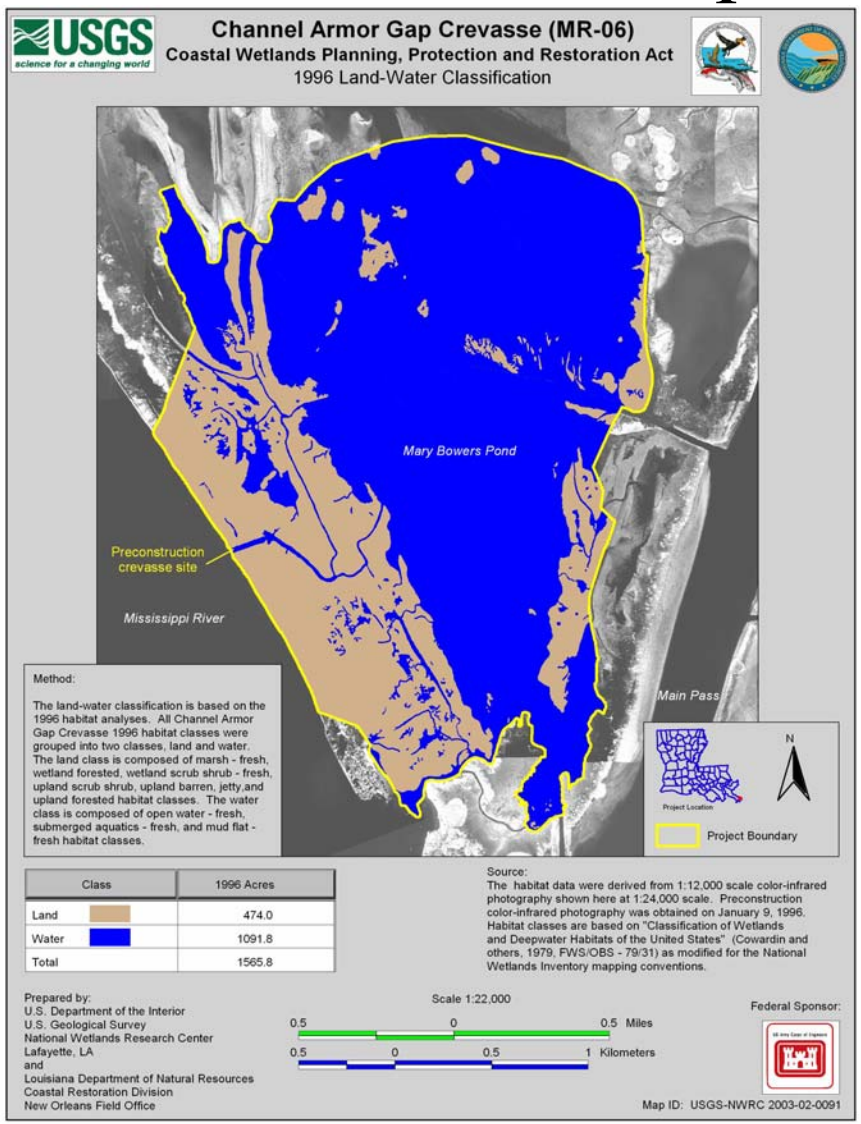

Figure 4. 1997 (preconstruction) land/water analysis of the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

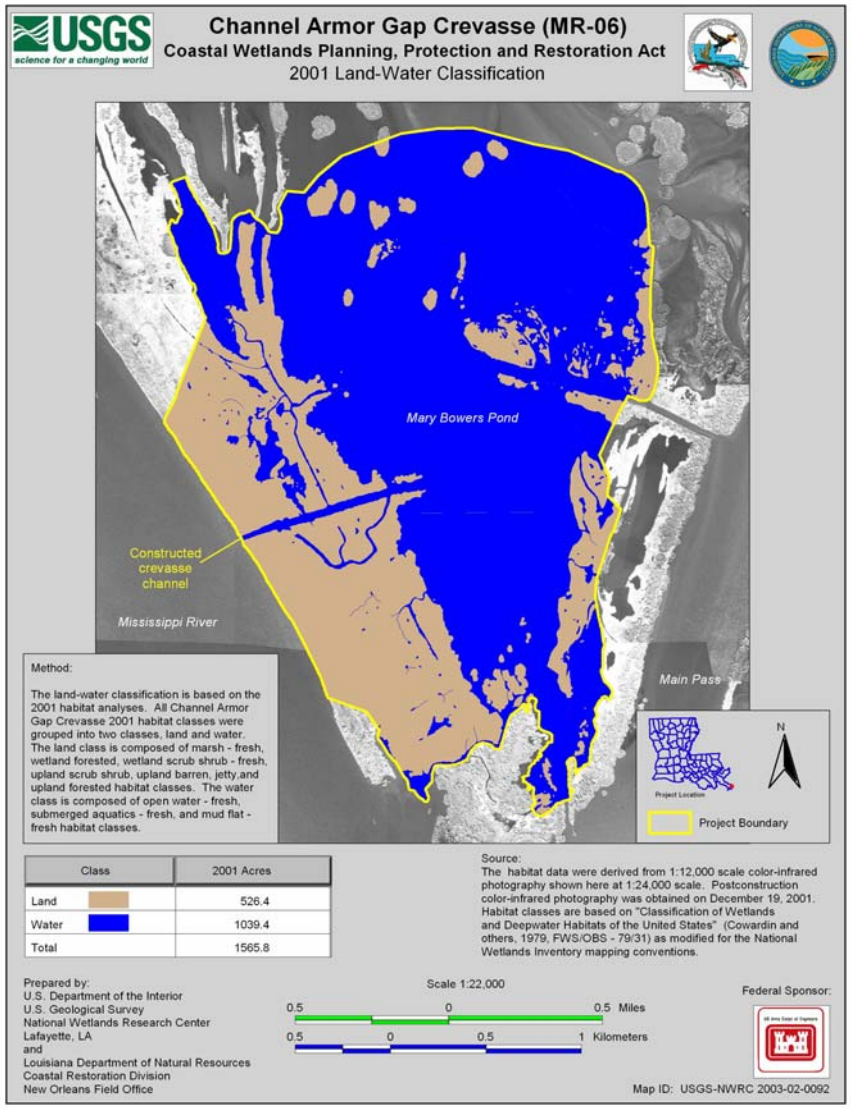

Figure 5. 2001 (postconstruction) land/water analysis of the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

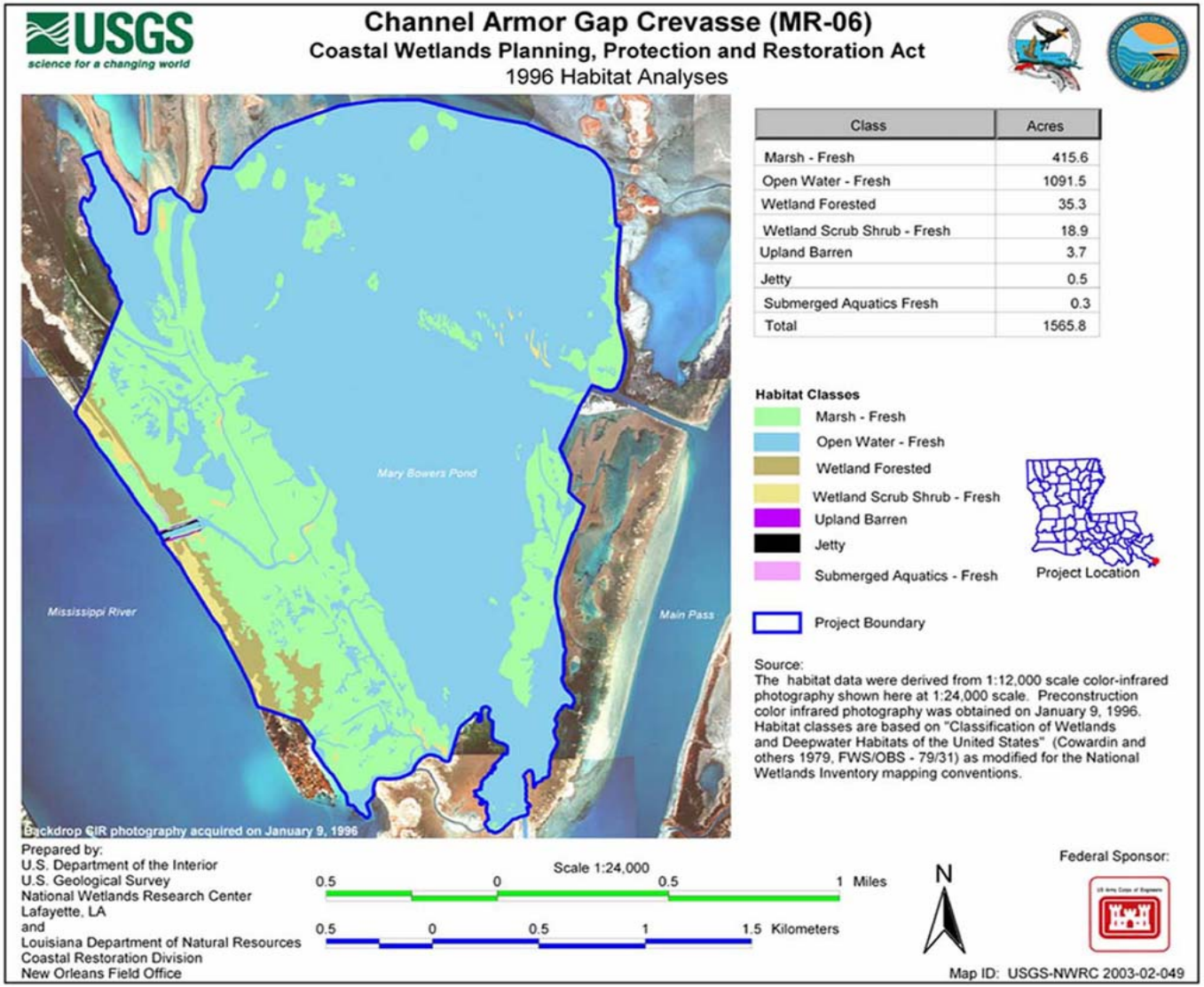

Figure 6. 1996 habitat analysis of the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

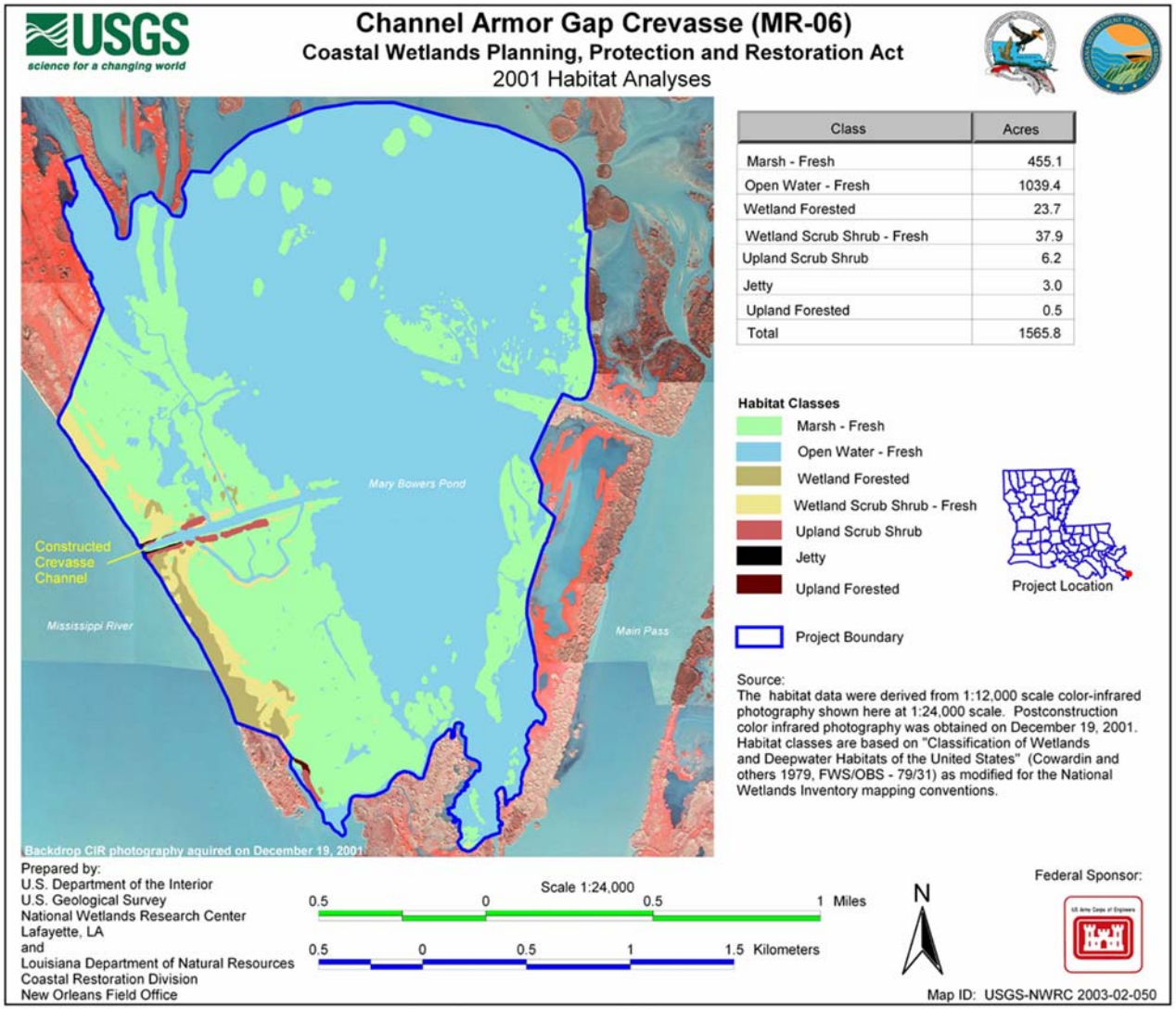

Figure 7. 2001 habitat analysis of the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

Sediment Elevation

In the 1997 survey, eleven transect lines were established perpendicular to the crevasse channel, 500 ft (152 m) apart, and extended the entire length of the open water areas in the receiving bay (figure 8). Elevations were recorded at 500-ft intervals along each transect and at any significant change in elevation within those intervals. Post construction elevation was surveyed on October 16, 2001. In the 2001 survey, the same transect lines were used, but elevations were recorded at 200-ft intervals and at any significant change in elevation within those intervals. Elevations of the entire project area (open water and land) were collected during the 2001 survey.

In 1997, average sediment elevation (figures 9 and 13) of the receiving bay was –3.48 ft (-1.06 m) NAVD 88 and ranged from –6.75 ft (-2.06 m) to –1.85 ft (-0.56 m) NAVD 88. The deepest sections of the bay were near the northern boundary of the project area, whereas the southern-most end of the receiving bay was shallowest. In 2001, average sediment elevation was –0.37 ft (-0.11 m) and ranged from –11.81 ft (-3.60 m) to 1.12 ft (0.34 m) NAVD 88 (tables 1 and 2). In 2001, the deeper areas were located where channels are beginning to form in the center of the project area leading northward (figure 10). An ANOVA indicated that elevation of the receiving bay was significantly higher in 2001 than in 1997 ($P < 0.001$) (figures 10 and 11, and tables 1 and 2). Sediment elevations increased in most of the receiving bay between 1.64 ft (0.5 m) and 4.92 ft (1.5 m) (figure 12). Little change occurred near the center of the receiving bay, where channels appear to be forming.

MR-06 Channel Armor Gap Crevasse

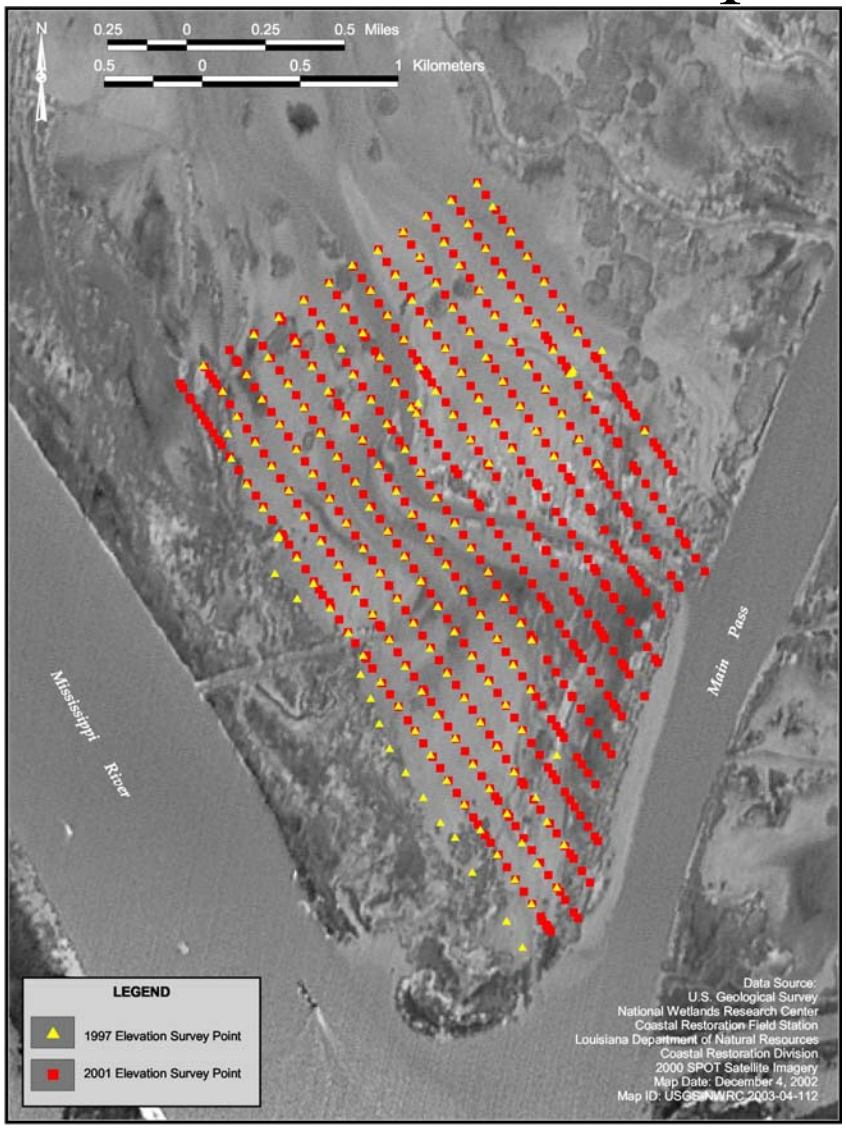

Figure 8. Schematic diagram of elevation sampling station locations in 1997 (yellow triangles) and 2001 (red squares) in the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

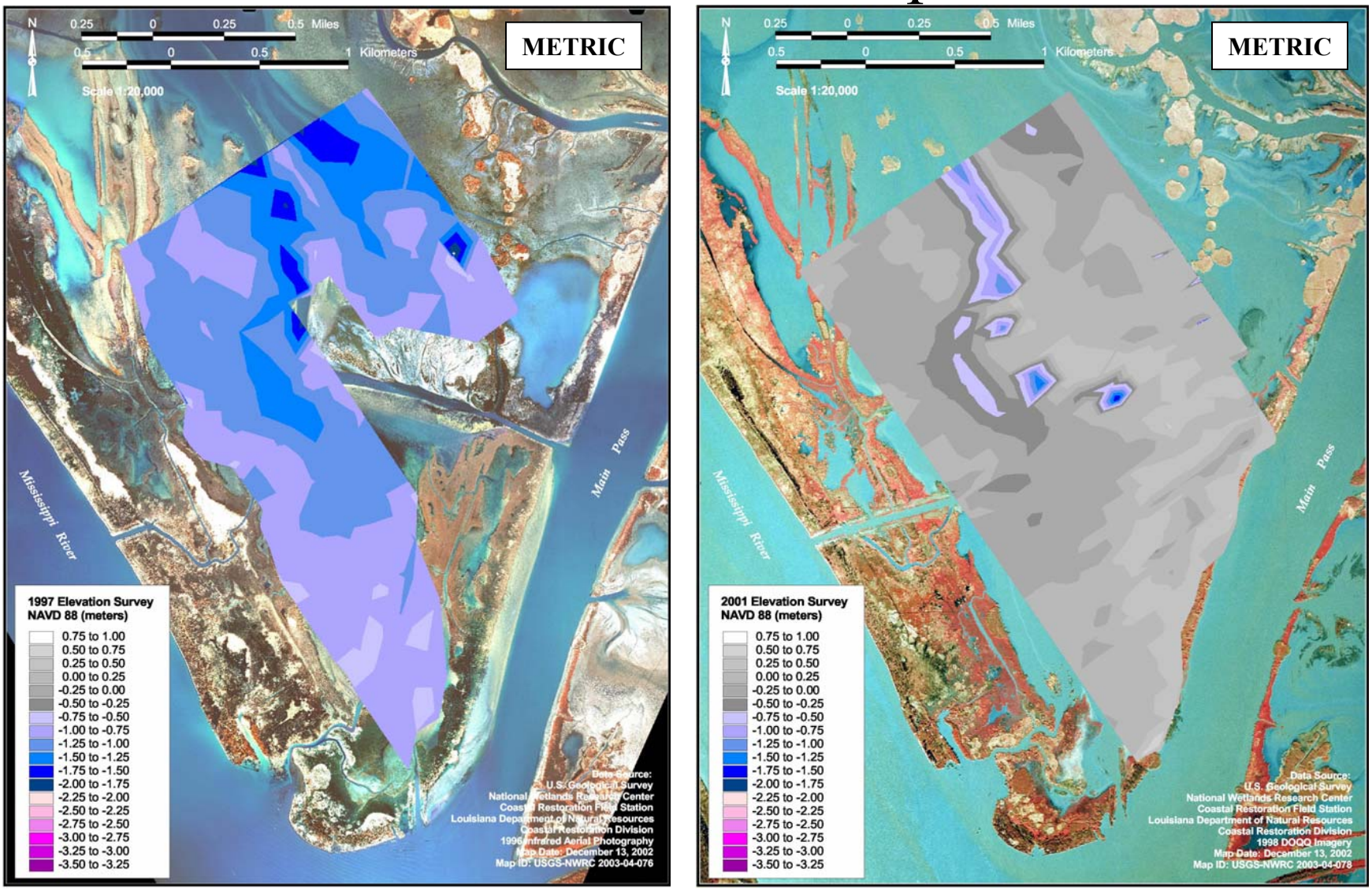

Figure 9. Sediment elevation within the receiving bay in 1997 (left) and 2001 (right) of the Channel Armor Gap Crevasse (MR-06) project.

MR-06 Channel Armor Gap Crevasse

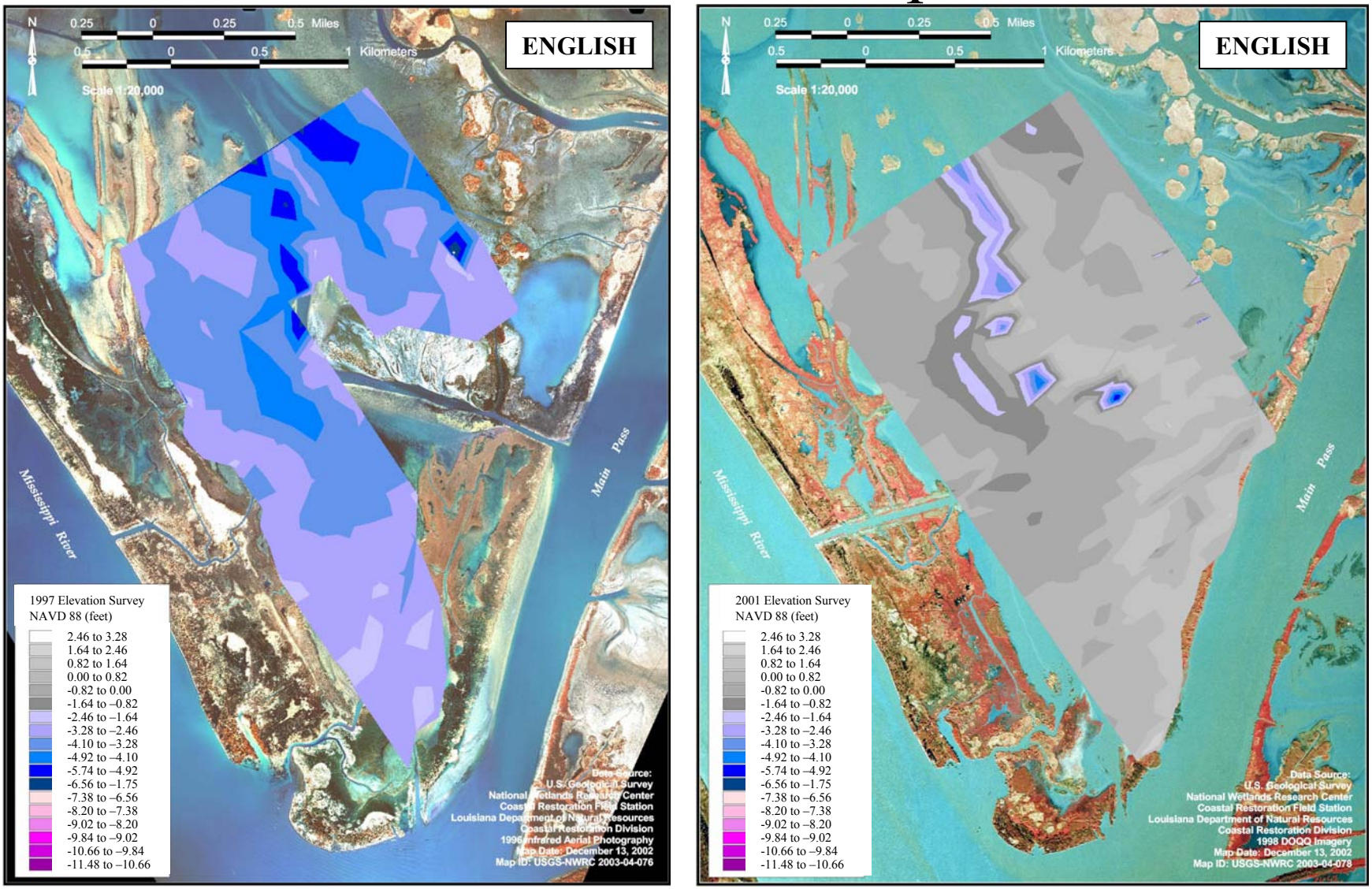

Figure 10. Sediment elevation within the receiving bay in 1997 (left) and 2001 (right) of the Channel Armor Gap Crevasse (MR-06) project.

MR-06 Channel Armor Gap Crevasse

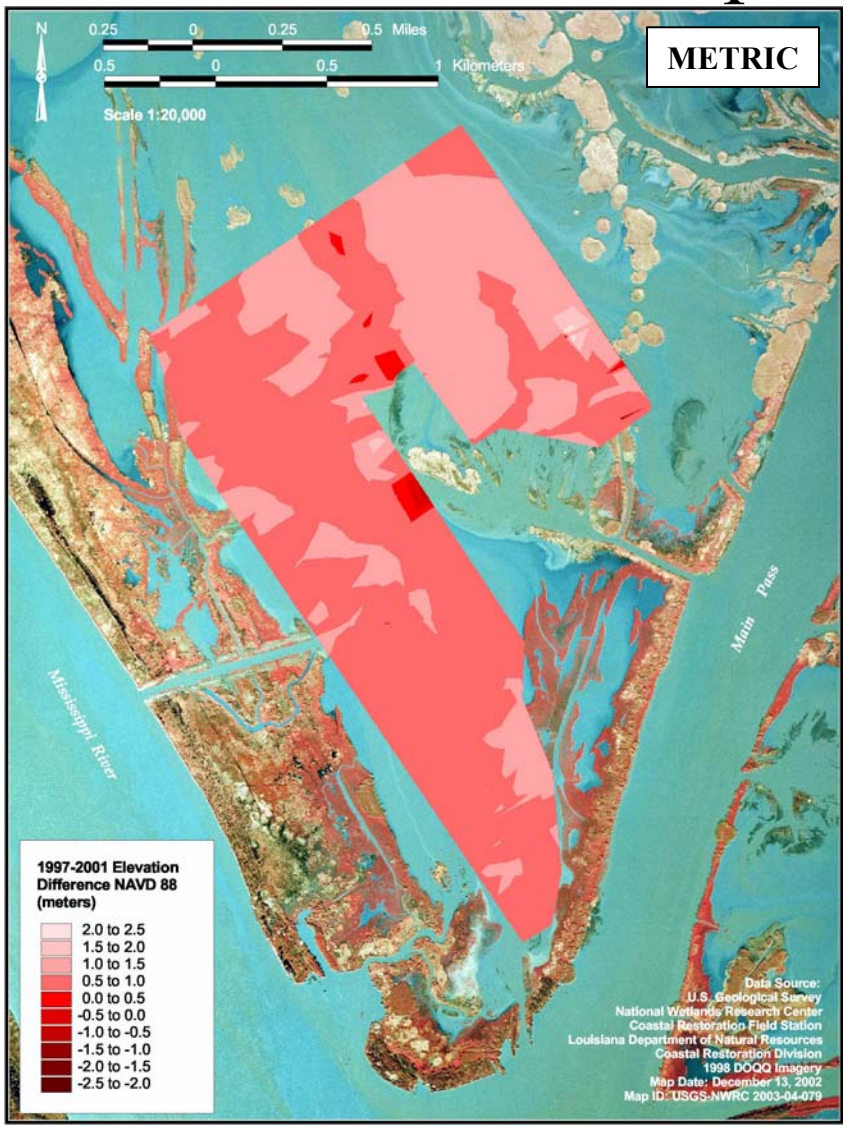

Figure 11. Sediment elevation change within the receiving basin between 1997 and 2001 in the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

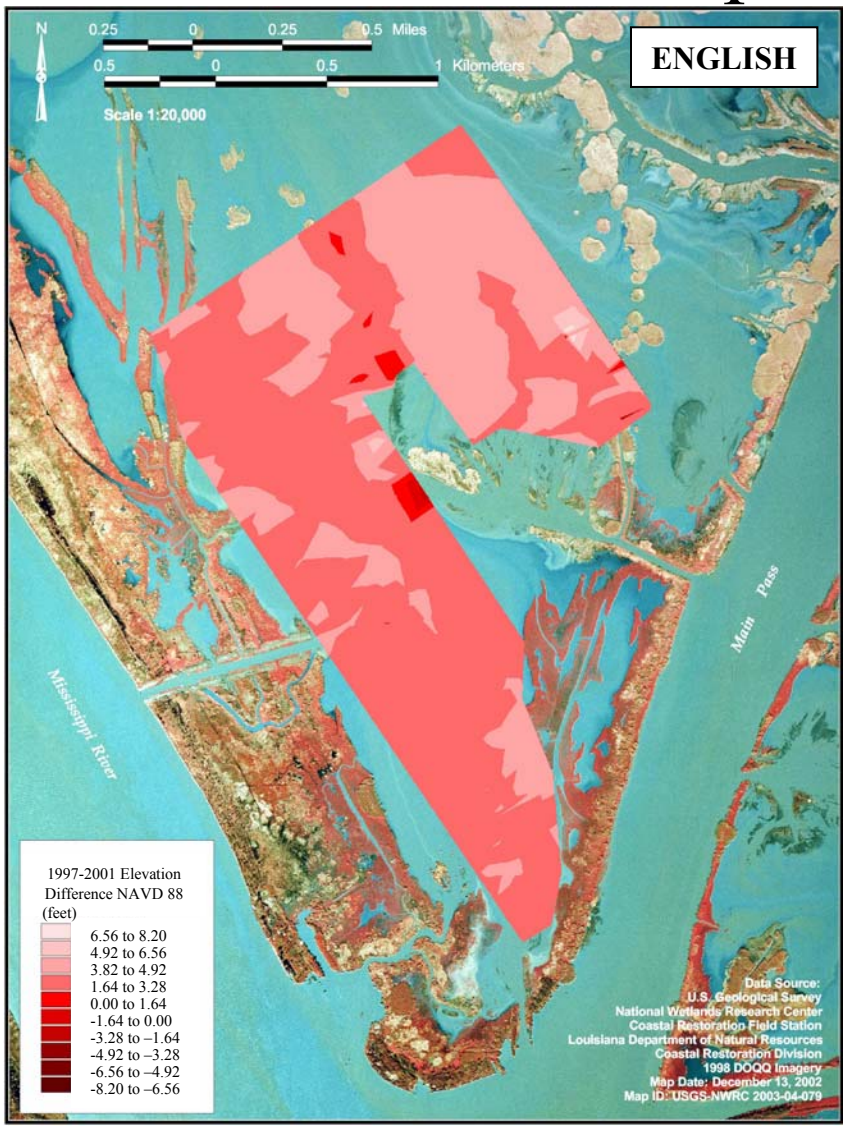

Figure 12. Sediment elevation change within the receiving basin between 1997 and 2001 in the Channel Armor Gap Crevasse (MR-06) project area.

MR-06 Channel Armor Gap Crevasse

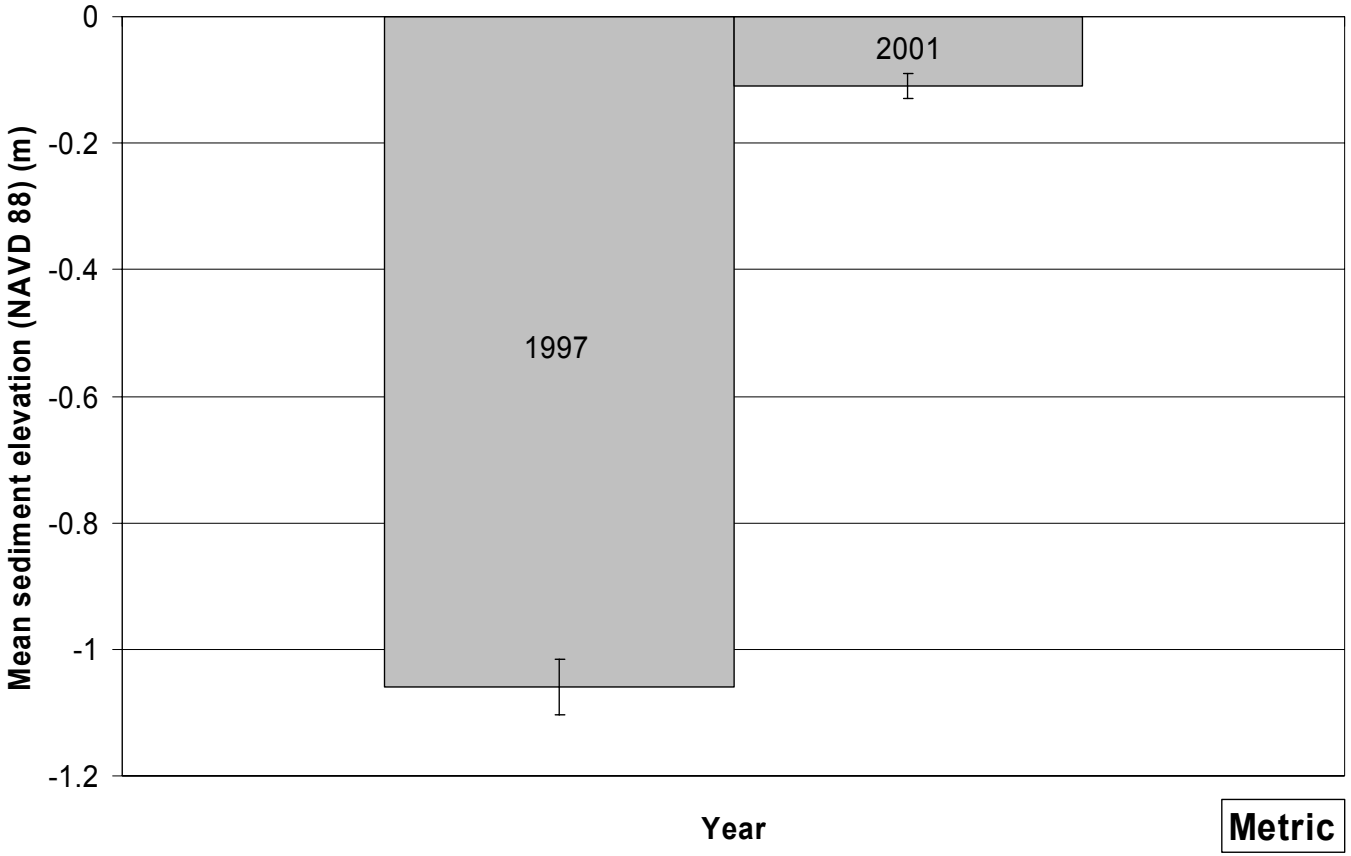

Figure 13. Mean sediment elevation (NAVD 88) in the project area in 1997 (preconstruction) and 2001 (postconstruction) stations that overlapped 1997 stations for the Channel Armor Gap Crevasse (MR-06) project

MR-06 Channel Armor Gap Crevasse

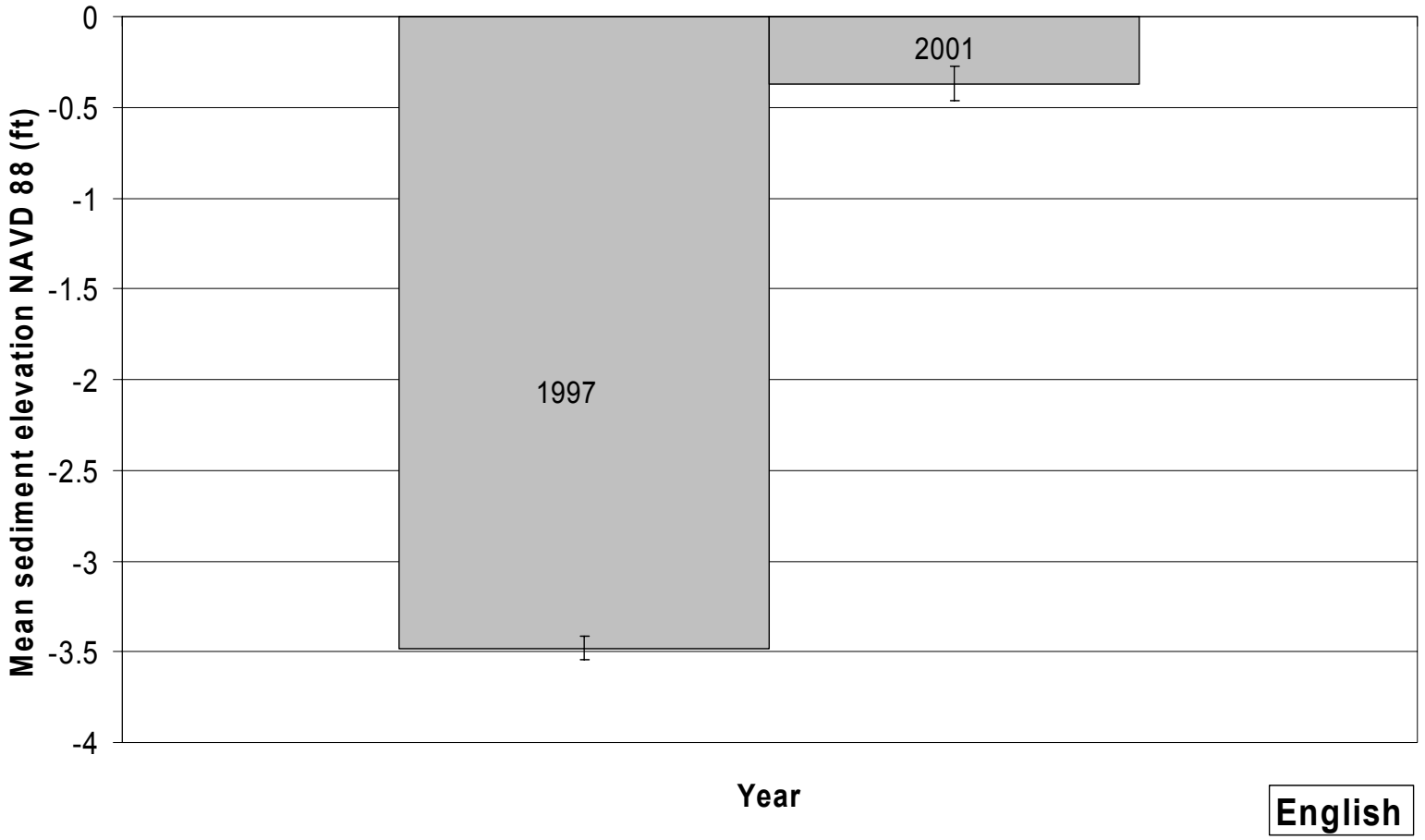

Figure 14. Mean sediment elevation (NAVD 88) in the project area in 1997 (preconstruction) and 2001 (postconstruction) stations that overlapped 1997 stations for the Channel Armor Gap Crevasse (MR-06) project.

MR-06 Channel Armor Gap Crevasse

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
1997 Sediment Elevation (ft)	195	-6.76	-1.84	-3.48	0.9
2001 Sediment Elevation (ft)	382	-11.81	1.12	-0.37	1.24

Paired Samples Test								
	Paired Differences							
	Mean Elevation (ft)	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
1997 - 2001	-3.220	1.610	0.120	-3.440	-2.990	-27.9	194	< 0.001

Table 1. T-test comparing overlapping 1997 and 2001 sediment elevations (ft).

English

MR-06 Channel Armor Gap Crevasse

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
1997 Sediment Elevation (m)	195	-2.06	-0.56	-1.06	0.28
2001 Sediment Elevation (m)	382	-3.60	0.34	-0.11	0.38

Paired Samples Test								
	Paired Differences							
	Mean Elevation (m)	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
1997 - 2001	-0.98	0.49	0.04	-1.05	-0.91	-27.91	194	< 0.001

Table 2. T-test comparing overlapping 1997 and 2001 sediment elevations (m).

Metric

MR-06 Channel Armor Gap Crevasse

Vegetation

During 2001, subaerial land formed adjacent to the end of the crevasse channel. Thus, the first two vegetation stations were established on October 17, 2001. Station MR06-0101, located on the southeast side of the crevasse channel, had 75 % coverage of *Sagittaria lancifolia* (bull tongue) that had an average height of 1.0 foot (30.5 cm). Station MR06-0102, located on the northwest side of the crevasse channel, had 60 % coverage of *Sagittaria lancifolia* that had an average height of 1.0 foot (30.5 cm).

During the 2002 survey, no subaerial land or emergent vegetation was observed in the receiving basin. Mississippi River water level was higher than in the 2001 survey. In addition, two tropical systems, Tropical Storm Isidore and Hurricane Lili, passed through southern Louisiana in late September and early October of 2002. The combination of high water and the high wind and wave energy from the storms may have eroded vegetation and sediment away from the previously established stations.

MR-06 Channel Armor Gap Crevasse

Preliminary Findings

Habitat Mapping

- Comparison of the 1996 and 2001 habitat analyses showed little change.
- This crevasse is still in the beginning of the progradational phase of development, which is characterized by subaqueous infilling of the receiving bay and establishment of major flow channels.

Sediment Elevation

- Sediment elevation in the receiving bay was significantly higher in the 2001 survey than in 1997.
- Subaerial land is expected to form in the receiving bay as elevation continues to increase.

MR-06 Channel Armor Gap Crevasse

Preliminary Findings

Vegetation

- The only species present at the new stations was *Sagittaria lancifolia*, which is known to colonize newly formed mud flats in the Mississippi River Delta.
- Vegetation plots and previously existing subaerial land were likely eroded during Hurricane Lily and Tropical Storm Isodore. This accounts for absence of land or vegetation in 2002.
- As sediment elevations increase and new land is formed, emergent vegetation coverage is expected to increase.