State of Louisiana
Department of Natural Resources
Coastal Restoration Division and
Coastal Engineering Division

2007 Operations, Maintenance, and Monitoring Report

for

LAKE CHAPEAU SEDIMENT INPUT AND HYDROLOGIC RESTORATION, POINT AU FER ISLAND

State Project Number TE-26
Priority Project List 3

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Terrebonne Parish

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2007 Operations, Maintenance, and Monitoring Report
for
Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26)

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I. Introduction

This comprehensive report presents operations, maintenance, and monitoring data for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project. This is a 20-year Coastal Wetlands, Planning, Protection, and Restoration Act (CWPPRA, Public Law 101-646, Title III) project administered by the National Marine Fisheries Service (NMFS) and the Louisiana Department of Natural Resources (LDNR). The project area contains 9,006 ac (3,645 ha) of brackish to intermediate marsh plus 4,543 ac (1,839 ha) of open water (NMFS 1994). This project, located on Point Au Fer Island, is bound to the northwest by Atchafalaya Bay, to the northeast by Four League Bay, and to the south by the Gulf of Mexico. It is located approximately 13 mi (20.9 km) southeast of the mouth of the Atchafalaya River in Terrebonne Parish (figure 1).

Marsh loss rates throughout Point Au Fer Island between 1932 and 1974 peaked at 45.45 ac/year (18.4 ha/yr) and occurred as a direct result of oil exploration activities (NMFS 1994). The rate of interior marsh loss has decreased since that time and is currently estimated to be 20.14 ac/yr (8.15 ha/yr) (1983-1990). Shoreline erosion along Lake Chapeau was estimated to be 3 ft/yr (0.91 m/yr) between 1932 and 1983. The land loss rate inside the TE-26 project boundary was approximately 106.9 ac/yr (43.3 ha/yr) between 1988 and 2000 (NMFS 1994). Oil and gas access canals cut into the interior of Point Au Fer Island have deteriorated the hydrologic separation between the Locust Bayou and Alligator Bayou watersheds and dramatically altered the island's natural drainage pattern (NMFS 1994). Sheet flow and over bank flow were drastically reduced by artificial levees, which in turn impounded marsh and led to degradation due to soil water logging. Due to unnatural hydrologic patterns the abundant sediment load generated by the Atchafalaya River circulating through the island's interior have not been effectively utilized. Additional assumed causes of land loss have been attributed to natural subsidence and natural shoreline erosion.

The objectives of the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project are to 1) convert approximately 168 ac (105 ha) of open water to marsh at final elevation of 0.5 ft (0.15 m) National Geodetic Vertical Datum of 1929 (NGVD29) or 0.346 ft (0.105 m) North American Vertical Datum of 1988 (NAVD88) west of Lake Chapeau between the Locust Bayou and Alligator Bayou watersheds using sediment mined from Atchafalaya Bay, and 2) restore natural sediment and hydrologic pathways by plugging canals in the project area. By plugging man-made canals the inland marshes would be preserved and protected from marine influences while reestablishing the original hydrologic regime (NMFS 1998). Creating marsh north and west of Lake Chapeau would reestablish the hydrologic separation of the Locust Bayou and Alligator Bayou watersheds.

Construction for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project began on September 14, 1998, and was completed on May 18, 1999. The project has a 20-year economic life which began in May 1999.

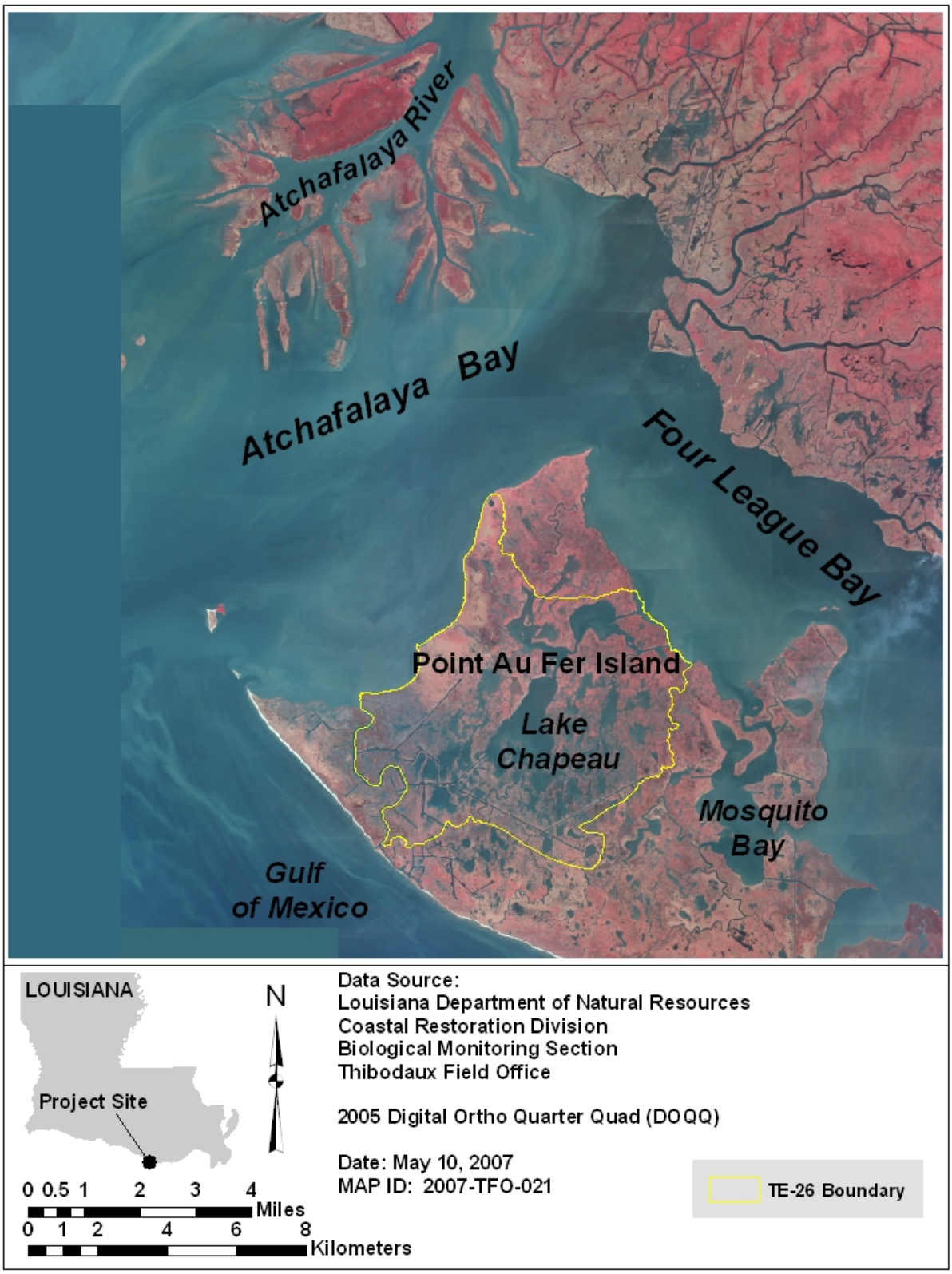

Figure 1. Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project location map.

The principal project features constructed include (figures 2-3):

- Dredging approximately 78 ac (32 ha) of Atchafalaya Bay water bottom to approximately -10.9 ft (-3.3 m) National Geodetic Vertical Datum of 1929 (NGVD29) or -11.1 ft (-3.4 m) North American Vertical Datum of 1988 (NAVD88) and pumping the 721,931 yd^3 (551,956 m^3) of sediment into a containment area approximately 193.6 ac (78 ha) in size to an initial target elevation of +1.5 ft (0.46 m) NGVD29 or 1.3 ft (0.40 m) NAVD88, with a final target elevation of 0.5 ft (0.15 m) NGVD29 or 0.346 ft (0.105 m) NAVD88 after consolidation.
- Construction of seven rock weirs across manmade oil access canals located along the fringes of the project area. Six of the weirs were built to a top elevation of -0.00 ft (0.0 m) NGVD29 or -0.15 ft (-0.05 m) NAVD88 with a crest width of 10 ft (3.0 m). One of the weirs included a boat bay constructed to an elevation of -4.0 ft (-1.2 m) NGVD29 or -4.17 ft (-1.27 m) NAVD88 with a fixed crest elevation of 0.0 ft (0.0 m) NGVD29 or -0.17 ft (-0.05 m) NAVD88. All of the weirs were constructed with a core of reef shell wrapped in a geotextile woven fabric layer, and then topped with 2 ft (0.61 m) of 250 lb (113.3 kg) class rock rip rap.
- Construction of a 167 ft (60 m) rock plug with a crest height of 5 ft (1.5 m) NGVD29 or 4.8 ft (1.5 m) NAVD88 along a shoreline breach created by the dredge pipeline. The plug was built from 250 lb (113.3 kg) class rock rip rap core placed on top of a geotextile fabric layer.
- Dredging approximately 6,400 linear ft (1951 m) of Locust Bayou to a bottom elevation of -4.2 ft (-1.3 m) NGVD29 or -4.4 ft (-1.3 m) NAVD88 with an average width of 70 ft (21 m). Several 25 ft (7.62 m) gaps were cut into the spoil banks to allow for natural bank overflow and high water events.
- Note: All elevation conversions from NGVD29 to NAVD88 were calculated using Corpscon 6.0.

The following project feature was not part of the original project design but was added in May 1999, one growing season after dredge material placement, because of low natural recruitment of vegetation from the marshes surrounding the fill area:

- Installation of 46,980 vegetative plugs of *Spartina alterniflora* Loisel. (smooth cordgrass) throughout the fill area, placed on 5 ft (1.5 m) center spacings along randomly located paired rows also spaced 5 ft (1.5 m) apart (Coastal Environments 2000).

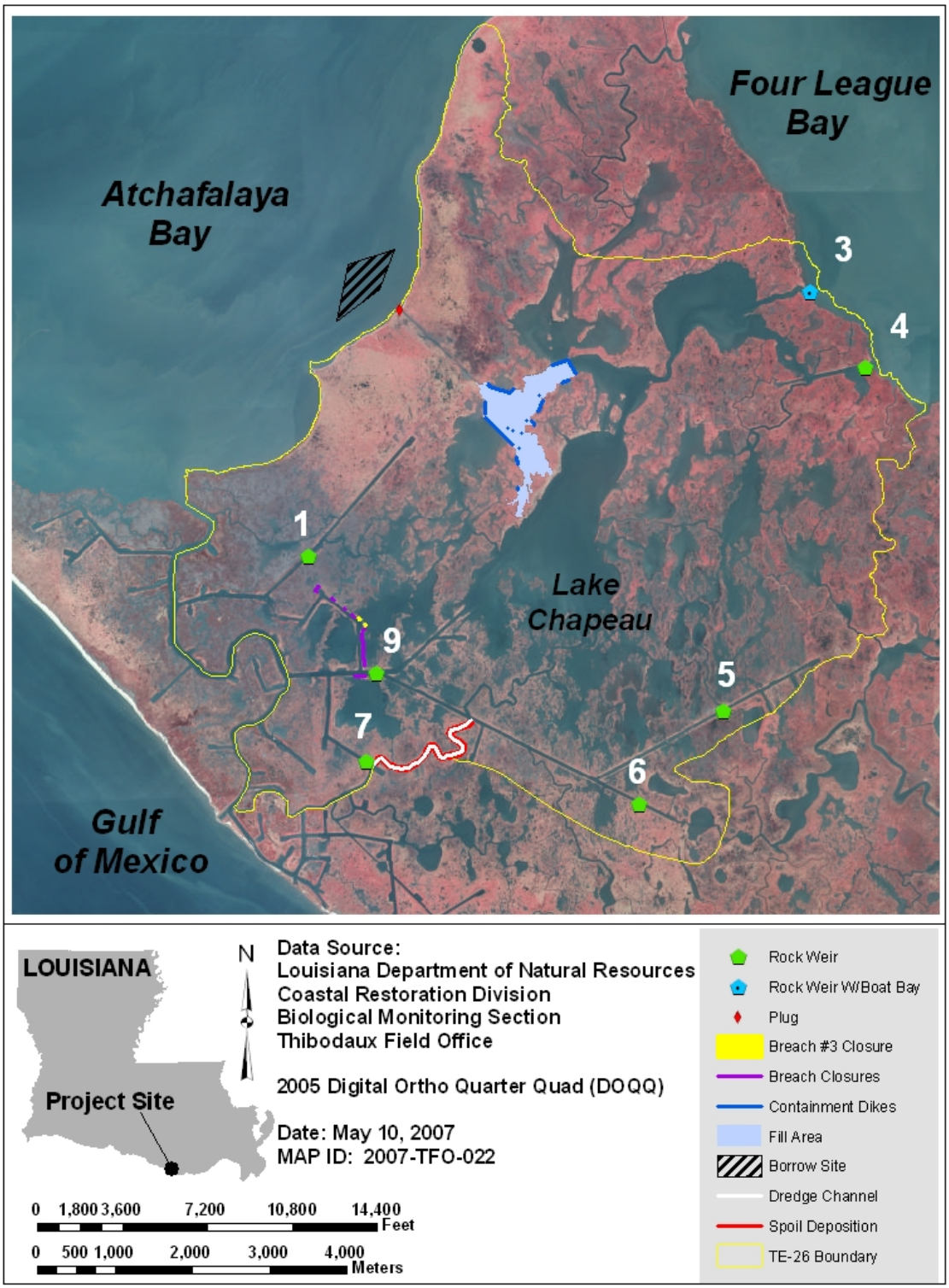

Figure 2. Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project boundary and features.

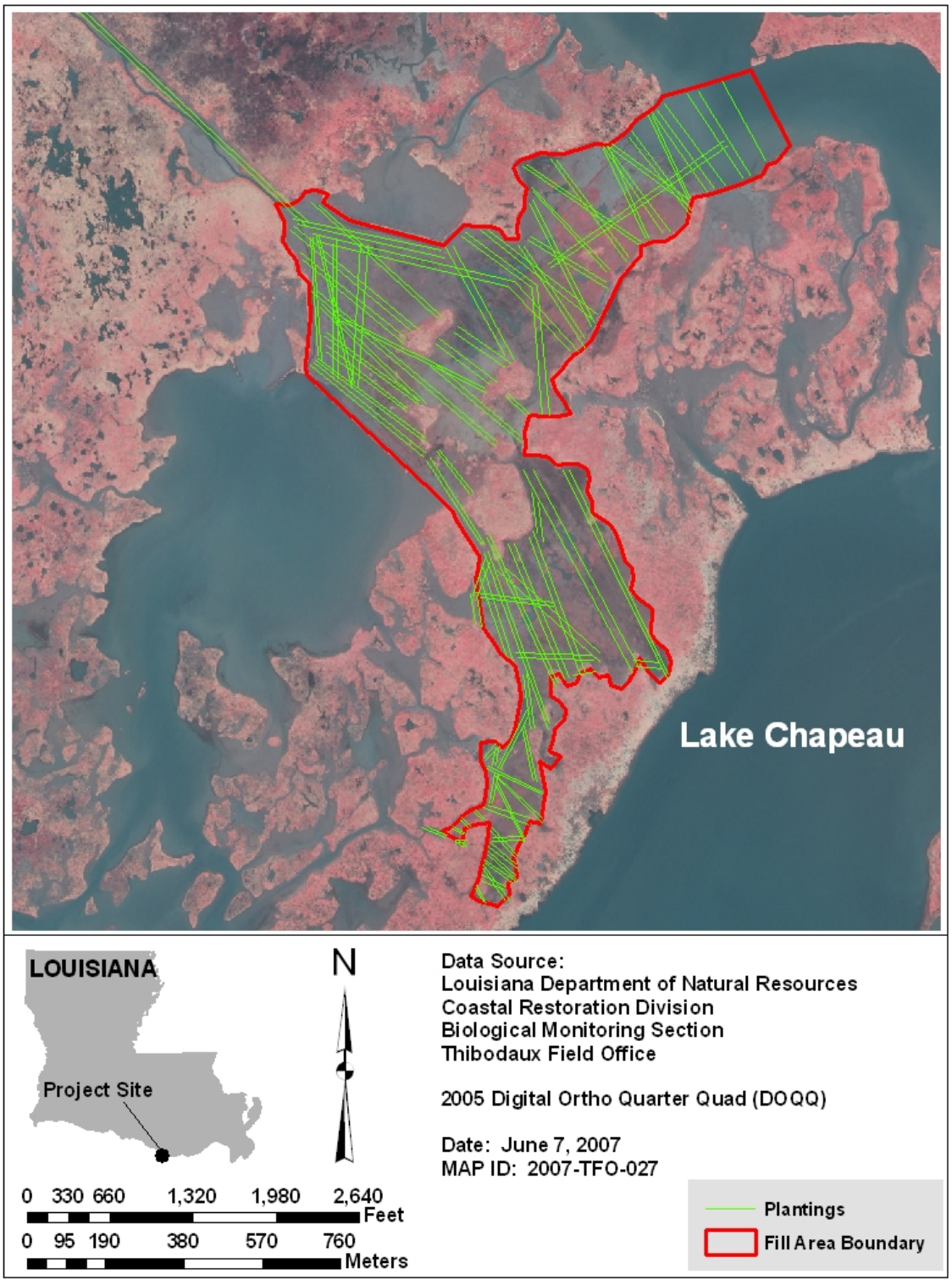

Figure 3. Location map indicating as-built plantings of *Spartina alterniflora* on the dredge material fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, construction, and contingencies and an assessment of the urgency of such repairs (LDNR/Coastal Restoration Division [CRD], Pyburn and Odom, Inc. 2002). The annual inspection report also contains a summary of maintenance projects which were completed since completion of constructed project features and an estimated projected budget for the upcoming three (3) years for operation, maintenance, and rehabilitation. Inspection photos and the three (3) year projected operation and maintenance budget for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island project are shown in Appendix A and B, respectively. A summary of past operation and maintenance projects completed since the completion of the Lake Chapeau Project is outlined in section II.c.

The annual inspection of the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project took place on February 7, 2007. The inspection included the interior weir structures 1, 3, 4, 5, 6, 7, and 9 (figure 2). Due to extremely low water levels, the rock plug along the shoreline of Atchafalaya Bay near the corridor to the marsh creation feature of the project was not included in the inspection. In attendance were Shane Triche, Brian Babin, and Elaine Lear from LDNR. Cheryl Brodnax with the NMFS and Allan Ensminger with Wetlands and Wildlife Management Co. were notified of the inspection but were unable to attend due to prior commitments. All parties met at Bob's Marina in Bayou Black, Louisiana. The weather conditions included clear skies and mild temperatures with some moderate winds. The annual inspection began at approximately 9:30 a.m. at rock plug site 1, continued through the remaining interior rock plug sites, and ended at 2:30 p.m. on the west bank of Four League Bay near structure No. 4.

The field inspection included a complete visual inspection of the hydrologic restoration features of the project. The interior marsh creation feature of the project was not inspected due to the remote location and difficulty accessing this area. Due to the recent construction of the timber barricade system preventing access to the rock weirs (Structures 1, 3, 5, 6, 7, and 9), the depth of water above the crest was not measured. Where available, staff gauge readings were used to determine water elevations at the time of the inspection. Field inspection notes were completed in the field to record measurements and deficiencies (Appendix C).

b. History and Project Description

The final design of the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project consisted of three (3) components, with additional project features added to address problems encountered during and after construction:

1. To re-establish a land bridge between Locust Bayou and Alligator Bayou, the first component was to hydraulically dredge approximately 721,931 cubic yards of material from the Atchafalaya Bay and spread to an average of two (2) feet to create approximately 168 acres of marsh between these two bayous (D. Burkholder, Final Report n.d.).

2. The second component of the project (hydrologic restoration) consisted of the construction of seven (7) rock plugs in manmade canals around the perimeter of Lake Chapeau and gapping existing spoil banks in one channel. The plugs and gapping are designed to help restore the natural circulation and drainage pattern with the central portion of Point Au Fer Island (D. Burkholder, Final Report n.d.). The principle project features of this component are:

    - Structure No. 1 – Rock weir – 150 linear feet (LF)
    - Structure No. 3 – Rock weir – 229 LF
    - Structure No. 4 – Rock weir – 174 LF
    - Structure No. 5 – Rock weir – 70 LF
    - Structure No. 6 – Rock weir – 145 LF
    - Structure No. 7 – Rock weir – 157 LF
    - Structure No. 9 – Rock weir – 240 LF

3. The third component of the project consisted of dredging a 6,700 foot long silted section of Locust Bayou. This was done to accommodate the increased flows resulting from the re-establishment of the island's natural drainage patterns. A total of 59,218 cubic yards (CY) of material was dredged and placed in 1.5 ft high by 80 ft wide spoil banks on both sides of the bayou. The spoil banks were gapped periodically so as not to impede the flow of natural waterways and drainage (D. Burkholder, Final Report n.d.)

Engineering, design, and construction administration for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project was performed by Burk-Kleinpeter (BKI) of New Orleans, La., under contract to the LDNR. BKI utilized two subcontractors during the design phase of the project. T. Baker Smith, Inc. of Houma, La., performed the field surveys and Eustice Engineering Company, Inc. of Metairie, La., performed the geotechnical investigation of the weir sites. The sediment coring and geotechnical analysis of the borrow site in the Atchafalaya Bay were performed by C-K Associates, Inc. of Baton Rouge, La., and were completed through an indefinite delivery

contract with NMFS. Landrights necessary for construction of the project were obtained by the LDNR and included servitude agreements with three (3) landowners: Point au Fer LLC/Archdiocese of New Orleans; Terrebonne Parish School Board; and the Louisiana Department of Wildlife and Fisheries. A letter of no objection was also obtained from the Louisiana State Lands Office for the dredging and placement of spoil material on state lands (D. Burkholder, Final Report n.d.).

Below is a timeline of significant events:

September 1995	Engineering design activities began.
September 1996	Preliminary design report and deliverables submitted by BKI.
June 1997	Final design completed.
April 1998	All landrights necessary to proceed with construction completed.
June 1998	Advertising for bids.
July 1998	Bids for construction opened.
September 1998	Notice to proceed with construction issued to River Road Construction.
January 1999	Breach 3 repaired/ safety buoy installed (Change Order).
May 1999	Construction completed.
October 1999	Notice of acceptance issued by LDNR.

Several problems were encountered during the design and construction phase of the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project which required remedial action and resulted in delays in the project.

1. Landrights acquisition was hampered by a title dispute that developed after completion of the preliminary design phase of the project. Portions of the dredge fill area west of Lake Chapeau were claimed by both the Louisiana State Lands Office and Point au Fer LLC/Archdiocese of New Orleans. After extensive negotiations during the period of November 1996 through April 1998, LDNR was successful in executing a servitude agreement with the land owner and a letter of no objection with the State Lands Office. Both of these instruments included language reservation rights which would allow the project to go forward without prejudice to any party should they decide to assert their claim at some future time (D. Burkholder, Final Report n.d.).

2. When installation of the seven (7) weirs was completed in November 1998, a wetlands consultant employed by the landowners of Point au Fer Island contacted LDNR and NMFS regarding the deterioration of spoil banks in one of the existing channels located southwest of Lake Chapeau. Concerns were raised that breaches in the spoil bank might reduce the effectiveness of the plugs. Initial attempts made to close the breach were unsuccessful, at which time LDNR contracted BKI to develop a scope to include a rock plug repair of the major breach and dredge material to close the minor breaches (Breach 3 Construction). The repairs of Breach 3 were completed by River Road Construction in January 1999 under change order to their construction contract.

This change order also included the installation of safety warning buoys at six (6) of the seven (7) rock weirs (D. Burkholder, Final Report n.d.).

3. Observations during the final inspection in May 1999 raised several concerns. First, the dredge discharge pipeline corridor was found to be in unsatisfactory condition and in need of repair. The marsh buggy transit during construction had damaged the existing vegetation and formed a tidal channel connecting the interior of the island to the Atchafalaya Bay, washing away the shell ridge along the shoreline. Second, very little vegetation growth was present on the dredge fill area. Lastly, an additional spoil bank breach was found to have occurred near the previous repairs (Breach 3) (D. Burkholder, Final Report n.d.).

4. While there was disagreement between LDNR and BKI regarding who was responsible for the repairs needed to the dredge discharge pipeline corridor, it was felt that immediate action was necessary to prevent tidal flows from eroding the newly placed fill material, which was still very soft at the time. BKI was authorized by LDNR to prepare a scope of work for a rip rap plug along the shoreline at the end of the pipeline corridor. This repair work was completed by River Road Construction in August 1999 under a second change order to their construction contract (D. Burkholder, Final Report n.d.).

5. At the request of NMFS, plans and specifications for vegetative plantings were prepared by LDNR Engineering Section to vegetate the fill area of Lake Chapeau. Bids were opened in September 1999 and a contract was awarded to Coastal Environments, Inc. (CEI) of Baton Rouge, La. Plantings began in April 2000 and a final inspection was held in May 2000. A total of 46,980 smooth cordgrass plugs were planted. Construction oversight for the planting contractor was provided by Morris P. Hebert, Inc. of Houma, La., under contract to LDNR. A Notice of Acceptance was issued by LDNR to CEI in June 2000 (D. Burkholder, Final Report n.d.).

6. Plans and specifications to repair the additional spoil bank erosion (Breach 3) were also prepared by LDNR Engineering Section. This work was included in Phase II of the Point Au Fer Island (TE-22) Phase III bid package and advertised for bids. The contract for this work was awarded to Johnny F. Smith Trucking & Dragline Service, Inc. of Slidell, La., in November 1999. Construction of a stone weir (Breach 3) and bucket dredging to repair five (5) separate breaches were completed by Johnny F. Smith Trucking and Dragline Service, Inc. and a final inspection was held in June 2000. Construction oversight for this work was provided by Picciolla and Associates, Inc. of CutOff, La., under contract to LDNR. The Notice of Acceptance was issued to the contractor in September 2000 (D. Burkholder, Final Report n.d.).

c. Summary of Past Operation and Maintenance Projects

Below is a summary of completed maintenance projects and operation tasks performed since October 1999, the Notice of Acceptance date for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

June 2000 – Repair of spoil bank breach by constructing a rock weir (breach 3) and the repair and maintenance of five spoil bank areas by bucket dredging material in a canal located southwest of Lake Chapeau just west of plug Site No. 9. This work was performed by Johnny F. Smith Truck & Dragline Service, Inc. of Slidell, La., as part of the Point Au Fer Project (TE-22) Phase III construction contract. Notice of Acceptance for this work was issued by LDNR in September 2000.

October 2004 – Maintenance project consisted of removal and replacement of existing warning buoy system with a more rigid timber barricade system at structures 1, 4, 5, 6, 7, and 9. The timber barricade system included timber piles driven every 20 ft across the canal with 4" diameter horizontal piping connecting the vertical timber piling. Each structure was marked with warning signs and reflective tape to assure visibility at night. The project was designed by Piciolla and Associates of Larose, La., and constructed by Dupre Brothers Construction Co., Inc. of Houma, La. The project was completed in October 2004 at a total cost of $330,745.50 (Includes: engineering, design, bidding, construction administration, inspection, and construction).

September 2005 – Repair of breach along the south side of Structure No. 3 by adding approximately 50 linear feet of rock rip rap to the south side of the structure along with articulated concrete mats under a geotextile fabric to slow future marsh erosion and breaching. This work was performed in conjunction with maintenance work on the Point Au Fer Project (TE-22), which consisted of breach closures adjacent to the rock dikes along Mobil and Transco Canals and extension of the bulkhead at Structure No. 8. This work was performed by Luhr Bros., Inc. with construction oversight services provided by Picciolla and Associates, Inc. of Larose.

d. Inspection Results

<u>Rock Weir – Dredge Discharge Pipeline Corridor at the Atchafalaya Bay Shoreline</u>

Due to extremely low water levels on the day of the inspection, the inspection party was unable to navigate close enough to this structure to perform a thorough inspection. However, LDNR, NMFS, and the landowners are aware of the breach along the shoreline at the corridor entrance to the Lake Chapeau fill area and corrective action is currently underway. LDNR/Coastal Engineering Division (CED) Design Section has prepared plans and specifications for a small dedicated dredge project directly adjacent to the existing fill area to construct approximately 50 acres of marsh. Included in the design of this proposed project are provisions to fill the existing corridor and plug the breach along the shoreline to prevent tidal

influence through the corridor to the fill areas. This project is scheduled for bidding in late spring and construction is expected to begin in the summer 2007.

Structure No. 1 – Rock Weir

Overall, the rock weir and tie-ins to the earthen embankments appeared to be in good condition with no apparent erosion of the tie-ins to the canal banks (Appendix A; Photos 1-3). The warning signs and timber pile barricade system appeared to be in good condition. No maintenance will be required at this site. The existing water gauge located near this site (TE-26-03) indicated that the water level at 9:45 a.m. was approximately -0.10 ft NAVD88. Due to the location of the barricade system, we were unable to approach the structure to determine the depth of water above the weir. The latest field data available on the elevation of the rock weir was collected from a survey performed by Acadian Engineers of Eunice, La., in June 2004. The average elevation of the weir was determined to be -1.53 ft NAVD88. The design elevation for Site No.1, as shown on the construction drawings, is 0.0 ft NGVD29 or -0.14 ft NAVD88 (Corpscon conversion). Therefore, the difference in elevation observed in the field and the designed height is -1.39 ft. Since no as-built drawings were produced following construction, the design elevation was used for comparison.

Structure No. 3 – Rock Weir with Boat Bay

The rock weir was found to be in fair condition with no obvious settlement or displacement of the rock rip rap. The earthen embankment tie-ins, however, were in poor condition with moderate to severe erosion on the northern end of the rock embankment (Appendix A; Photos 4 through 8). The marsh in this area has eroded back to the face of the rock embankment, leaving the potential for a breach to occur around the structure as erosion persists. The marsh on the south side of the structure has also experienced significant erosion, although not as severe as the north side. Based on our observations, it is highly probable that the north side of the structure will breach within the coming year and will require maintenance. The warning signs and supports were in good condition other than slight fading of the orange trim and black lettering. Since this is a rock weir with boat bay, no barricade system exists. It is recommended that the rock embankment be extended northward to an area of more stable marsh. From the maintenance survey performed in June 2004, the elevation of the weir at Structure No. 3 was measured at -5.15 ft NAVD with the original design height of the crest at -4.17 NAVD (-4.0 ft NGVD on plans). The difference between the weir elevation measured in 2004 and the design elevation is approximately -0.98 ft.

Structure No. 4 – Rock Weir

The rock weir appeared to be in good condition (Appendix A; Photos 9 and 10). The rock tie-ins, earthen embankments, timber barricade system, signs, and supports were also in good condition. As reported on previous inspections, the two (2) center pilings installed under the timber barricade project on the eastern side of the structure were found to be unstable. LDNR will continue to monitor the stability of these pilings. The average elevation of the rock weir was determined to be approximately -1.29 ft NAVD88 from a survey perform in 2004 profiling the structure. With a design elevation of -0.16 NAVD88 (converted using Corpscon), it was determined that the structure had settled approximately 1.13 ft NAVD88 from the original design elevation.

Structure No. 5 – Rock Weir

Rock weir, tie-ins, earthen embankments, barricade system, warning signs, and supports all appeared to be in good condition (Appendix A; Photos 11 through 13). The water level in the channel adjacent to the structure was very low at the time of the inspection, with a portion of the rock weir exposed. In 2004, a profile survey indicated that the average elevation of the rock weir was approximately -0.28 ft NAVD88. It was estimated, based on the design elevation of -0.14 ft, that the structure had settled an average of 0.14 ft. Since no as-built survey was conducted, it is assumed that the rock weir was constructed to the design elevation on the plans.

Structure No. 6 – Rock Weir

Rock weir, tie-ins, earthen embankments, barricade system, signs, and supports were in good condition with no obvious damage or deficiencies (Appendix A; Photos 14 through 16). The rock weir was designed to an elevation of 0.0 ft. NGVD29 (-0.13 ft NAVD88 – Corpscon conversion). From the 2004 survey profile, it was determined that the average elevation of the rock weir was at an elevation of -1.25 ft NAVD88. The difference between the design elevation and measured elevation indicates an average settlement of approximately 1.12 ft.

Structure No. 7 – Rock Weir

The rock tie-ins, earthen embankments, timber barricade system, and signs and supports at Structure No. 7 were all in good condition with no apparent damage or breaching of earthen tie-ins (Appendix A; Photos 17 through 19). The survey profile of the rock weir taken in 2004 indicated that the average elevation of the weir was determined to be -1.80 ft NAVD88. The design weir elevation as shown on the construction drawings was 0.0 ft NGVD29 or -0.14 ft NAVD88 using the Corpscon conversion. It is estimated that the weir had settled approximately 1.66 ft by the difference in the design elevation and the measured height.

Structure No. 9 – Rock Weir

The rock tie-ins, earthen embankments, timber barricade system, signs and supports at structure No. 9 appeared to be in good condition (Appendix A; Photos 20 through 22). The 2004 profile survey of this structure measured an average elevation of -1.80 ft NAVD88. The design weir elevation for Structure No. 9 was -0.14 ft NAVD88 (0.0 ft NGVD29 on plans). The difference between the weir elevation observed in the field and the design elevation is approximately 1.66 ft.

Topographic and Bathymetric Surveys

As outlined in the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) Project Monitoring Plan, a topographic and bathymetric survey was performed by Acadian Engineers and Environmental Consultants, Inc. in 2004. This field survey encompassed the original borrow area, the fill area, and the Locust Bayou dredge area. The elevation data from the topographic and bathymetric as-built surveys collected by River Road Construction, the contractor responsible for constructing the project, were adjusted to the post-construction survey taken in 2004 by Acadian Engineers. The data was entered into Arcmap where grids were created for the borrow area, fill area, and the Locust Bayou dredge channel. A comparison summary of as-built elevation data and the 2004 post-construction survey are shown in Appendix D.

e. Maintenance Recommendations

i. Immediate/Emergency

As outlined in the inspection results section, the marsh on the northern end of Structure No. 3 has eroded back to the face of the rock embankment and is in danger of breaching in the near future. Based on our observations and knowledge of erosion problems in this area, we recommend that a maintenance plan be initiated for the extension of the rock dike northward to more stable marsh. In Appendix B, LDNR has prepared a cost estimate for this work, including engineering, design, construction, and construction oversight services.

Although survey profile data collected in 2004 indicates a varying degree of settlement (0.14 ft to 1.66 ft) of the rock weirs, there is insufficient monitoring data to conclude that the subsidence of the weirs is having a negative impact on the overall effectiveness of the project. Therefore, based on the uncertain impacts related to the subsidence of the rock weirs, we are not proposing corrective actions to raise the fixed crest weirs to their original design height at this time.

ii. Programmatic/Routine

Currently, we do not have any proposed programmatic or routine maintenance concerns. However, we do recommend that secondary monuments be adjusted or replaced should it be determined that coordinates are incorrect due to subsidence or physical damage.

III. Operation Activity

The Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project does not contain any features which require active operations.

IV. Monitoring Activity

a. Monitoring Goals

The objectives of the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project are to convert approximately 168 ac* (67.98 ha) of open water to marsh at a mean elevation of 0.5 ft (0.15 m) National Geodetic Vertical Datum of 1929 (NGVD29) or 0.346 ft (0.105 m) North American Vertical Datum of 1988 (NAVD88) west of Lake Chapeau between the Locust Bayou and Alligator Bayou watersheds using sediment mined from Atchafalaya Bay, and to restore natural sediment and hydrologic pathways by plugging canals in the project area.

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

1. Create approximately 168 ac (67.98 ha) of marsh west of Lake Chapeau.
2. Decrease the water level variability within the project area.

* The monitoring plan (Lear 2003) states a goal of 168 ac (67.98 ha) of marsh creation; however, the polygon built for analyzing this data only has an area of 193.6 ac (78.3 ha). This polygon is used for land:water analysis and for the topographic survey in the marsh creation portion of the project. The polygon used is the fill area boundary in figure 3 which uses the containment dikes and the marsh edge features built or used during construction.

b. Monitoring Elements

Habitat Mapping

Color-infrared aerial photography (1:24,000 scale) was obtained for project and reference areas in order to document vegetated and non-vegetated areas, changes in vegetative community type, and submerged aquatic vegetation. The photography was photo-interpreted, scanned, mosaicked, geo-rectified, and analyzed by United States Geological Survey (USGS) National Wetlands Research Center (NWRC) personnel according to the standard operating procedure described in Steyer et al. (1995, revised 2000). Photography was obtained in 1994, 1997 (pre-construction), and 2001 (post-construction), and will be collected in 2010. Habitat mapping was conducted on the 1994, 1997, and 2001 photography; however, based upon recommendations when the Coastwide Reference Monitoring Station (CRMS)-*Wetlands* was implemented, only a land:water analysis will be conducted on the 2010 photography.

Water Level

To monitor water level variability, two continuous recorders were located within the project area and one continuous recorder was located in each of the two reference sites (figure 4). Water level was recorded hourly. Mean daily water level variability has been monitored continuously prior to construction in 1997-1998 and after construction in 1999 through 2006, and will continue through 2016. In addition, flooding duration and frequency of flooding in the project area and reference sites will be evaluated. The location of sampling

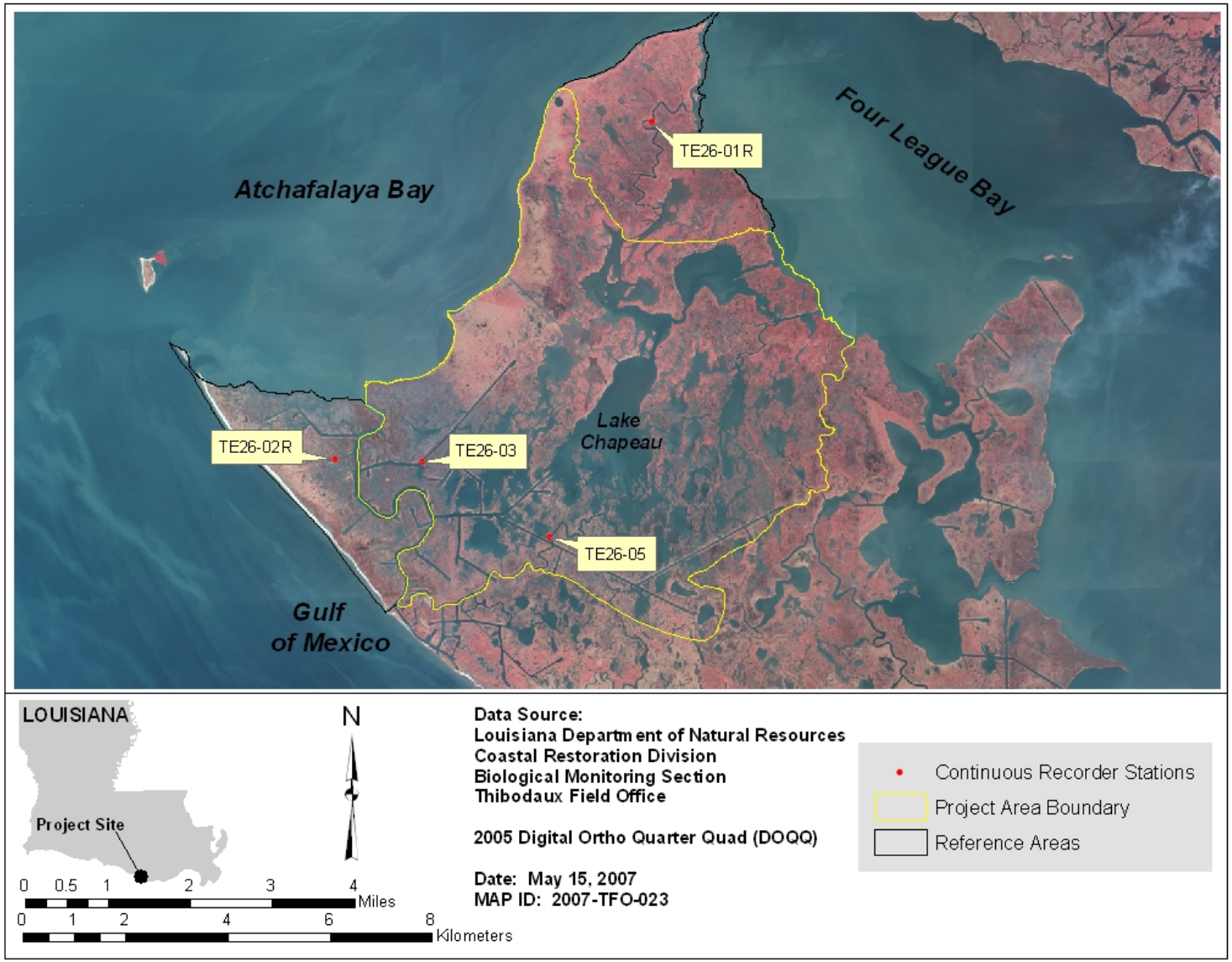

Figure 4. Location map of active continuous recorder stations for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

stations may be adjusted by LDNR/CRD based on interpretation of preliminary data acquired from the area.

Salinity

To monitor salinity variability, two continuous recorders were located within the project area and one continuous recorder was located in each of the two reference sites (figure 4). Salinity was recorded hourly. Mean daily water salinity has been monitored continuously prior to construction in 1997-1998 and after construction in 1999 through 2006, and will continue through 2016.

Vegetation

Dredge placement in the project area was completed in February 1999; however, vegetative plantings were not part of the original project design. Upon final inspection of the dredge material disposal area in May 1999, NMFS and LDNR personnel noted very little natural recruitment of vegetation and recognized the need for plantings. LDNR/CRD monitoring personnel randomly selected five 2 x 2 meter plots on the fill area and seven 2 x 2 meter plots in the natural marsh adjacent to the fill area in the fall of 1999 to begin monitoring vegetation. As a result of the May 1999 inspection, a total of 46,980 *Spartina alterniflora* Loisel. (smooth cordgrass) plugs were installed in April 2000 to establish vegetation on the exposed fill area (figure 3).

Species composition and percent cover were documented using the Braun-Blanquet method (Steyer et al. 1995; revised 2000) inside the 12 randomly selected plots in order to monitor the plantings (figure 5). Seven reference plots and five project plots were sampled in 1999, 2001, and 2004 according to the standard operating procedure described in Folse and West (2005). Species composition and percent cover were evaluated in the late summer or early fall, prior to plant senescence (from July 15 to September 15). Each plot was marked with a PVC pole on the southeast corner to allow personnel to revisit them over time. Data collection will occur again in 2007, 2010, 2013, and 2016.

Topographic and Bathymetric Elevation Surveys

Originally, the monitoring plan included collection of sediment staff gauge data for the dredge material fill area; however, the gauges were never installed so monitoring for this variable was replaced with topographic and bathymetric elevation surveys. To document elevation changes in the dredge material fill area, the dredge borrow area, and a portion of the Locust Bayou channel bottom where dredging occurred, topographic and bathymetric elevation surveys were conducted twice in 1999 (pre-construction and as-built), and again in 2004 (five years post-construction).

c. CRMS-*Wetlands*

In 2003, the CWPPRA Task Force adopted the Coastwide Reference Monitoring System (CRMS)-*Wetlands* program to evaluate the effectiveness of each constructed restoration project. CRMS-*Wetlands* provides a network or "pool" of reference sites that can be used to not only evaluate the effectiveness of individual projects but also hydrologic basins and entire coastal

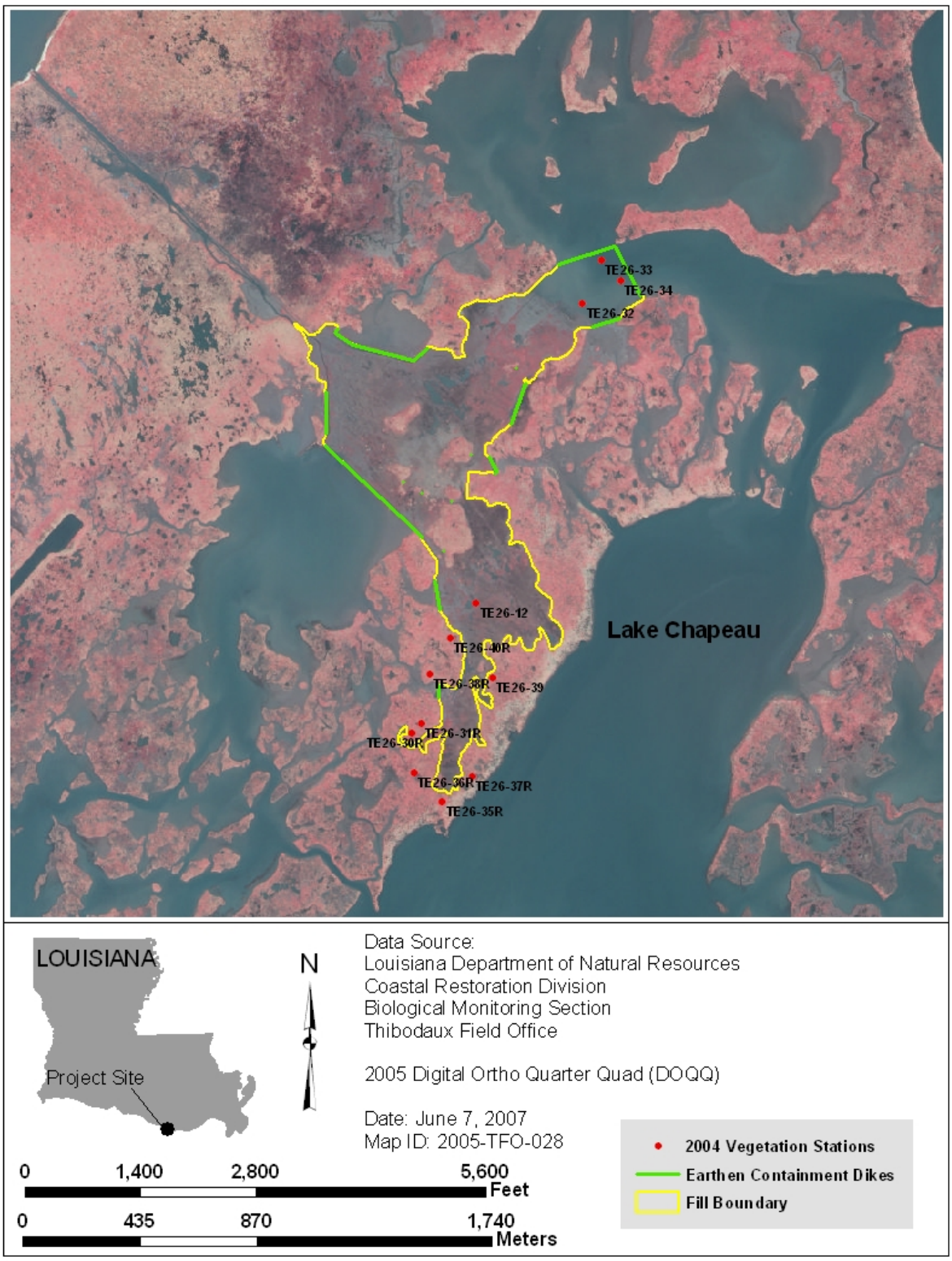

Figure 5. Location map of active vegetation data collection stations for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

ecosystems. Each 1-km^2 CRMS-*Wetlands* site is monitored consistently according to a "Standard Operating Procedures" document with the following parameters collected at each site: hourly hydrographic (includes salinity, water level, and water temperature), monthly soil porewater salinity, semi-annual surface elevation and sediment accretion, annual emergent vegetation, land:water ratio estimated from aerial photography taken every three to four years, and soil properties collected once at each CRMS site.

CRMS-*Wetlands* is currently in the implementation stage (i.e., securing landrights, site characterizations, and site construction) and not all sites are fully operational. However, data collection has begun at over half of the sites and data will be used to help support project-specific monitoring as soon as it becomes available. The Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project does not have any CRMS-*Wetlands* monitoring sites within its project or reference boundaries; however, there are several sites surrounding the project (figure 6). Data collected from these surrounding CRMS-*Wetlands* sites along with future project-specific data collection efforts will provide a broader evaluation of project effectiveness.

d. Preliminary Monitoring Results and Discussion

Habitat Mapping

The USGS/NWRC personnel completed scanning, geo-rectification and production of photomosaics for aerial photography flown in 1994, 1997, and 2001. These images were presented in the 2004 Operations, Maintenance, and Monitoring Report (Lear and Triche 2007) for this project.

Habitat analysis of the project and reference areas was completed by USGS/NWRC personnel for the 1994, 1997, and 2001 photography. Analysis yielded pre-construction and post-construction acreages for the habitat classes found in the project and reference areas (figures 7-9).

Prior to construction in May 1999, acreage of non-fresh marsh inside the project boundary declined from 7,870 ac in 1994 to 7,604 ac in 1997, while open water correspondingly increased from 5,412 ac in 1994 to 5,668 ac in 1997 (table 1; figures 7-8). Conversely, there was a large increase in non-fresh marsh (238 ac) and a large decrease in open water (-239 ac) between November 1997 and December 2001, primarily but not exclusively due to the creation of the fill area in May 1999. By December 2001, two years post-construction, loss of non-fresh marsh was still apparent but much reduced when compared to pre-construction losses, presumably attributable to creation of the fill area.

By 2001, reference area 1 experienced an overall loss of non-fresh marsh (-32 ac), but at only half the acreage (-62 ac) than in 1997 (table 2; figures 7-9). It appears that some of this acreage may have converted to mud flat and upland barren and presumably cannot all be due to erosion. The open water acreage (27 ac) remained the same between 1994 and 2001.

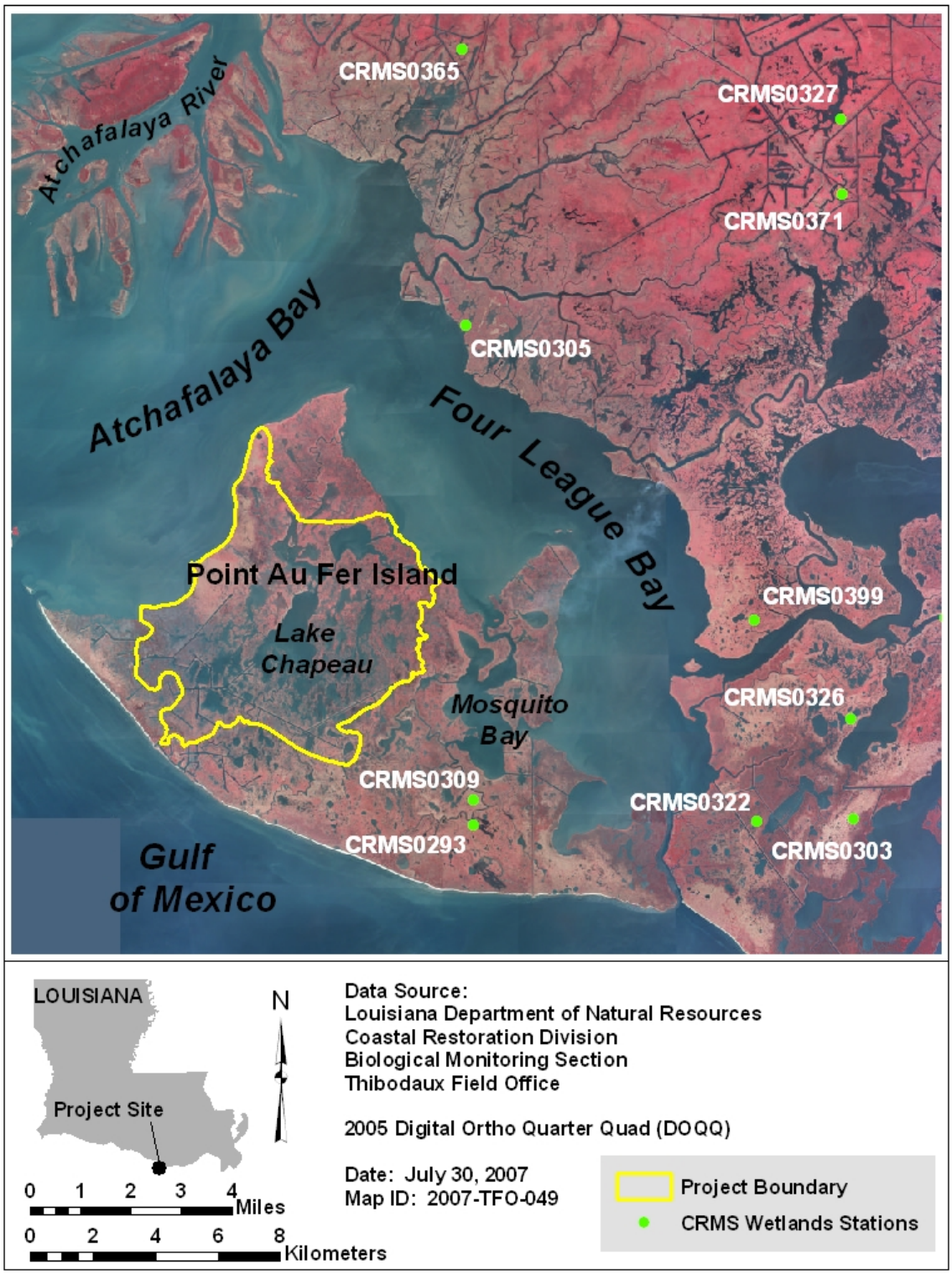

Figure 6. Location map of CRMS-*Wetlands* stations outside the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

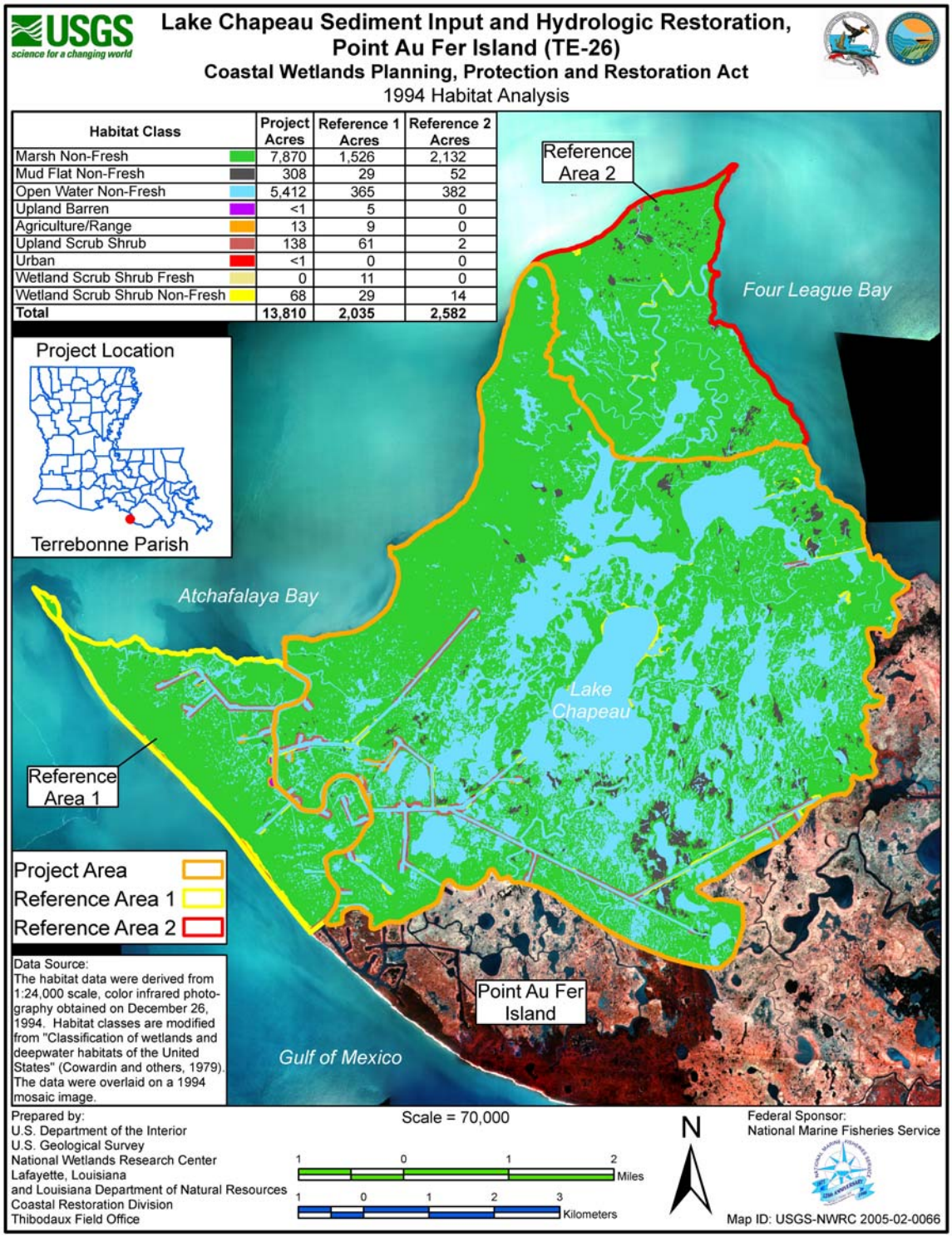

Figure 7. 1994 habitat analysis of the project and reference areas for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

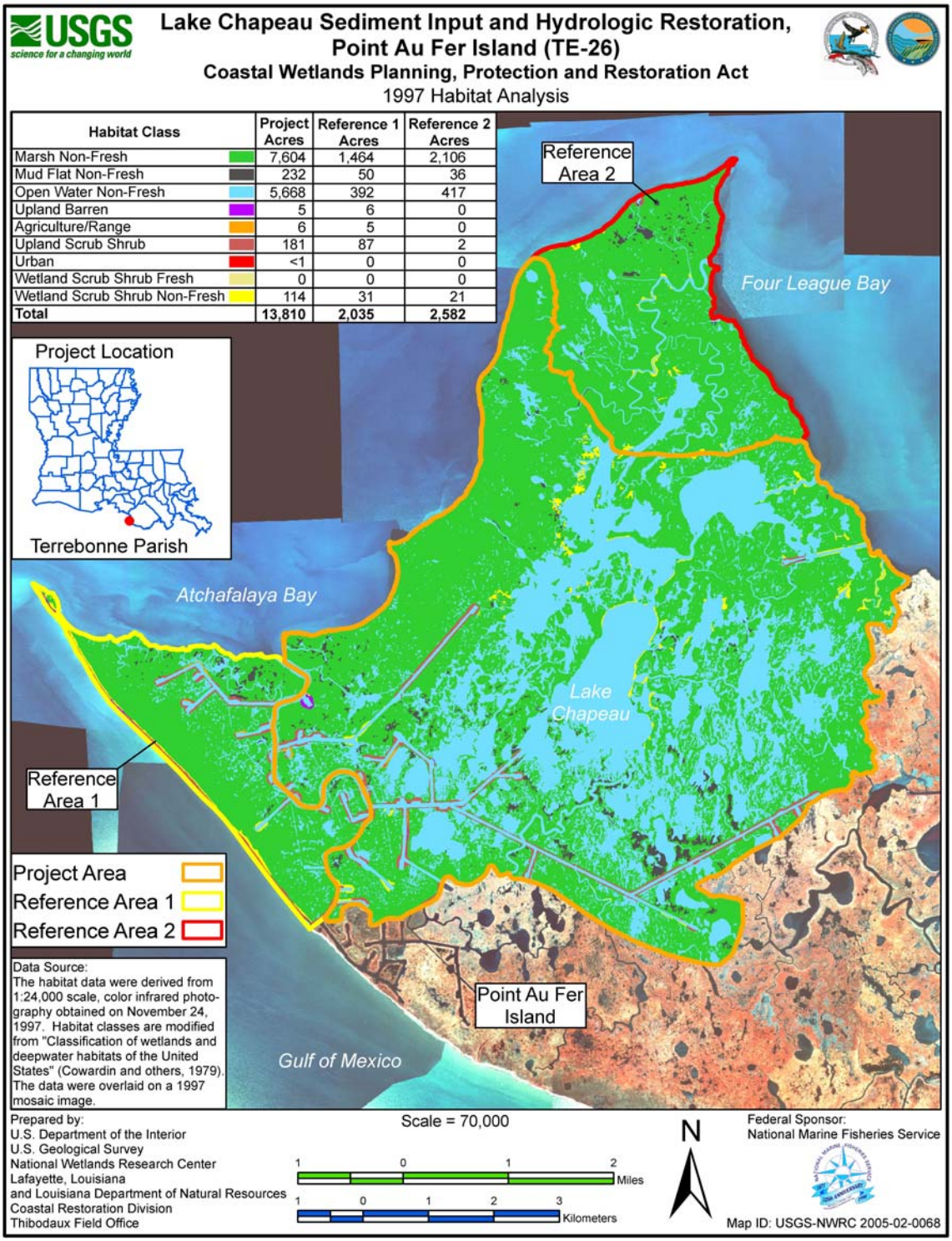

Figure 8. 1997 habitat analysis of the project and reference areas for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

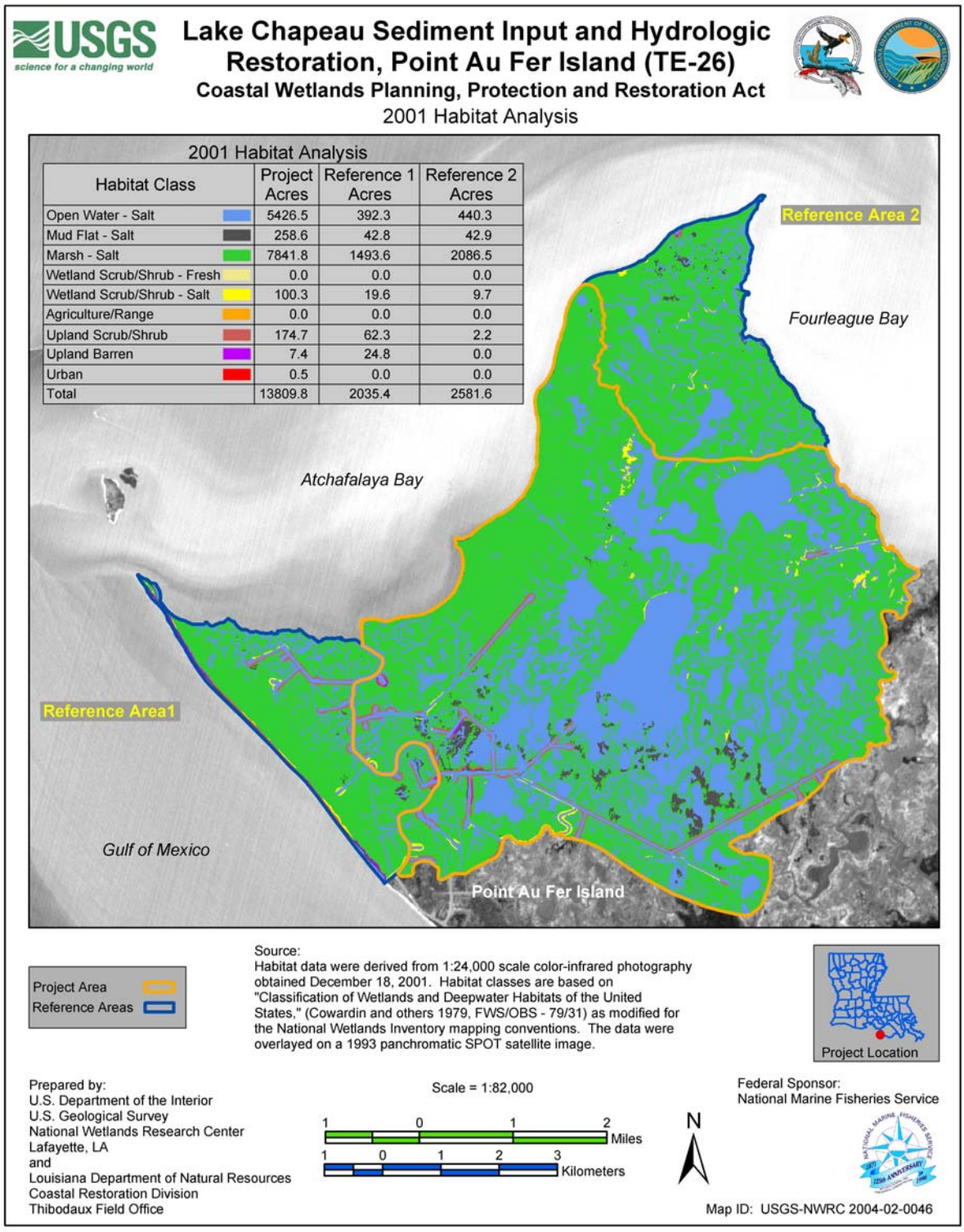

Figure 9. 2001 habitat analysis of the project and reference areas for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Table 1. Acreage changes in habitat classifications by project area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

	Project Change		
	1994-1997	1997-2001	1994-2001
Marsh Non-Fresh	-266	238	-28
Mud Flat Non-Fresh	-76	26.6	-49.4
Upland Barren	5	2.4	7.4
Agriculture /Range	-7	-6	-13
Upland Scrub Shrub	43	-6.3	36.7
Urban	0	<1	<1
Wetland Scrub Shrub Fresh	0	0	0
Wetland Scrub Shrub Non-Fresh	46	13.7	32.3
Open Water Non-Fresh	256	-239	17

Table 2. Acreage changes in habitat classifications by reference area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

	Reference 1 Change			Reference 2 Change		
	1994-1997	1997-2001	1994-2001	1994-1997	1997-2001	1994-2001
Marsh Non-Fresh	-62	30	-32	26	-20.5	-45.5
Mud Flat Non-Fresh	21	7.2	13.8	-16	6.9	-9.1
Upland Barren	1	18.8	19.8	0	0	0
Agriculture /Range	-4	-5	-9	0	0	0
Upland Scrub Shrub	26	-24.7	-1.3	0	0.2	0.2
Urban	0	0	0	0	0	0
Wetland Scrub Shrub Fresh	-11	0	-11	0	0	0
Wetland Scrub Shrub Non-Fresh	2	-11.4	-9.4	7	-11.3	-4.3
Open Water Non-Fresh	27	0	27	35	23.3	58.3

Reference area 2 steadily lost non-fresh marsh acreage (-45.5 ac) between 1994 and 2001 and gained open water acreage. It appears that most of the marsh loss was due to its conversion to open water and mud flat.

The shift from marsh to mud flat and open water in both the project and reference areas is probably due to a continuation of both natural and anthropogenic factors affecting this portion of the coastline as mentioned in the introductory portion of this report. Project effects can be partially attributed to the decrease in marsh loss within the fill area.

Land-water analysis was conducted on photography collected in 1994 and 2001 for the fill area only. Results showed a gain of 139.5 acres of land in the area as a result of the dredge placement (Lear and Triche 2007).

Water Level

Hourly water level data have been collected at four continuous recorder stations (figure 4). Hourly readings were used to obtain the mean weekly readings. Mean weekly readings were used to reduce the effects of diurnal tides that occur in the project area. Tidal cycles often span more than one day; consequently, analyzing data on a daily basis does not account for the tidal cycle. All of the water level data were adjusted to a new elevation survey conducted in 2003 in order to tie the data into the LDNR secondary network of monuments. Installation of four new staff gauges to replace the old ones at each of the continuous recorder stations was contracted and completed in 2003. The GPS static survey scope for this contract required the adjustment of each staff gauge and nail elevation at each constant recorder station to the Louisiana Coastal Zone GPS network.

Analysis of Weekly Means

Analysis of mean weekly water levels indicate that the reference areas were significantly higher than the project area ($P = 0.0001$), and although neither the project area nor reference area changed significantly after the project was completed, there was a significant interaction ($P < 0.0001$) caused by the reference area average weekly water level increasing more than the increase in the project area (figure 10). Analysis by station showed no significant changes in any individual stations pre- to post-construction, and both project and reference stations trended toward slightly higher water levels (table 3; figure 11). Water levels at station TE26-02R showed the greatest change, but not enough to be significant. The combination of these insignificant changes at the station level did add up to the significant difference in mean weekly water levels among project and reference areas.

This analysis indicates that the project features are having some effect on maintaining 0.1 ft lower mean weekly water levels.

Table 3. Pre-construction versus post-construction trends for two project stations and two reference stations for the average weekly mean adjusted water levels at the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project. Note: P values <0.05 are significant.

	TE26-01R	TE26-02R	TE26-03	TE26-05
Partial vs Post P values	0.9130	0.5575	1.0000	0.9822
Trend	Higher	Higher	Higher	Higher

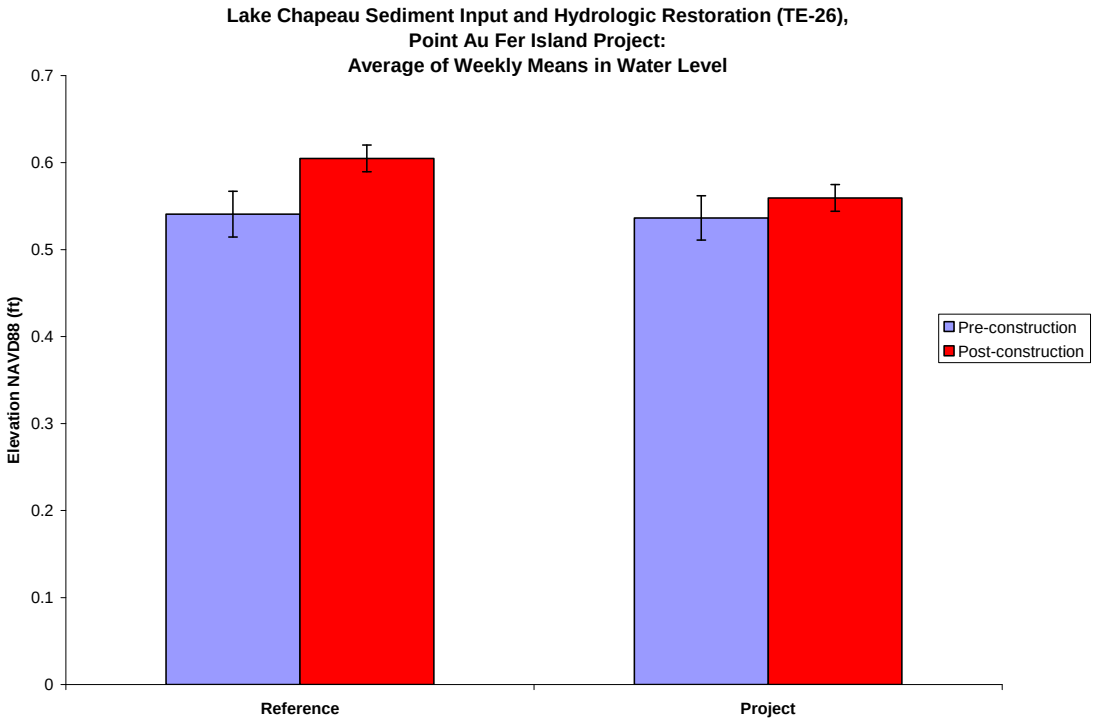

Figure 10. Average of the weekly means with standard deviations in water level for reference and project stations, pre-construction (April 24, 1997 – May 17, 1999) and post-construction (May 18, 1999 – December 5, 2006), for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

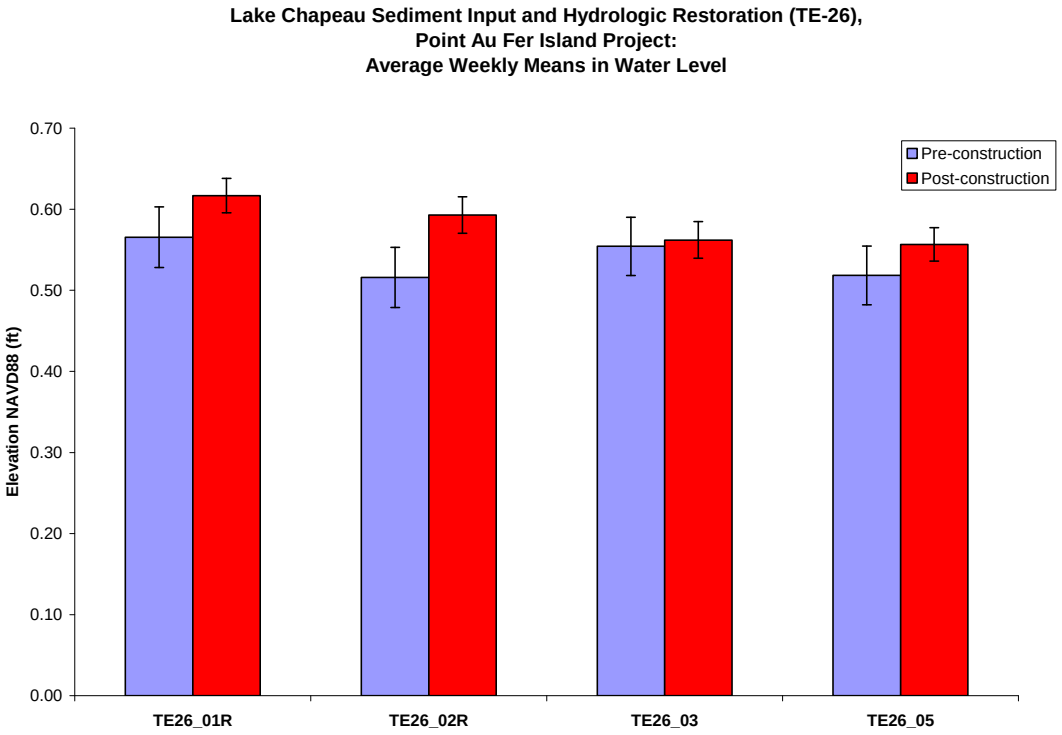

Figure 11. Average of the weekly mean adjusted water level with standard deviations by station, pre-construction (April 24, 1997 – May 17, 1999) and post-construction (May 18, 1999 – December 5, 2006), for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Analysis of Hourly Changes (Variation)

Hourly water level changes were calculated for each station. These data were analyzed in a GLM using the Tukey-Kramer least square test. The data were analyzed using each individual station and by combining project and reference area stations.

Results for the individual stations separated by pre- and post-construction data showed a significant difference ($p<0.0001$) for stations TE26-01R and TE26-05. Figure 12 illustrates the mean hourly water level change along with the standard deviation. When the data were analyzed using project and reference areas, i.e., TE26-01R and TE26-02R combined and TE26-03 and TE26-05 combined, the results showed a significant difference ($P<0.0001$). However, the mean hourly change only increased by 0.0058 feet. As with the station data the difference was less than 0.1 feet. These results may be statistically different, but ecologically the difference is not significant at this time.

Preliminary results by Visser (2007) show a slightly lower stress index post-construction. Water level data were analyzed using marsh elevations near the continuous recorders to obtain

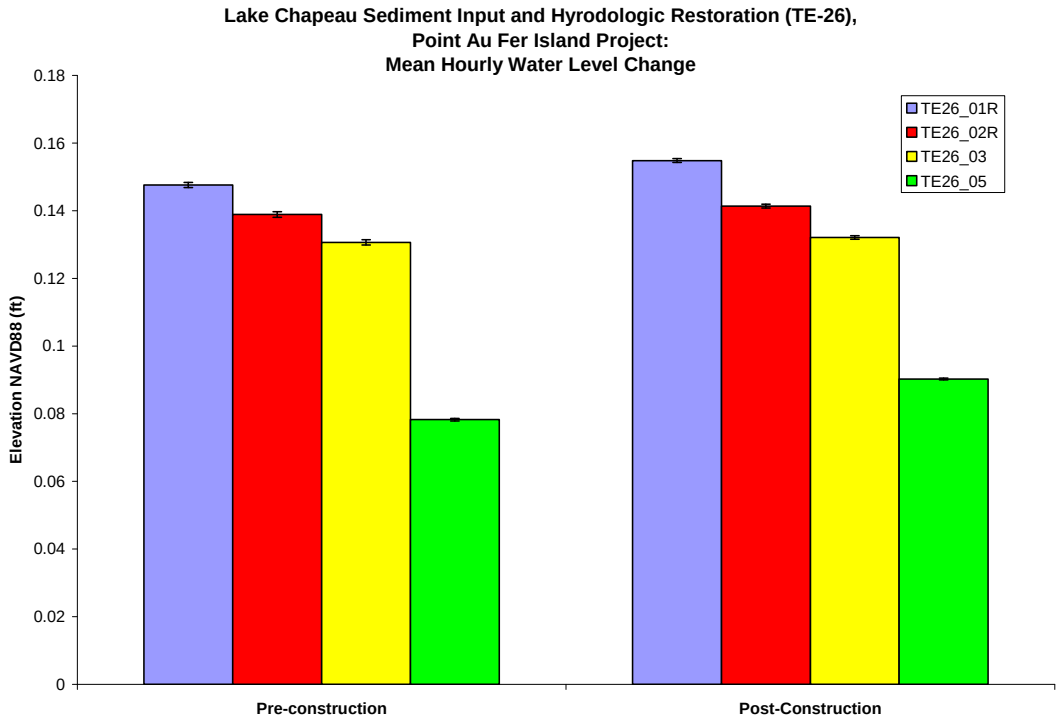

Figure 12. Mean hourly water level change with standard deviation for each project and reference station, pre-construction (April 24, 1997 – May 17, 1999) and post-construction (May 18, 1999 – December 5, 2006), for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

the depth and duration of marsh flooding. *Spartina patens* (Ait.) Muhl. (marshhay cordgrass) is the dominant species in this area; therefore, the stress index was used for this plant species.

Salinity

Analysis of Weekly Means

Analysis of the salinity was also conducted using average weekly means to reduce the effects of diurnal tides. However, these differed from the water levels in that while the project and reference were significantly different from each other ($P < 0.0001$) the project had no effect on salinity (figure 13). Analysis by station showed no significant changes in any individual stations pre- to post-construction (table 4; figure 14). The average weekly mean salinity for both project and reference stations trended either slightly higher or lower.

This indicates that while there may be some project effect on average weekly water levels it is not enough to affect salinity.

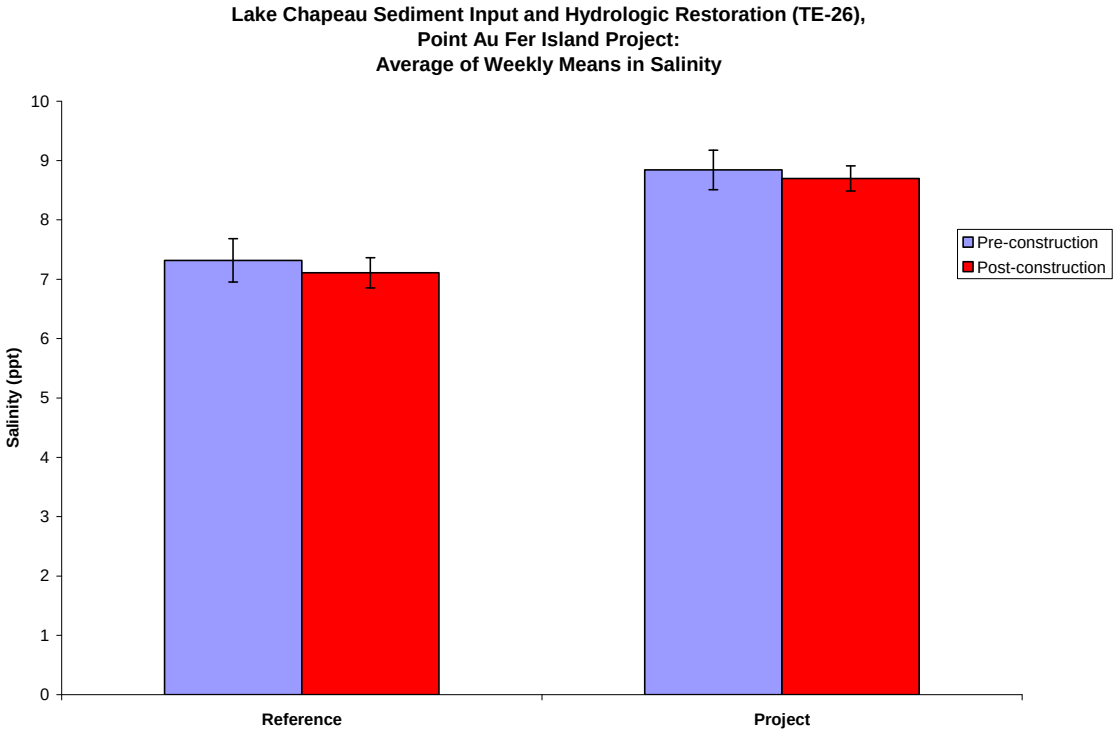

Figure 13. Average of the weekly mean salinity with standard deviations for the reference and project stations, pre-construction (April 24, 1997 – May 17, 1999) and post-construction (May 18, 1999 – December 5, 2006) for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Table 4. Pre-construction versus post-construction trends for two project stations and two reference stations for the average weekly mean adjusted salinity at the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project. Note: P values <0.05 are significant.

	TE26-01R	TE26-02R	TE26-03	TE26-05
Partial vs Post P values	0.9627	1.0000	1.0000	0.9979
Trend	Lower	Higher	Higher	Lower

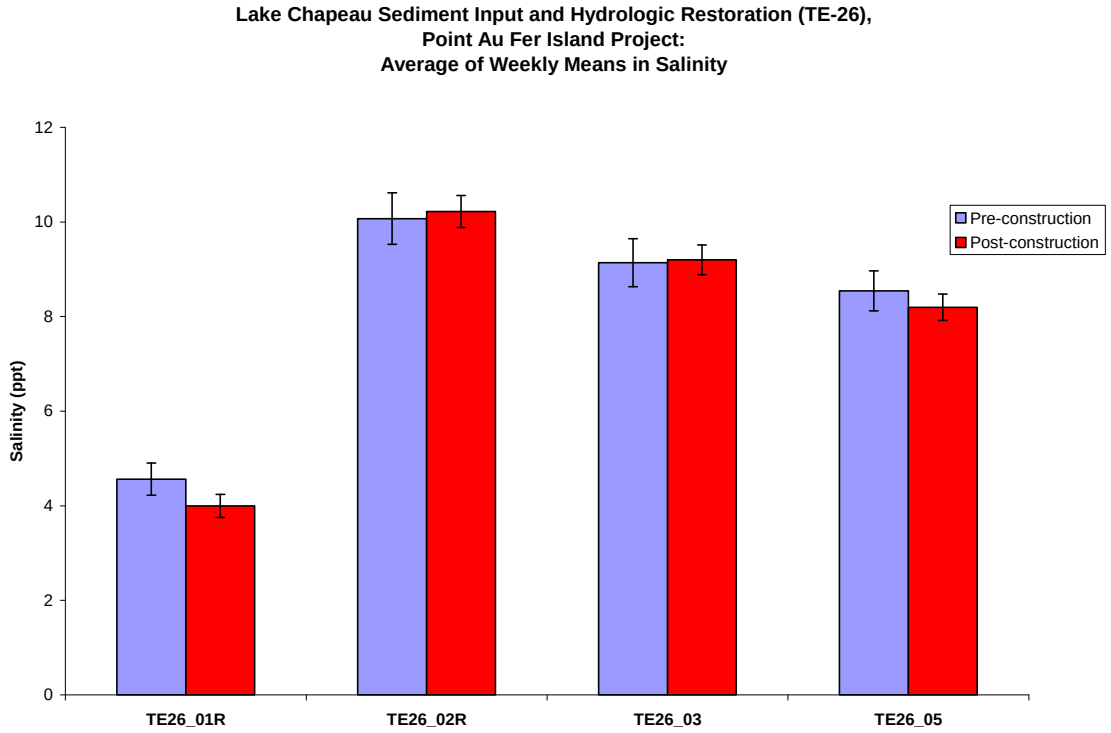

Figure 14. Average of weekly mean salinity with standard deviations for each project and reference station, pre-construction (April 24, 1997 – May 17, 1999) and post-construction (May 18, 1999 – December 5, 2006) for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Analysis of Hourly Change (Variation)

Hourly salinity changes were calculated for each station. This data was analyzed in a GLM using the Tukey-Kramer least square test. The data was analyzed using each individual station and by combining project and reference area stations.

When the individual stations were analyzed by pre- and post-construction, the results show a significant difference ($P<0.0001$) for station TE26-05 while the other three (3) stations had no significant difference. Figure 15 shows the mean hourly salinity change for each station by pre- and post-construction. When the data was combined for project and reference, there was a significant difference ($P<0.0001$), with an increase in mean hourly salinity change of 0.0133 ppt from pre- to post-construction.

Preliminary results by Visser (2007) show an increase in the stress index for salinity as it affects *S. patens* (Ait.) Muhl., the dominant vegetation species.

As indicated in figure 13, the lower mean readings for salinity for the reference area may be attributed to the location of the TE26-01R station. It is approximately 5.5 miles northeast of TE26-02R and more influenced by the Atchafalya river stages, while the stations on the southern end are more influenced by the gulf waters because of their proximity. Figure 14 shows the 5-6 ppt difference in weekly means as compared to the other stations.

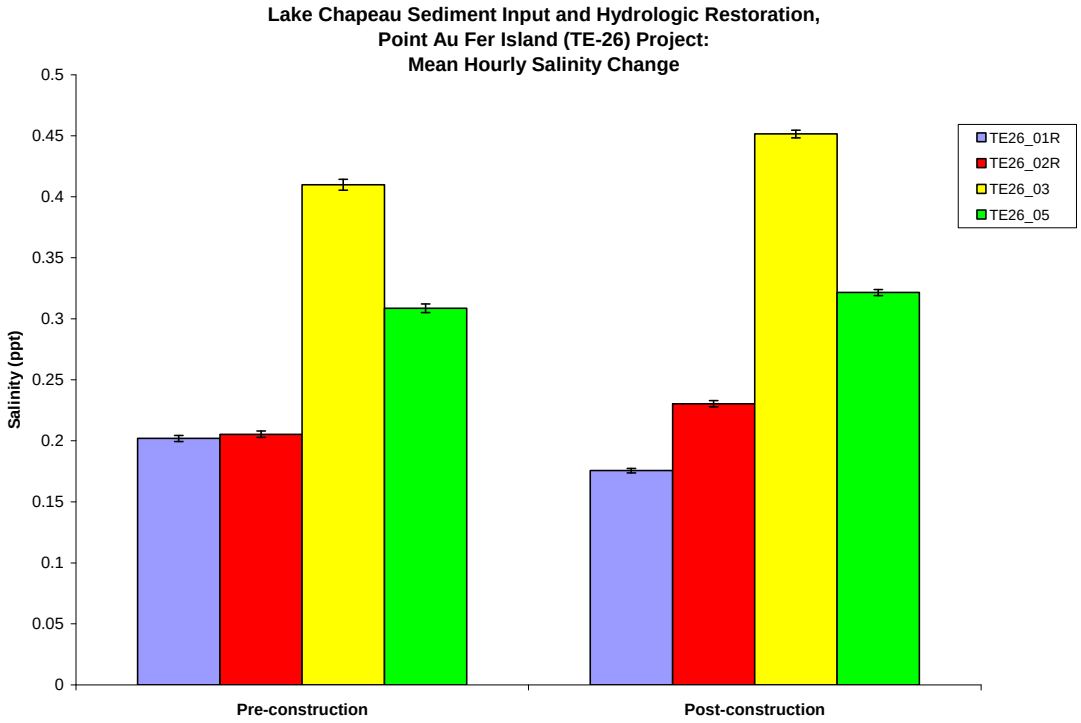

Figure 15. Mean hourly salinity change for each project and reference station, pre-construction (April 24, 1997 – May 17, 1999) and post-construction (May 18, 1999 – December 5, 2006), for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Vegetation

Seven (7) randomly selected reference plots were established in existing marsh adjacent to the fill area, and five (5) randomly selected project plots for the fill area were established in 1999 (figure 5; table 5). Each plot measures 6.6 ft x 6.6 ft (2m x 2m) with each plot marked with a PVC pole in the southeast corner. Species composition and estimated percent cover were determined using the Braun-Blanquet method (Mueller-Dombois and Ellenberg 1974). Before leaving the site, Differential Global Positioning System (DGPS) equipment was used to acquire the coordinates for each PVC pole. This equipment is sub-meter accurate and was used to locate the plots in 2001 and 2004. The corner poles for three reference plots and one project plot established in 1999 were missing

Table 5. Vegetation data collection stations for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Station	1999	2001	2004	Replacement
TE26-11	Yes	Yes	Missing	TE26-39
TE26-12	Yes	Yes	Yes	None
TE26-13	Yes	Yes	Missing	TE26-32
TE26-14	Yes	Missing	No	TE26-28
TE26-15	Yes	Yes	Missing	TE26-34
TE26-21R	Yes	Missing	No	TE26-30R
TE26-22R	Yes	Missing	No	TE26-29R
TE26-23R	Yes	Yes	Missing	TE26-37R
TE26-24R	Yes	Yes	Missing	TE26-38R
TE26-25R	Yes	Yes	Missing	TE26-40R
TE26-26R	Yes	Missing	No	TE26-31R
TE26-27R	Yes	Yes	Missing	TE26-35R
TE26-28	No	Yes	Missing	TE26-33
TE26-29R	No	Yes	Missing	TE26-36R

when LDNR/CRD personnel revisited the site for data collection in 2001. These four stations were inactivated and four new stations were established as close to the old plots as possible using DGPS equipment. The corner poles for five reference plots and four project plots were missing when LDNR/CRD personnel revisited the site for data collection in 2004. These stations were inactivated and new stations were established as close to the old plots as possible using the DGPS equipment.

Relative mean percent cover was determined for all vegetation occurring inside the 6.6 ft x 6.6 ft (2m x 2m) Braun-Blanquet plots (figure 16). During the fall of 1999 (one growing season post-construction) all five project plots were 100% bare ground. Field observations also indicate that three of the five project plots were in open water, despite the fact that dredge material placement had already occurred. The reference plots had a greater relative mean cover with *Spartina patens* (Ait.) Muhl. (marshhay cordgrass) as the dominant species.

The relative mean cover increased in the project plots by the fall of 2004 (six growing seasons post-construction) though three of those plots still remained in open water. Natural recruitment of vegetation in the project plots was also evident with the introduction of four species, including the planted species, *Spartina alterniflora* Loisel. (smooth cordgrass). Bare ground decreased substantially in the project plots, but its relative mean cover was still high.

Conversely, the relative mean percent cover for bare ground in the reference plots was non-existent in 1999, but increased to 19% by 2004. Also, relative mean cover of the dominant species, *S. patens* (Ait.) Muhl., in the reference plots steadily decreased between 1999 and 2004 by half. The planted species was evident in the reference plots by the fall of 2001 and its cover remained relatively unchanged by 2004.

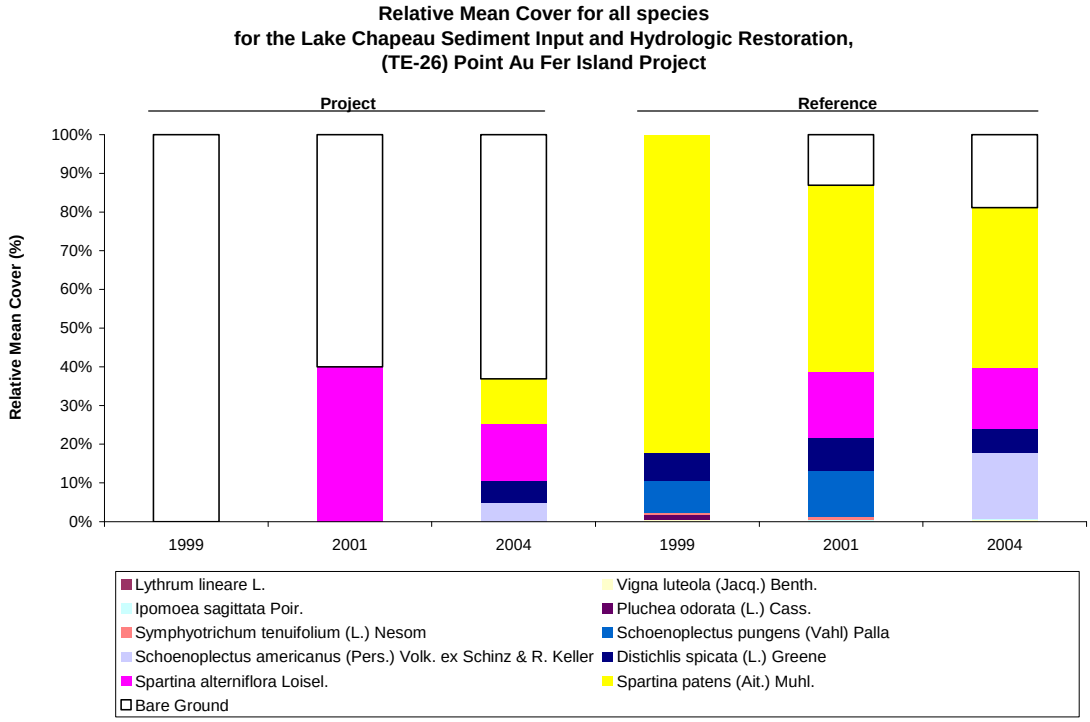

Figure 16. Relative mean percent cover of emergent vegetation species inside the 2 x 2 meter Braun Blanquet vegetation plots for 1999, 2001, and 2004 at the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Upon completion of the marsh creation aspect of the project feature, a small portion in the northeastern corner of the fill area was not created to the appropriate elevation. As a result the three project vegetation plots randomly placed there have always been in open water (TE26-32, TE26-33, and TE26-34), i.e., no marsh plant species are present in the vicinity of the plots. Given the low number of plots (N=12) coupled with the large bare ground cover contributed by the open water plots, the data set could possibly have been skewed. Additional analysis was conducted on the vegetation data to more closely examine the relative mean cover, but to the exclusion of the three open water plots. As a result, the relative mean cover of bare ground for the project plots remained the same for 1999, but was non-existent in 2001, while it represented only 12% in 2004. Since the altered data set only involved project plots, the relative mean cover of bare ground for the reference plots did not change. The data and visual reconnaissance show that with the proper elevation the relative mean vegetative cover throughout the marsh creation aspect of the project would have been much higher as the plants have thrived in the higher elevation.

Topographic and Bathymetric Elevation Surveys

Elevation data from the topographic and bathymetric surveys taken in 1999 (pre-construction and as-built) by River Road Construction, Inc. were adjusted to the post-construction survey taken in 2004 by Acadian Engineers and Environmental Consultants, Inc. The data was entered

into ArcMap® version 9.1 where grids were created for the borrow area, the fill area, and the Locust Bayou dredge channel. Elevation statistics were calculated from the grids for the areas inside the boundary polygons. Contour elevation maps were created in ArcViewGIS® version 3.2 and placed in Appendix D of this report. Change grids were produced in ArcViewGIS® version 3.2 by subtracting the contour grids produced in ArcMap® version 9.1. Elevation statistics were calculated from these change grids for the areas inside the boundary polygons and elevation change maps were produced in ArcViewGIS® version 3.2 (figures 17-25).

Contour Elevations

Locust Bayou Dredge Channel:

Contour elevation class statistics are presented in table 6 for the Locust Bayou dredge channel. Contour elevation maps are located in Appendix D of this report (figures 1-3).

Table 6. Comparative contour elevation statistics for the Locust Bayou dredge channel inside the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

	NAVD88 ft (m)			
	Mean	**Minimum**	**Maximum**	**Standard Deviation**
Pre-construction	-1.581 (-0.481)	-5.216 (-1.589)	1.522 (0.463)	0.3963
As-built	-4.364 (-1.330)	-8.859 (-2.711)	-0.237 (-0.072)	0.7274
Post-construction	-5.254 (-1.601)	-9.930 (-3.026)	1.597 (0.486)	0.8284

The lowering of the mean elevation is a direct result of the dredging performed during construction. The five year post-construction survey shows the mean elevation was lowered by 0.89 ft (0.27 m) from the end of construction. This may be a result of more water flowing through the area from Lake Chapeau through the northern reaches of Locust Bayou and into the dredge portion of the bayou. More water may be funneling through Lake Chapeau as a result of the dredge material in the fill area.

Fill Area:

Contour elevation class statistics are presented in table 7 for the dredge material fill area. Contour elevation maps are located in Appendix D of this report (figures 4-6).

Table 7. Comparative contour elevation statistics for the dredge material fill area inside the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

	NAVD88 ft (m)			
	Mean	**Minimum**	**Maximum**	**Standard Deviation**
Pre-construction	-0.839 (-0.255)	-3.260 (-0.993)	1.447 (0.441)	0.205
As-built	1.374 (0.418)	-2.111 (-0.643)	2.818 (0.858)	0.1672
Post-construction	0.815 (0.248)	-2.229 (-0.679)	1.967(0.599)	0.2003

The increase in mean elevation is a direct result of the placement of the fill material. The decrease of 0.559 ft (0.17 m) five years post-construction may be a result of dewatering, sediment compression, and loss of some sediment over the years as the sediment tries to

stabilize. The mean post-construction elevation is 0.47 ft higher than intended at the time of the survey. Although the elevation is higher, the species composition is still emergent marsh species; therefore, this elevation is acceptable for the marsh creation aspect of the project.

Borrow Area:
Contour elevation class statistics are presented in table 8 for the borrow area. Contour elevation maps are located in Appendix D of this report (figures 7-9).

Table 8. Comparative elevation statistics for the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

Borrow Area (Contour Elevation Means) NAVD88

	NAVD88 ft (m)			
	Mean	**Minimum**	**Maximum**	**Standard Deviation**
Pre-construction	-5.002 (-1.524)	-5.798 (-1.767)	-4.33 (-1.351)	0.054
As-built	-11.100 (-3.383)	-21.327 (-6.500)	-4.402 (-1.341)	1.65
Post-construction	-5.364 (-1.634)	-6.615 (-2.016)	-4.031(-1.228)	1.244

The reduced elevation is a direct result of the dredge activity in the borrow area. The five year post-construction survey shows the borrow area has filled in with sediment from the bay.

Change Class Statistics
Locust Bayou:
Change class statistics for the Locust Bayou dredge channel are found in figures 17-19 of this report. Figure 17 shows the elevation changes from the pre-construction survey in 1999 to the as-built survey in 1999. Figure 18 shows the elevation changes from the as-built survey in 1999 to the post-construction survey in 2004. Figure 19 shows the elevation changes from the pre-construction survey to the post-construction survey. The elevation changes are broken down into classes and the acreage is given for each change class. Also, the overall mean, maximum, and minimum elevation changes are given for the area within the Locust Bayou dredge channel boundary.

Dredging of the Locust Bayou channel created an overall mean elevation change of -3.693 ft between pre-construction and post-construction (figure 19). Change analysis indicates that the channel continued to deepen after the dredge event, though the mean elevation change (-0.924 ft) was not as pronounced between the as-built and post-construction surveys (figure 18) as the mean elevation change (-2.777 ft) between the pre-construction and as-built surveys (figure 17). Also, it appears from the analysis in figure 18 that once the dredge material was placed along the bank lines, some material sloughed off into the channel and was transported by the current and re-deposited in curves along the bayou, while the channel continued to deepen. Since the change analysis is limited to an area inside the channel fixed by the extent of where the three surveys overlap, it does not capture all of what is going on adjacent to the channel. The continued deepening of the channel five years after the dredge event may be the result of an increased flow of water from the north as a result of the marsh creation (fill area). Water from the northern portion of the project is now focused to Lake Chapeau and through Locust Bayou, having a

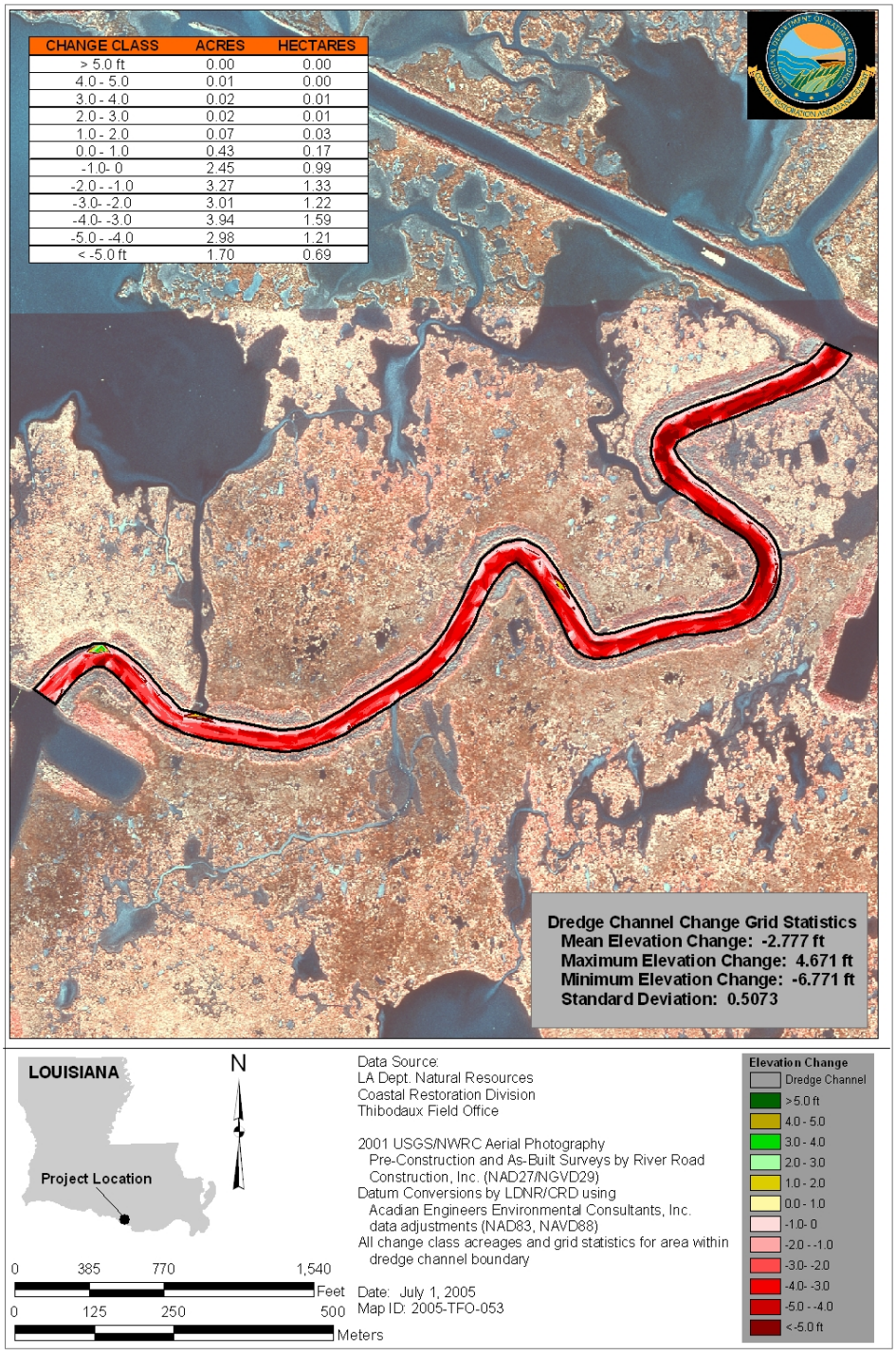

Figure 17. Change class acreages for the pre-construction (1999) versus as-built (1999) elevation surveys of the Locust Bayou dredge channel for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

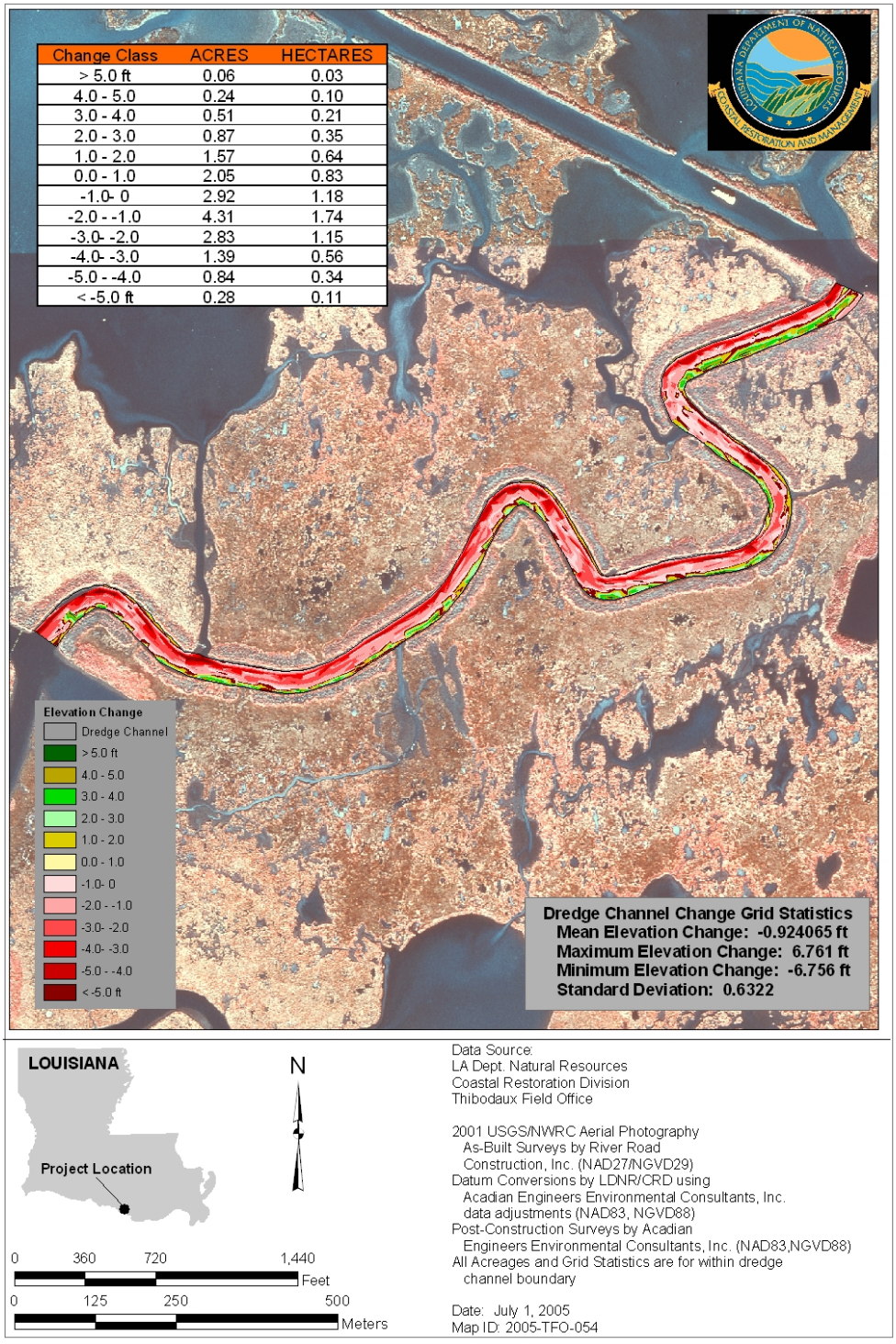

Figure 18. Change class acreages for the as-built (1999) versus post-construction (2004) elevation surveys of the Locust Bayou dredge channel for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

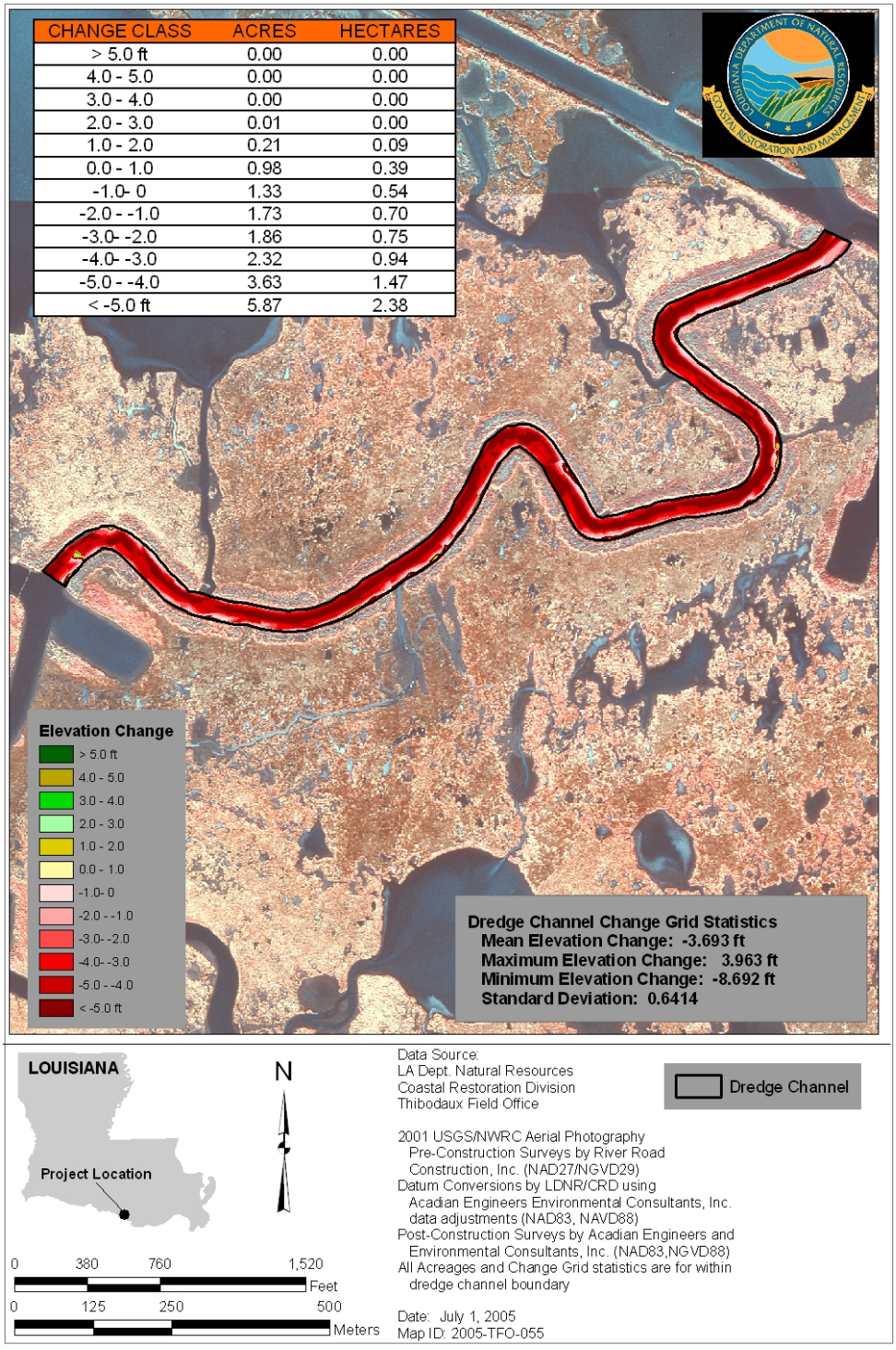

Figure 19. Change class acreages for the pre-construction (1999) versus post-construction (2004) elevation surveys of the Locust Bayou dredge channel for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

velocity that has maintained and even deepened the dredge area. Since one of the objectives was to remove silt from the channel bottom in order to accommodate an increased flow due to the re-establishment of the island's natural drainage patterns, it appears that there may be some project effect in this regard.

Fill Area:
Change class statistics for the dredge material fill area are found in figures 20-22 of this report. Figure 20 shows the elevation changes from the pre-construction survey in 1999 to the as-built survey in 1999. Figure 21 shows the elevation changes from the as-built survey in 1999 to the post-construction survey in 2004. Figure 22 shows the elevation changes from the pre-construction survey to the post-construction survey. The elevation changes are broken down into classes and the acreage is given for each change class. Also, the overall mean, maximum, and minimum elevation changes are given for the area within the dredge material fill area boundary.

The overall mean elevation change from pre-construction to post-construction was 1.655 ft (figure 22). The greatest mean elevation change was 2.219 ft, which occurred between the pre-construction and as-built surveys (figure 20), a direct result of dredge material placement. Figure 21 illustrates how most of the fill area elevation changes (132.70 ac) were in the negative range (-1.0 – 0 ft), indicating that the dredge material had dewatered and was subsiding five years after construction. Of particular note is the northeast portion of the fill area, where the most elevation change occurred (-2.0 - -3.0 ft). Field trips confirm that this area of the fill has remained flooded. Overall, however, the mean elevation of the borrow area based upon post-construction contour elevations from the 2004 survey was 0.815 ft.

Borrow Area:
Change class statistics for the borrow area are found in figures 23-25 of this report. Figure 23 shows the elevation changes from the pre-construction survey in 1999 to the as-built survey in 1999. Figure 24 shows the elevation changes from the as-built survey in 1999 to the post-construction survey in 2004. Figure 25 shows the elevation changes from the pre-construction survey to the post-construction survey. The elevation changes are broken down into classes and the acreage is given for each change class. Also, the overall mean, maximum, and minimum elevation changes are given for the area within the borrow area boundary.

From pre-construction to post-construction the overall mean elevation change was -0.3618 ft, with most of the change (51.91 ac) occurring in the -1 – 0 change class range (figure 25). The greatest mean elevation change of -6.092 ft occurred between the pre-construction and as-built surveys (figure 23), and is attributed to the dredging of the borrow area. Conversely, an almost equal mean elevation change (5.696 ft) occurred between the as-built and post-construction surveys, but in the positive range. It appears that the borrow area has filled in only five years after construction. The mean elevation change from pre-construction to post-construction was minimal and it appears the borrow area served as a natural sink where sediment is trapped. This has made it possible for the borrow area to be used again for future dredge events, depending on the fill material composition.

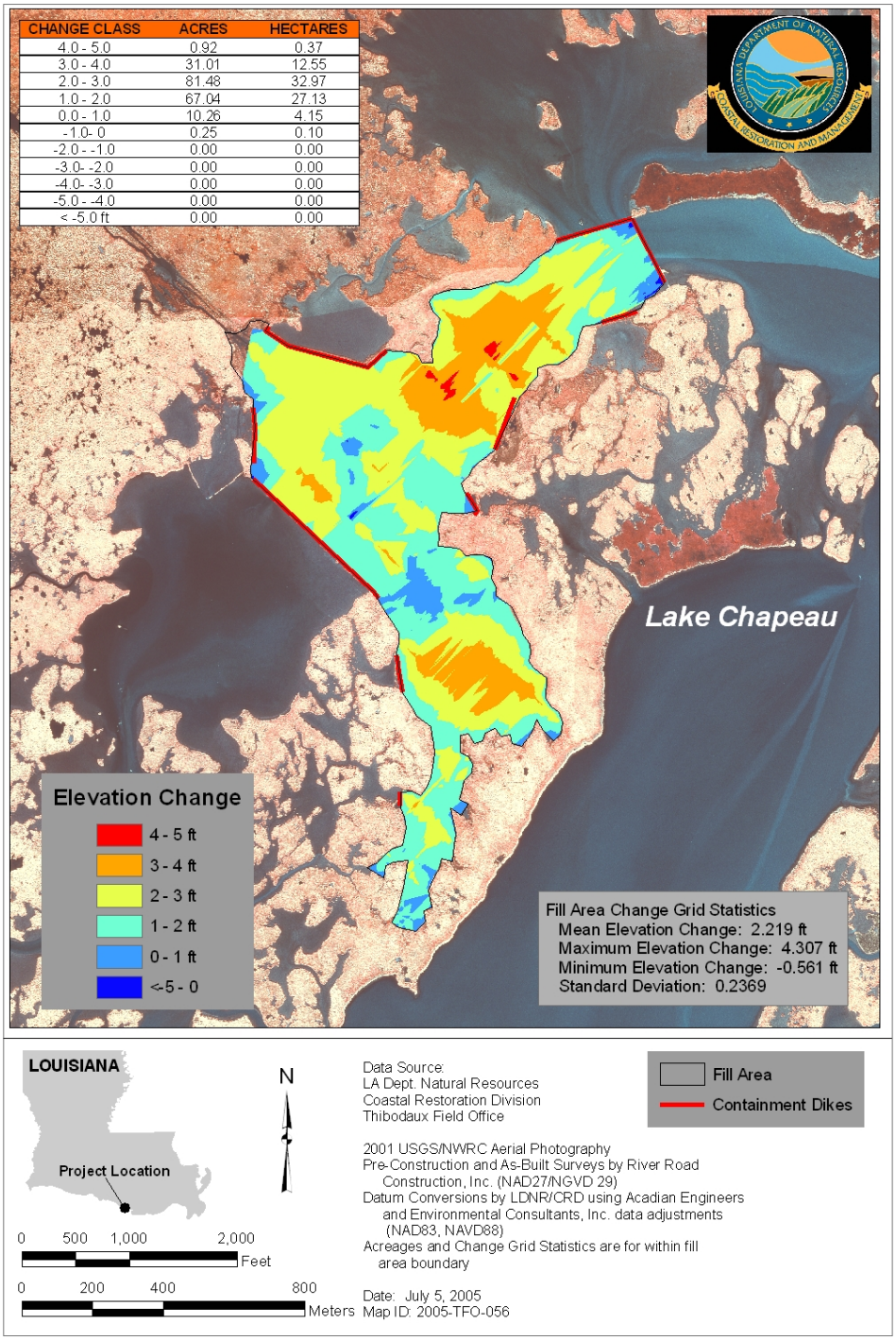

Figure 20. Change class acreages for the pre-construction (1999) versus as-built (1999) elevation surveys of the fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

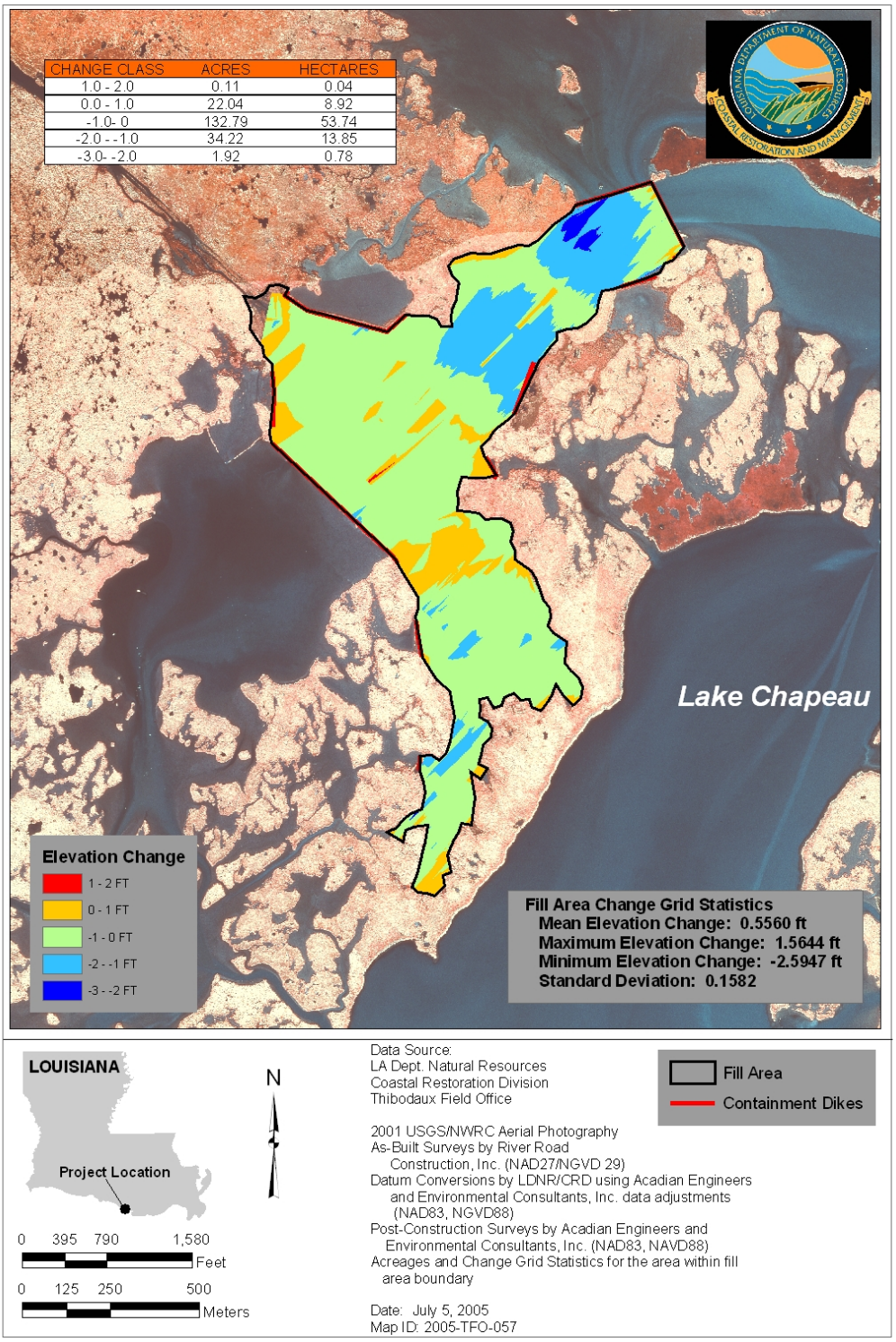

Figure 21. Change class acreages for the post-construction (2004) versus as-built (1999) elevation surveys of the fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

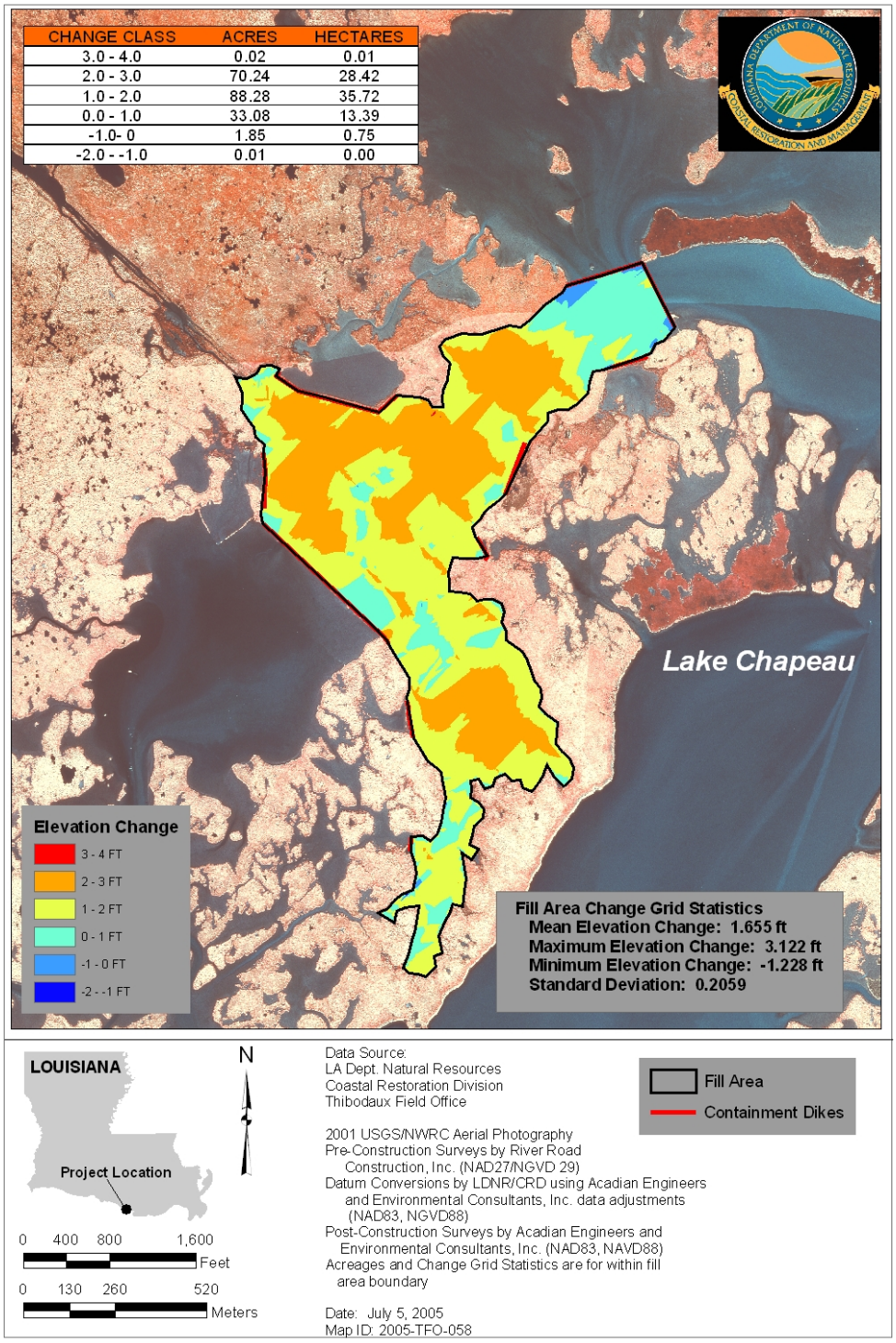

Figure 22. Change class acreages for the post-construction (2004) versus pre-construction (1999) elevation surveys of the fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

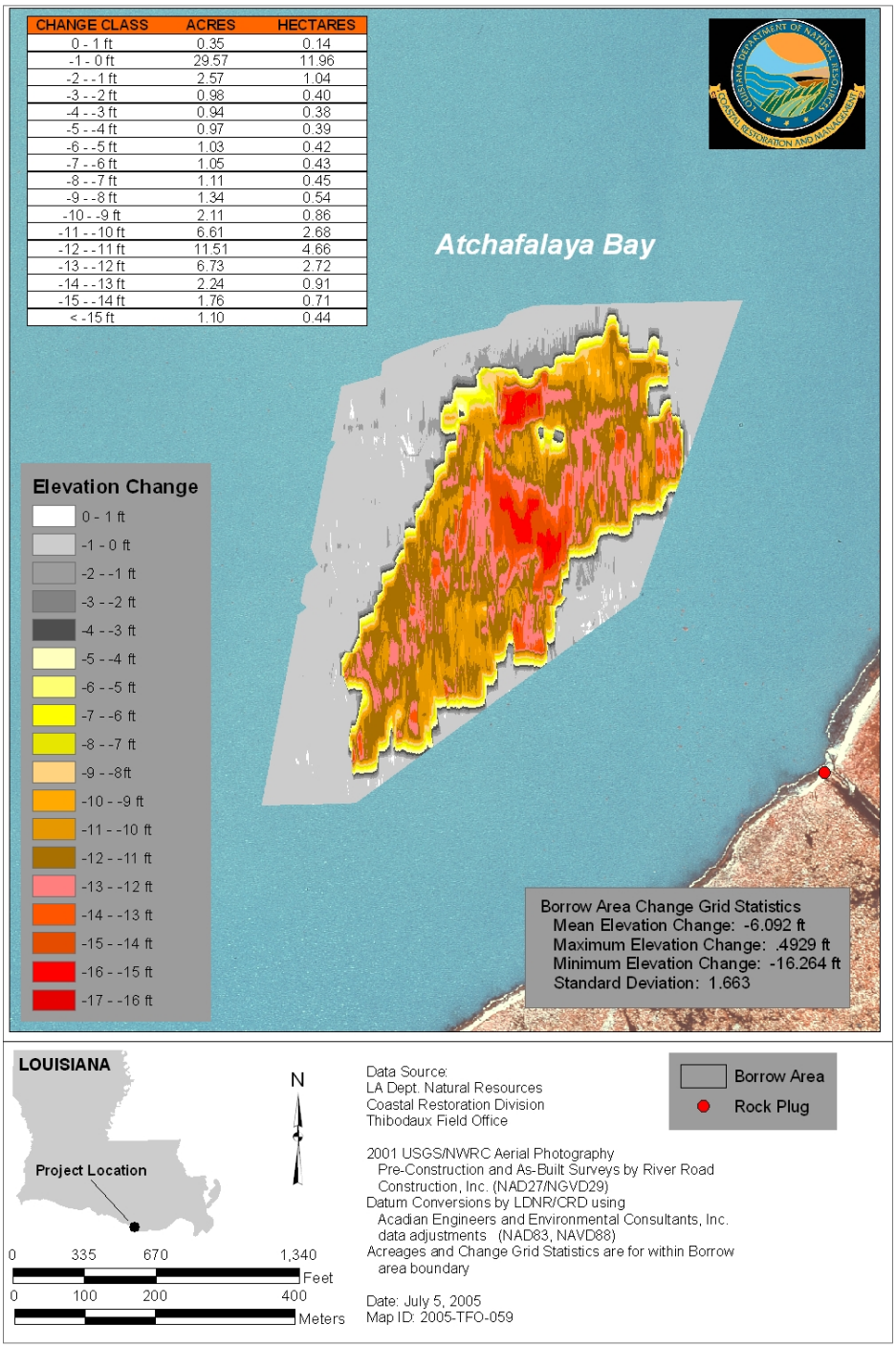

Figure 23. Change class acreages for the pre-construction (1999) versus as-built (1999) elevation surveys of the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

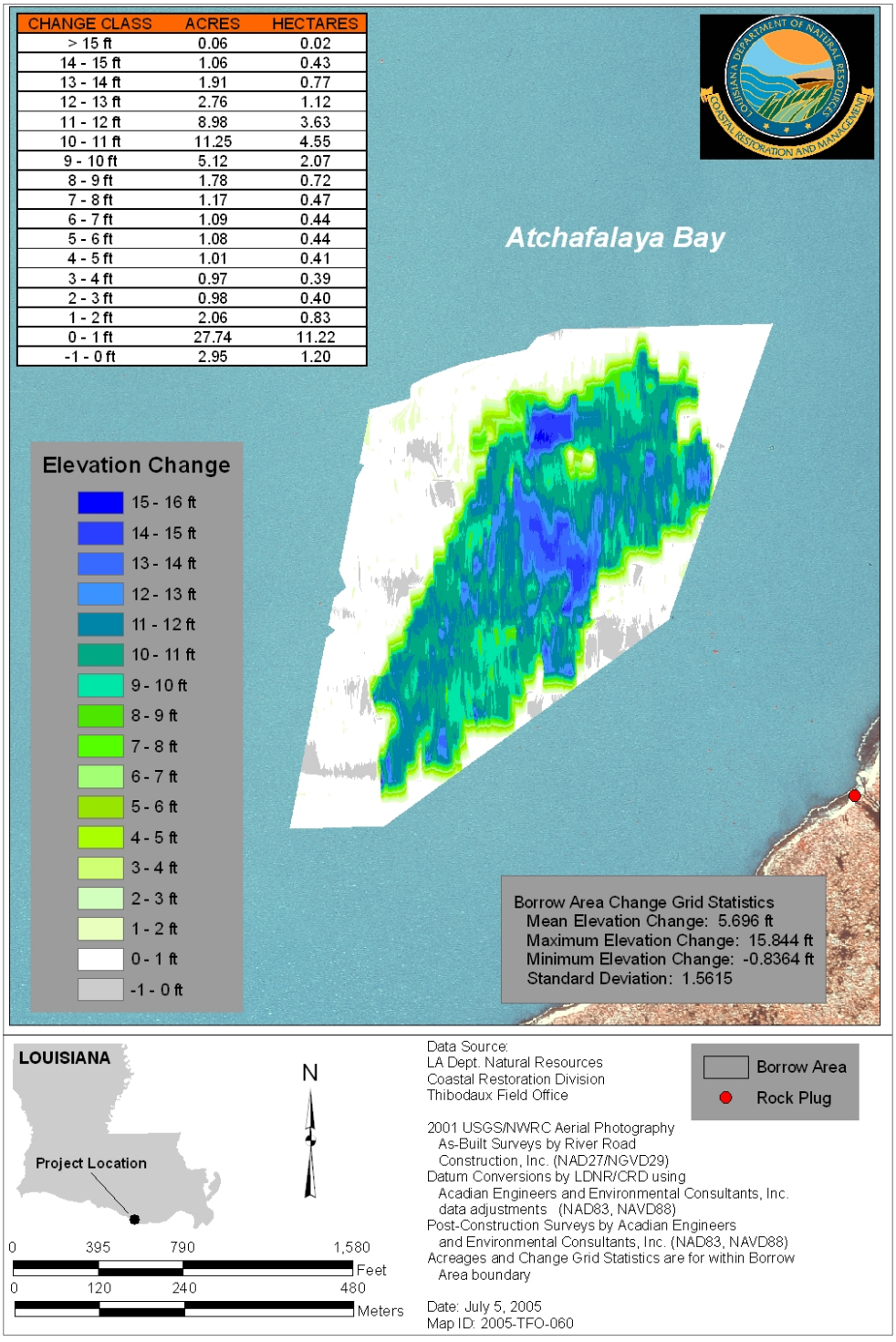

Figure 24. Change class acreages for the post-construction (2004) versus as-built (1999) elevation surveys of the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

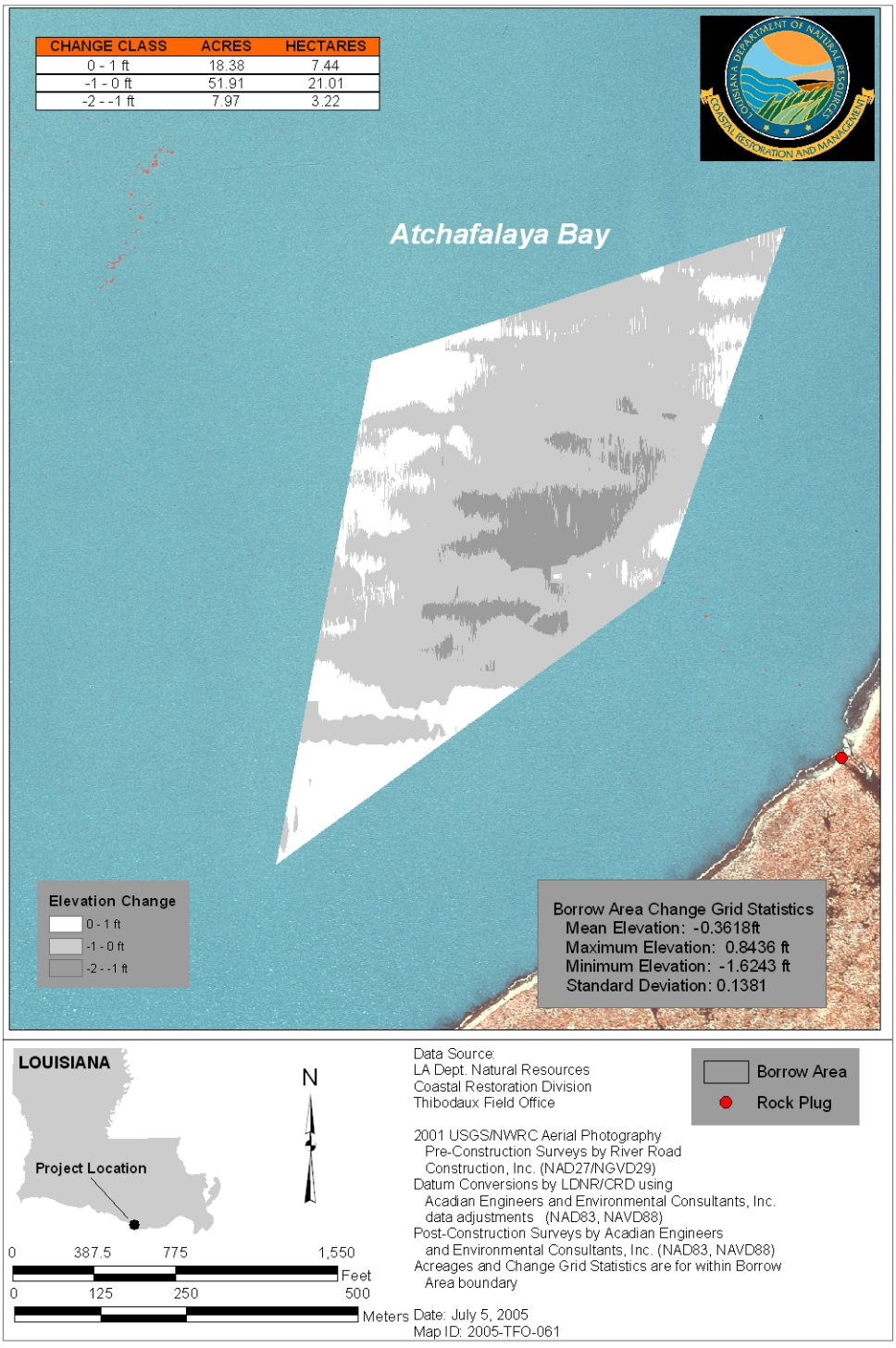

Figure 25. Change class acreages for the post-construction (2004) versus pre-construction (1999) elevation surveys of the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

V. Conclusions

a. Project Effectiveness

Five years post-construction shows 139.5 acres of marsh was created as a direct result of the dredge material placement and the subsequent installation of *S. alterniflora* plantings. The project goal was to create 168 acres, which results to a 28-acre shortage. The acreage created in the fill area may have created enough of a hydrologic separation of the Alligator Bayou and Locust Bayou to restore the historical hydrology; however, this remains inconclusive. Additionally, land water analysis indicates continued land loss inside the project boundary.

The installation of the *S. alterniflora* proved beneficial and effective in establishing rapid vegetative cover on the created marsh platform. The as-built vegetation data showed no plants growing in the marsh creation area; however, four years after planting data indicate approximately 88% vegetative cover and several other species present where the elevation is conducive for plant growth. Conversely, those areas that did not increase in elevation or meet the target elevation have no emergent vegetative growth.

The project features are demonstrating some effectiveness as it relates to the water level within the project area. Mean weekly water levels from the project stations were 0.01 ft less than the reference stations pre-construction and 0.05 ft less for during the post-construction period. On the other hand, the hourly change variability increased slightly within the project area, from 0.10 ft to 0.11 ft, whereas the reference area remained the same at 0.14 ft for both time periods. Visser (2007) showed a reduced flood stress on the dominant plant species at all stations.

Although not ecologically significant, the project features have not reduced the mean salinity readings amongst the project stations as much as the reference stations. The project stations showed a salinity reduction of 0.15 ppt versus the reference stations of 0.22 ppt between the pre- and post-construction data. The overall mean salinity readings for the pre- and post-construction periods are within the mesohaline (5-18 ppt) classification for estuarine marshes.

b. Recommended Improvements

The relocation of the project continuous recorder stations is being evaluated internally among LDNR personnel. The current location places them outside of the project features. There were concerns that moving the stations might cause servicing issues for LDNR and contractor personnel since they may be more difficult to visit. Relocation of stations will be completed within the next OM&M report's time frame.

As part of the annual inspections, monitoring personnel along with the project's O&M engineer should investigate the pipeline corridor and marsh creation area. This would require a separate trip and the use of an airboat, but it would provide visual documentation of the area in years when there is no vegetation data collection.

c. Lessons Learned

Engineering:

- A major concern during construction involved the damage to existing marsh located along the access corridor extending from the Atchafalaya Bay to the dredge disposal area causing a scour effect adjacent to the plug along the shoreline. Specifications should be written such that the contractor is clearly responsible for repairing damage to existing marsh that occurs due to his operations, including the placement of fill and planting of vegetation as needed to restore damaged areas of marsh (D. Burkholder, Final Report n.d.). As mentioned in Section II – Maintenance Activity, a proposed dedicated dredge project is currently underway to close this corridor to the Atchafalaya Bay, creating approximately 150 acres of marsh.
- Another unforeseen event during and after construction was the erosion of the spoil banks and breaching encountered following the installation of the rock weirs caused by rerouting of water flows in the project area. Surveys of the watershed tributaries to the project area and collection of sufficient water level data prior to design should enable the development of a model capable of predicting these post-construction flow patterns (D. Burkholder, Final Report, n.d.).
- It is essential that adequate pre-project data are collected and a hydrologic model developed for future hydrologic restoration projects in order that the effects of plugging canals with weirs and channel liners may be better assessed and more precise design criteria established (D. Burkholder, Final Report, n.d.). Model development will also assist in determining the overall project effectiveness during post-construction evaluations.
- There were no as-builts for the project structures. Comparisons of what the intended elevations were and what they are now are impossible to make.

Monitoring:

- The budget should have included money for surveying the marsh creation and borrow area to conclusively determine if the target elevation was met. Surveying Locust Bayou would indicate how long the channel maintained the target depth, which was dredged to restore the historic hydrology of the area.
- Hourly continuous recorders are currently placed south (outside) of the weirs. Placing the recorders inside of the weirs and some distance away would have provided a more definitive answer about project effectiveness as it relates to the hydrology portion of the project.

- Reference constant recorder (TE26-02R) needs to be investigated for relocation due to silting in of the channel.
- In order to accurately determine if the project has altered flow patterns to a more natural state, the proper instrumentation should have been deployed prior to construction and after construction. Flow meters would better determine the change in hydrology along with continuous water level recorders. The information from both instruments would have been used for a hydrologic model.

VI. Literature Cited:

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Appendix A

Inspection Photographs

Photo 1 - (Structure No. 1) - Rock weir and timber barricade structure looking north.

Photo 2 - (Structure No. 1) - Rock weir and timber barricade structure looking east.

Photo 3 – (Structure No. 1) – Rock weir and barricade structure looking northeast.

Photo 4 – (Structure No. 3) – Articulated concrete mats tie-in to marsh on south side.

Photo 5 – (Structure No. 3) – Articulated concrete mats tie-in to marsh on south side.

Photo 6 – (Structure No. 3) – Rock weir on the south side of the structure.

Photo 7 – (Structure No. 3) – Rock weir tie-in to marsh on the north side of structure.

Photo 8 – (Structure No. 3) – Rock weir tie-in to marsh on the north side of the structure.

Photo 9 – (Structure No. 4) – Rock weir and timber barricade system looking west.

Photo 10 – (Structure No. 4) – Rock weir and timber barricades looking south.

Photo 11 – (Structure No. 5) – Rock weir and barricade system looking southeast.

Photo 12 – (Structure No. 5) – Rock weir and barricade system looking southeast.

Photo 13 – (Structure No. 5) – Rock weir and timber barricade system looking southeast.

Photo 14 – (Structure No. 6) – Rock weir and timber barricade system looking southeast.

Photo 15 – (Structure No. 6) – Rock weir and timber barricade system looking northeast.

Photo 16 – (Structure No. 6) – Rock weir and barricade system looking south.

Photo 17 – (Structure No. 7) – Rock weir and barricade system looking northeast.

Photo 18 – (Structure No. 7) – Rock weir and barricade system looking east.

Photo 19 - (Structure No. 7) - Rock weir and barricade system looking south.

Photo 20 - (Structure No. 9) - Rock weir and barricade system looking northeast.

Photo 21 – (Structure No. 9) – Rock weir and barricade system looking south.

Photo 22 – (Structure No. 9) – Rock weir and barricade system looking southeast.

Photo 23 – (Breach 3) – Breach in rock lined bank along oilfield canal.

Photo 24 – (Breach 3) – Opening in rock dike at the end of an existing oilfield canal.

Appendix B

Three Year Budget Projections

Lake Chapeau Marsh Creation/ Hydrologic Restortaion/ TE-26 / PPL 3

Three-Year Operations & Maintenance Budgets 07/01/2007 - 06/30/10

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Brian Babin	*Shane Triche*	*NMFS*	*Brian Babin*

	2007/2008	2008/2009	2009/2010
Maintenance Inspection	$ 5,407.00	$ 5,569.00	$ 5,736.00
Structure Operation			
Administration		$ 2,000.00	
Maintenance/Rehabilitation			

07/08 Description: Breach repair along existing marsh adjacent to Structure No.3

E&D	$5,000.00
Construction	$170,612.00
Construction Oversight	$15,000.00
Sub Total - Maint. And Rehab.	$ 190,612.00

08/09 Description: Secondary Monument Adjustment

E&D		
Construction		$ 10,000.00
Construction Oversight		
	Sub Total - Maint. And Rehab.	$ 10,000.00

09/10 Description:

E&D			
Construction			
Construction Oversight			$ -
		Sub Total - Maint. And Rehab.	$ -

	2007/2008	2008/2009	2009/2010
Annual O&M Budgets	$ 196,019.00	$ 17,569.00	$ 5,736.00

O &M Budget (3 yr Total)	**$219,324.00**
Unexpended O & M Funds (includes $230,000 request last year)	**$252,289.00**
Remaining O & M Budget (Projected)	**$32,965.00**

Appendix C

Field Inspection Notes

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.1

Inspector(s): S. Triche, B. Babin and E. Lear (all DNR)

Structure Description: 150 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good	Some settlement		1 thru 3	**Observation:**
					Observed the structure to be in good condition with some settlement noted.
Signage/					Timber Barracade system and signage was in good condition.
Supports	Good				
Warning	Removed				**Remarks:**
Capsule	in				From survey data obtained in June 2004 by Acadian Engineers, we were able to
Buoys	2004				estimate the settlement of the rock weir to be approximately 1.4 ft. from the design
					elevation of 0.0' NAVD. No as-built drawings are available.
Earthen	Good				
Embankment					The existing water gage located near the site (TE-26-03) indicated that the water
Timber					elevation at the time of the inspection was at -0.10' NAVD at 9:45 a.m.
Barracade	Good		None		
System					

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.3

Inspector(s): S. Triche, B. Babin and E. Lear (all DNR)

Structure Description: 230 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good				**Observations:**
					The structure at site no.3 appears to be in fair condition. As a result of hurricane Katrina, The marsh on the northern end of the structure had eroded back to the face of the rock embankment. Any further erosion on this side will cause a breach around the structure.
Signage/ Supports	Good				All signs and supports were in good condition
Timber Barracde System	not installed at this location				
Eathen Embankment	Good				**Remarks:**
					From our observations, it is highly likely that a breach will occur around the structure within the coming year should erosion continue.
					From the June 2004 survey of this structure, it was determined that the rock weir had settled approximately 1.0' from the design elevation of -4.17 NAVD.
					No as-builts were completed for this project.

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.4

Inspector(s): S. Triche, B. Babin and E. Lear (all DNR)

Structure Description: 175 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good				**Observations:**
Signage/ Supports	Good				The rock plug, earthen embankment tie-ins, barricade system, warning signs and supports were all in good condition.
Warning Capsule Buoys	Removed in 2004				
Eathen Embankment	Good				**Remarks:**
Timber Barrade System	Good				As noted in previous inspections, The two timber piling supporting the barricade system and signage in the center of the channel were found to be a little unstable. This is due to the piling being located in an existing channel where the embeddment of the piling is not as deep. DNR will continue to monitor these piling. At this time, there is no indication that the piling will fail.
					From the 2004 maintenance surveys, we determined that the rock weir has settled an average of 1.13 ft. from the design elevation of -0.16 NAVD.

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.5

Inspector(s): S. Triche, B. Babin and E. Lear (All DNR)

Structure Description: 70 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good	Some settlement			**Observation:**
Signage/ Supports	Good				The rock weir, earthen tie-ins, embankments, barricade system, warning signs and supports all appeared to be in good condition. The water level at the time of the inspection was very low with a portion of the rock weir exposed.
Warning Capsule Buoys	Removed in 2004				
Earthen Embankment	Good				**Remarks:** As indicated from the 2004 maintenance survey, it was determined that the rock weir has settled an average of 0.14' from the original design elevation of -0.14 NAVD.
Timber Barricade System	Good				No as-built drawings were prepared for this project.

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.6

Inspector(s): S. Triche, B. Babin and E. Lear (All DNR)

Structure Description: 145 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good				**Observation:**
					The rock weir, earthen embankments, barricade system, signs and supports were all
Signage/					in good condition.
Supports	Good				
Warning	Removed				
Capsule	in				
Buoys	2004				**Remarks:**
					It was estimated from the 2004 maintenance survey that the rock weir had settled
Earthen	Good				an average of 1.12 ft. from the design elevation of -0.13 NAVD.
Embankment					
Timber					
Barricade	Good				
System					

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.7

Inspector(s): S. Triche, B. Babin and E. Lear (all DNR)

Structure Description: 157 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good				**Observation:**
					The rock weir, tie-ins, earthen embankments, timber barricade system, signs and
Signage/					supports were all in good condition with no apparent damage or breaches.
Supports	Good				
Warning	Removed				**Remarks:**
Capsule	in				
Buoys	2004				The survey profile of the rock weir performed in 2004 revealed that the rock weir had
					settled an average of 1.66 ft. from the design elevation of -0.14 NAVD.
Earthen	Good				
Embankment					

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Site No.9

Inspector(s): S. Triche, B. Babin and E. Lear

Structure Description: 240 linear ft. rock plug

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good				**Observations:**
Signage/ Supports	Good				The rock weir, tie-ins, earthen embankments, timber barricade system, signs and supports were all in good condition.
Warning Capsule Buoys	Removed in 2004				
Earthen Embankment Timber Barricade System	Good				**Remarks:** From the 2004 maintenance surveys, it was determined that the rock weir had settled an average of 1.7' from the original design elevation of -0.14 NAVD.

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: **TE-26 Lake Chapeau Marsh Creation**

Date of Inspection: 02/07/2007

Structure No. Breach No.3

Inspector(s): S. Triche, B. Babin and E. Lear (all DNR)

Structure Description: Breach repair performed as change order during Construction.

Water Level Inside: N/A Outside: N/A

Type of Inspection: Annual

Weather Conditions: Clear Skies and Mild Temp.

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Rock Rip-Rap	Good				**Observation:**
Eathen Embankment	Good				The rock rip-rap breach repair appeared to be in good condition with no noticeable settlement of the work weir. However, we did notice several breaches in the earthen embankment leading to the rock weir at the end of the location canal.
					Remarks:
					From previous inspections and converstations with LDNR personnel who were involved with the construction of this breach repair, the earthen embankments along the canal leading to breach 3 rock weir were refurbished. Currently, there are several breaches in the earthen embankment which have developed over the past few years that may require repair in the future. LDNR will evaluate the condition of these breaches on future site visits and develop a plan of action for repairs, if needed.

Appendix D

Elevation Contour Maps

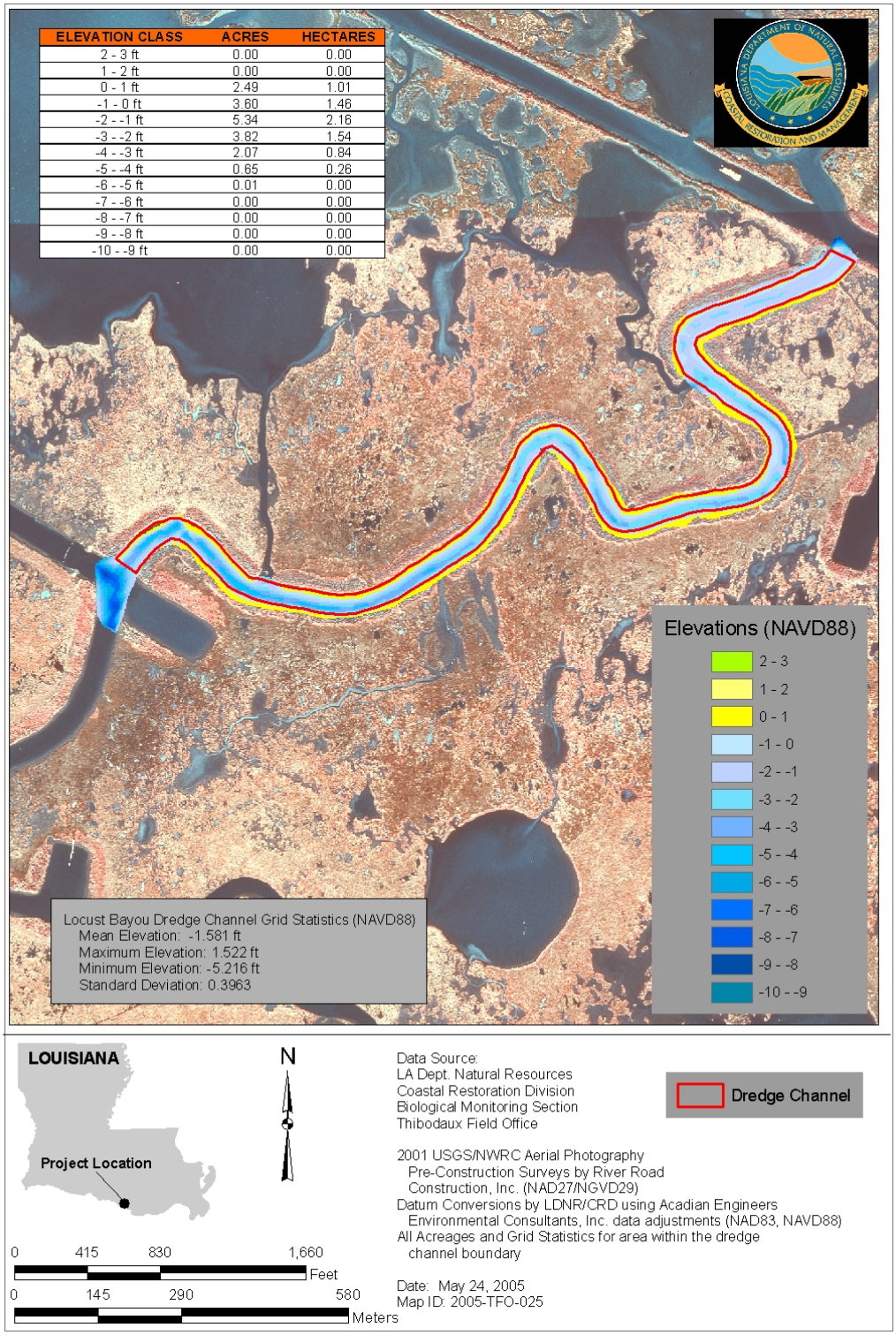

Figure 1. Contour elevation acreage for the pre-construction elevation survey of the Locust Bayou dredge channel for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

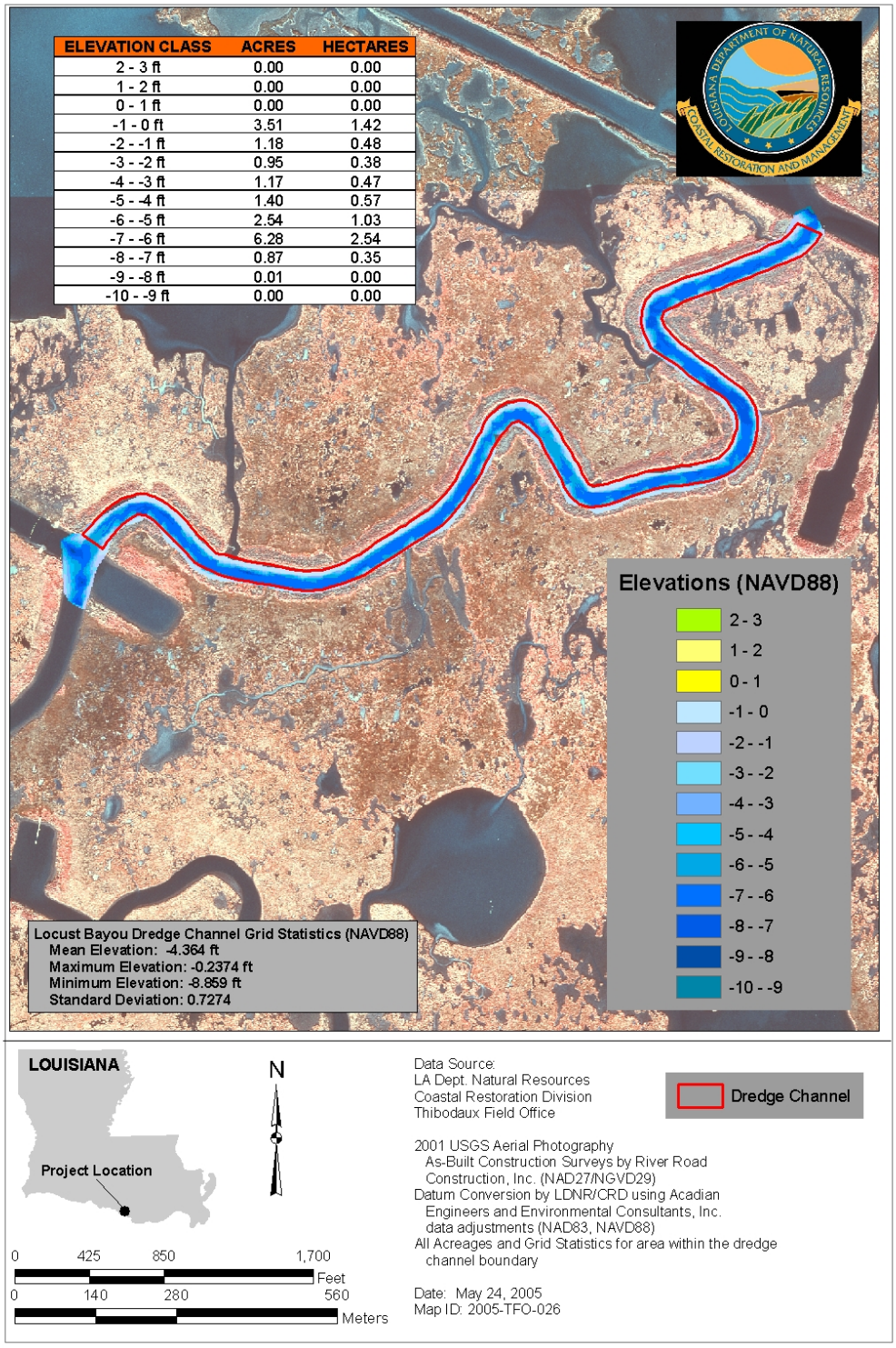

Figure 2. Contour elevation acreage for the as-built elevation survey of the Locust Bayou dredge channel for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

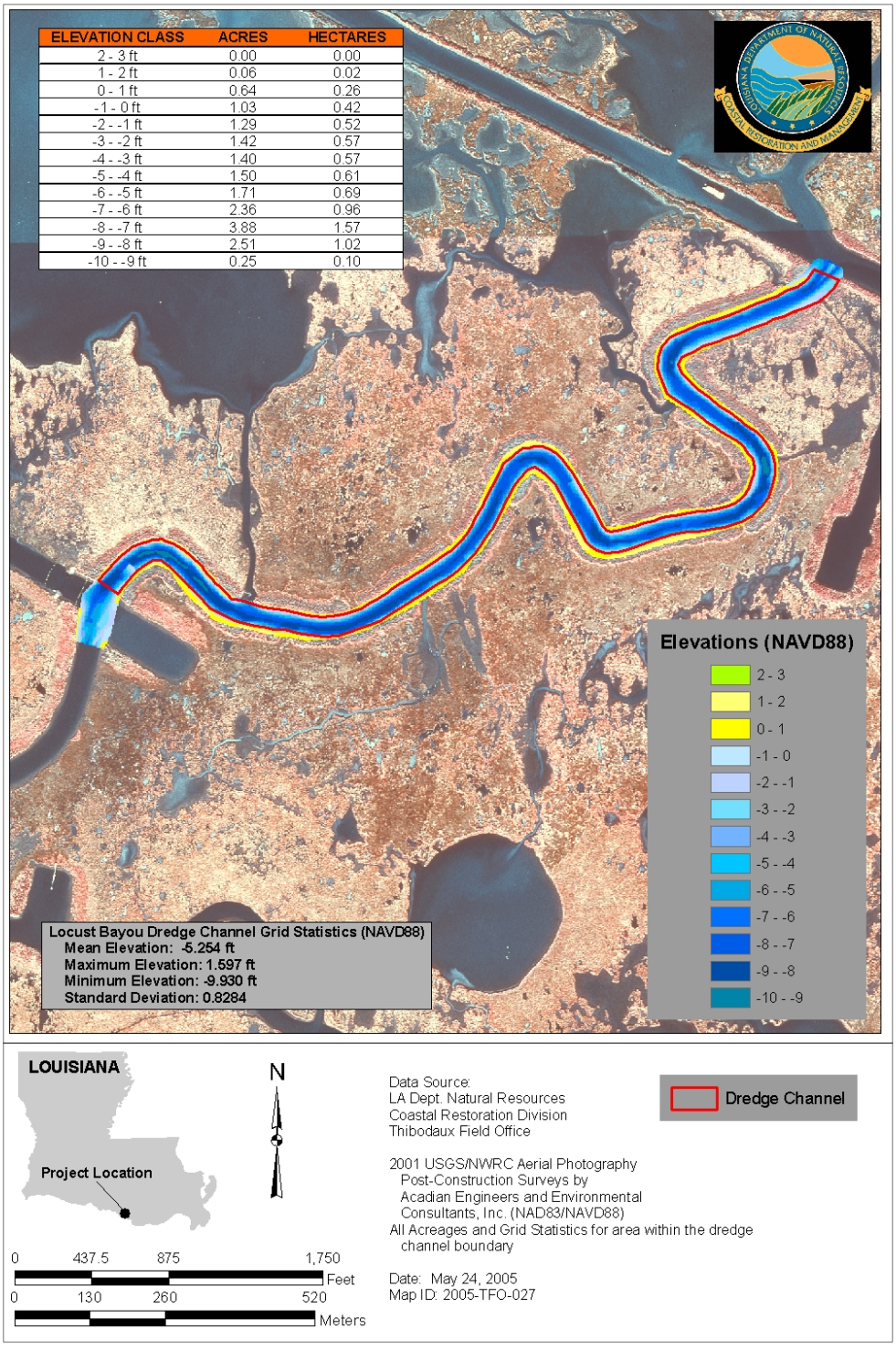

Figure 3. Contour elevation acreage for the post-construction elevation survey of the Locust Bayou dredge channel for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

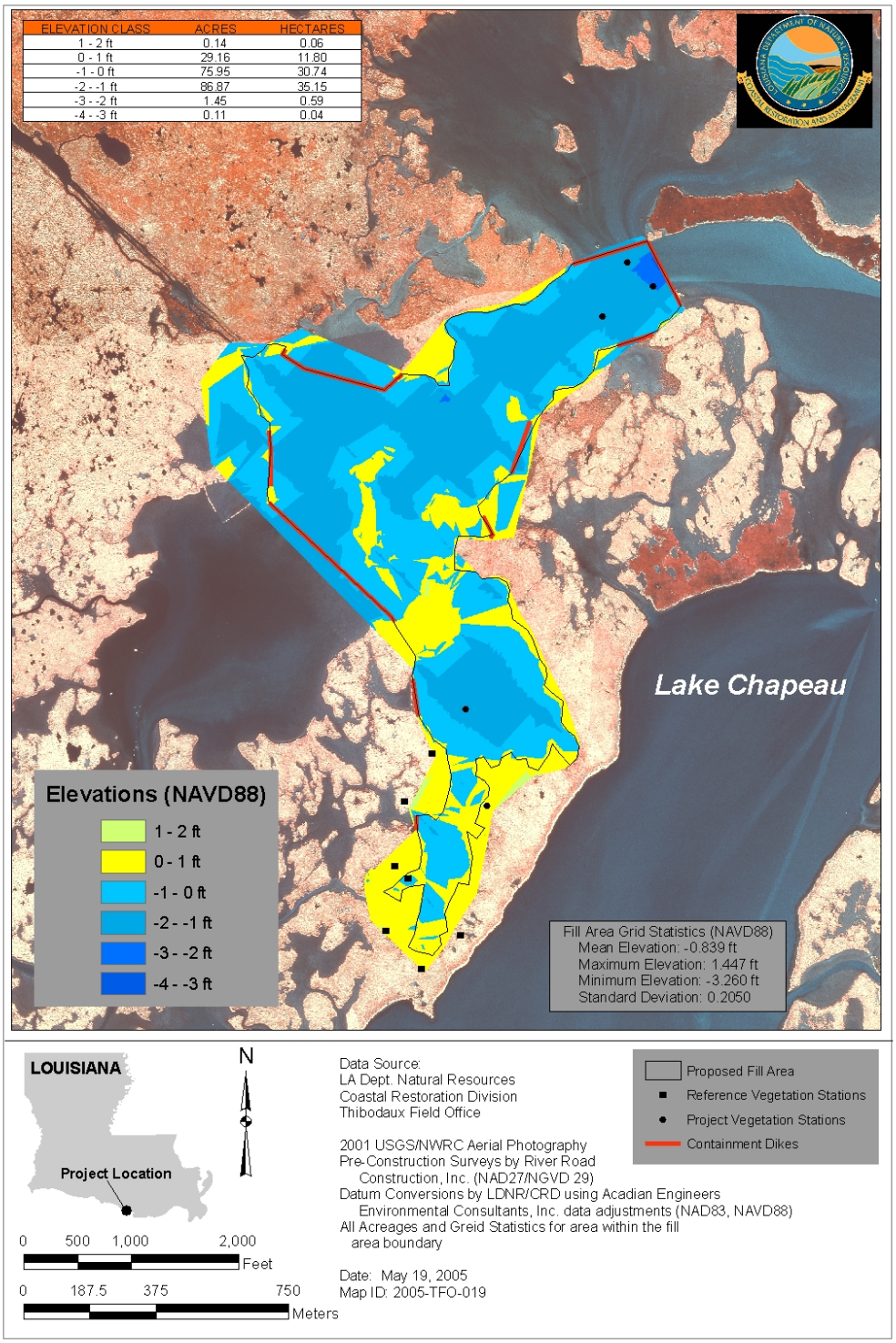

Figure 4. Contour elevation acreage for the pre-construction elevation survey of the fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

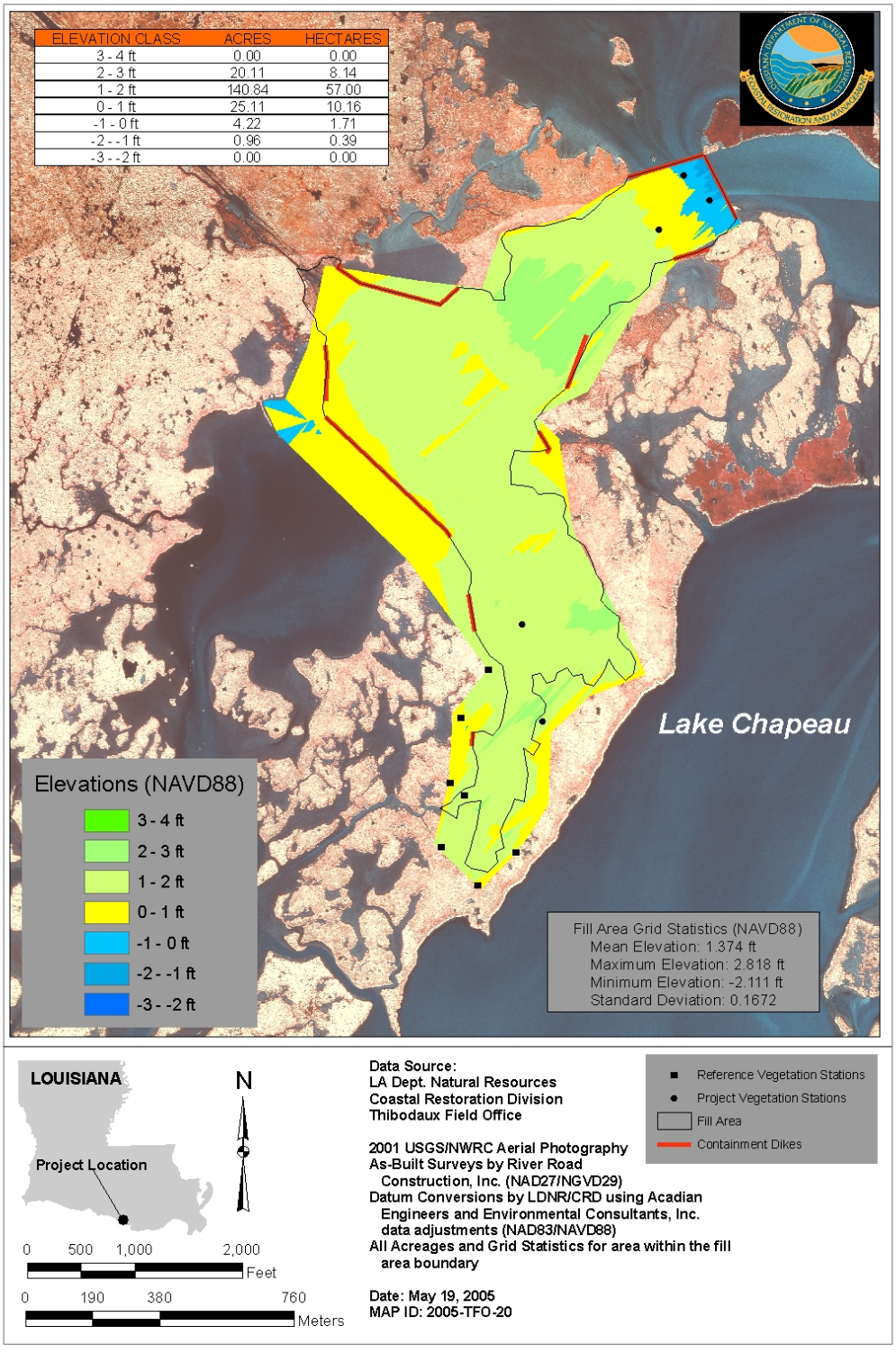

Figure 5. Contour elevation acreage for the as-built elevation survey of the fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

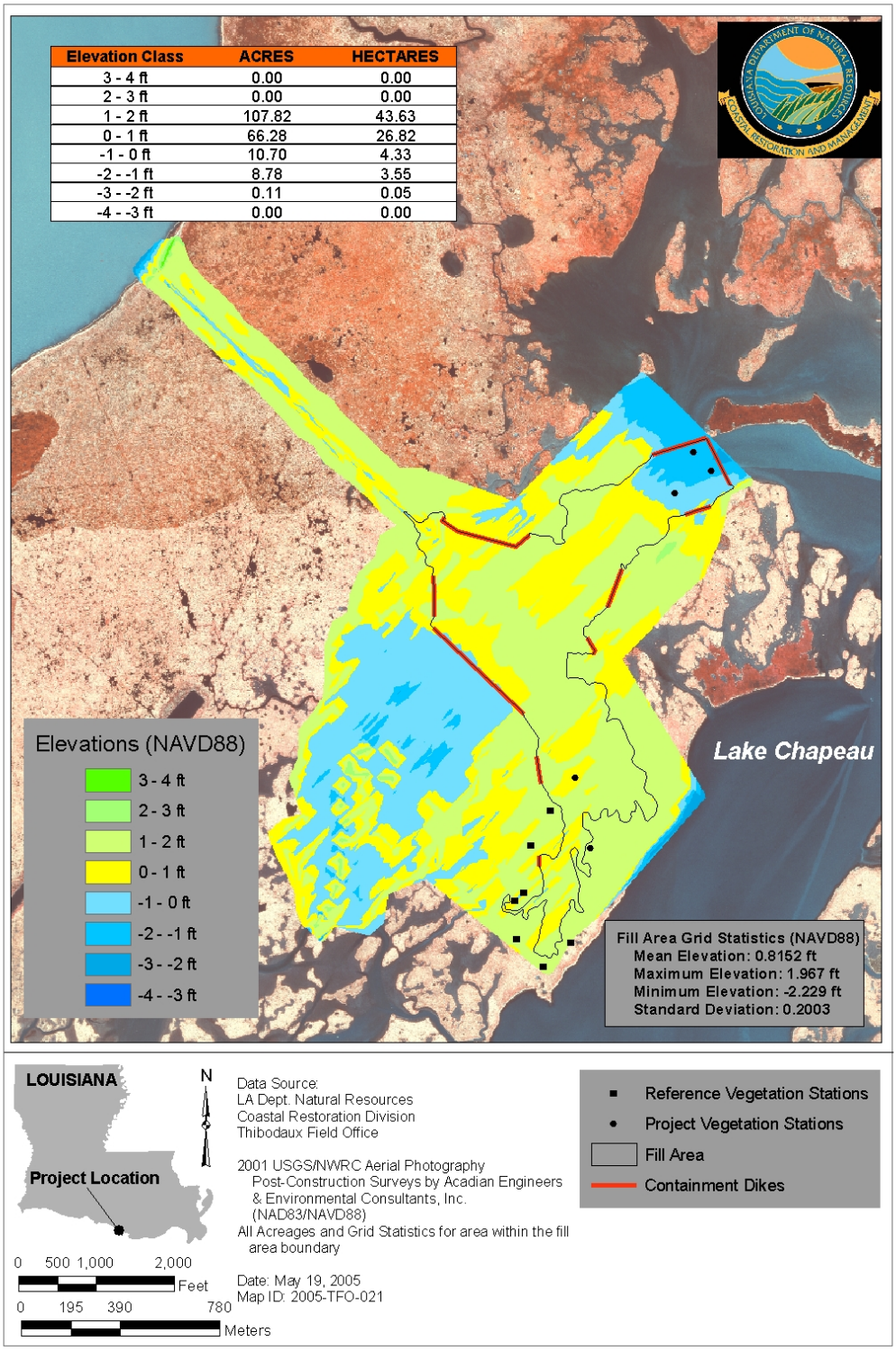

Figure 6. Contour elevation acreage for the post-construction elevation survey of the fill area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

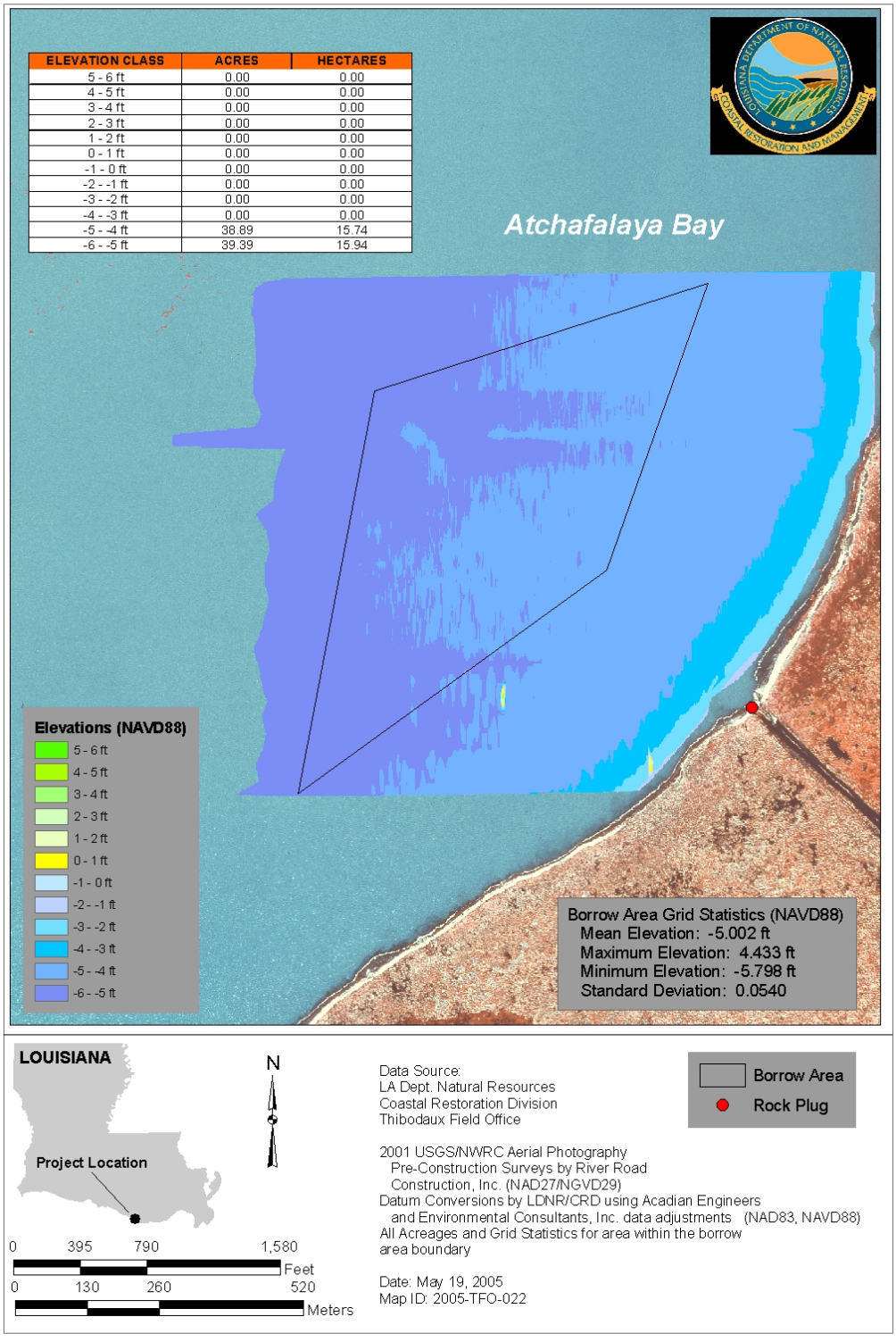

Figure 7. Contour elevation acreage for the pre-construction elevation survey of the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

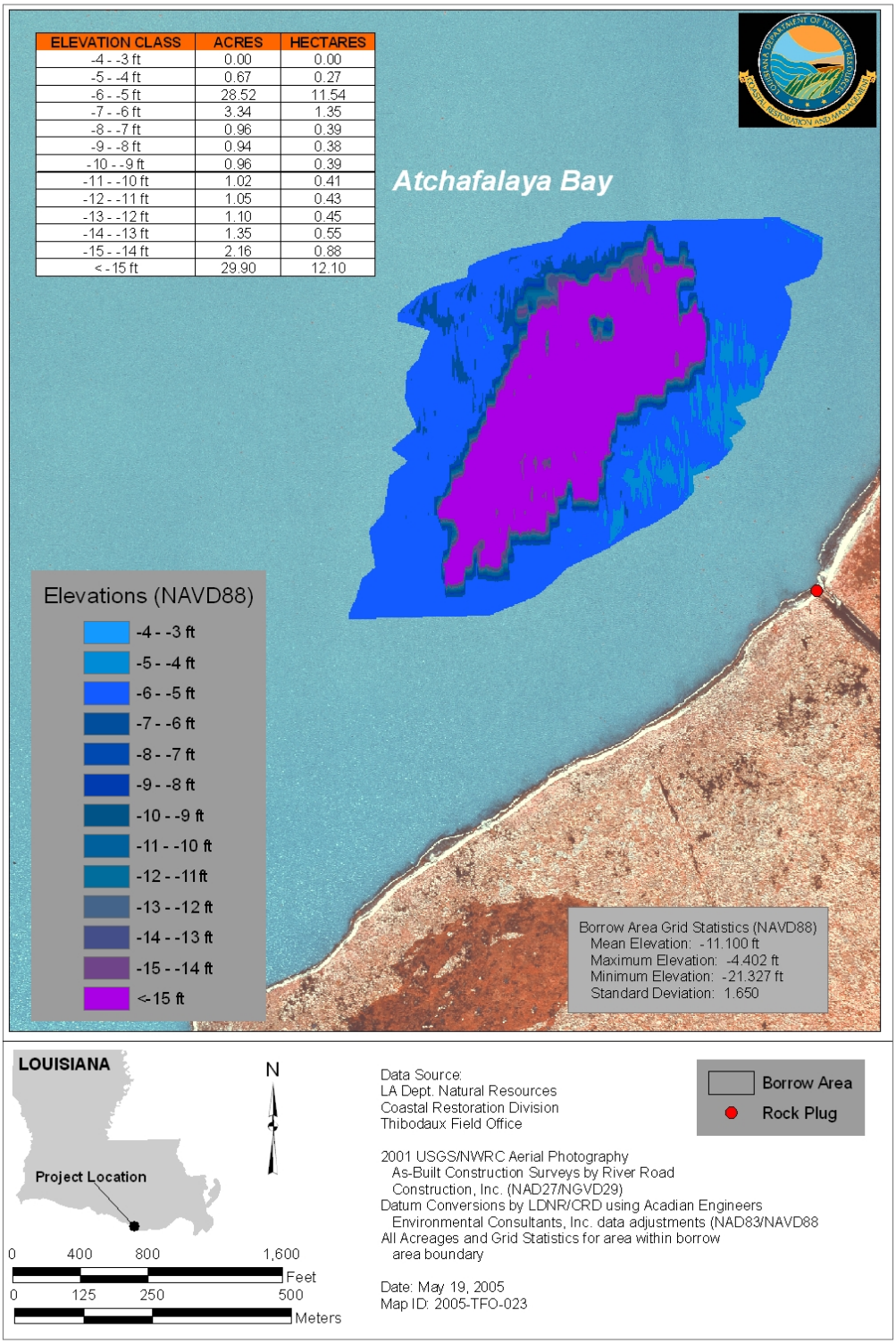

Figure 8. Contour elevation acreage for the as-built elevation survey of the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.

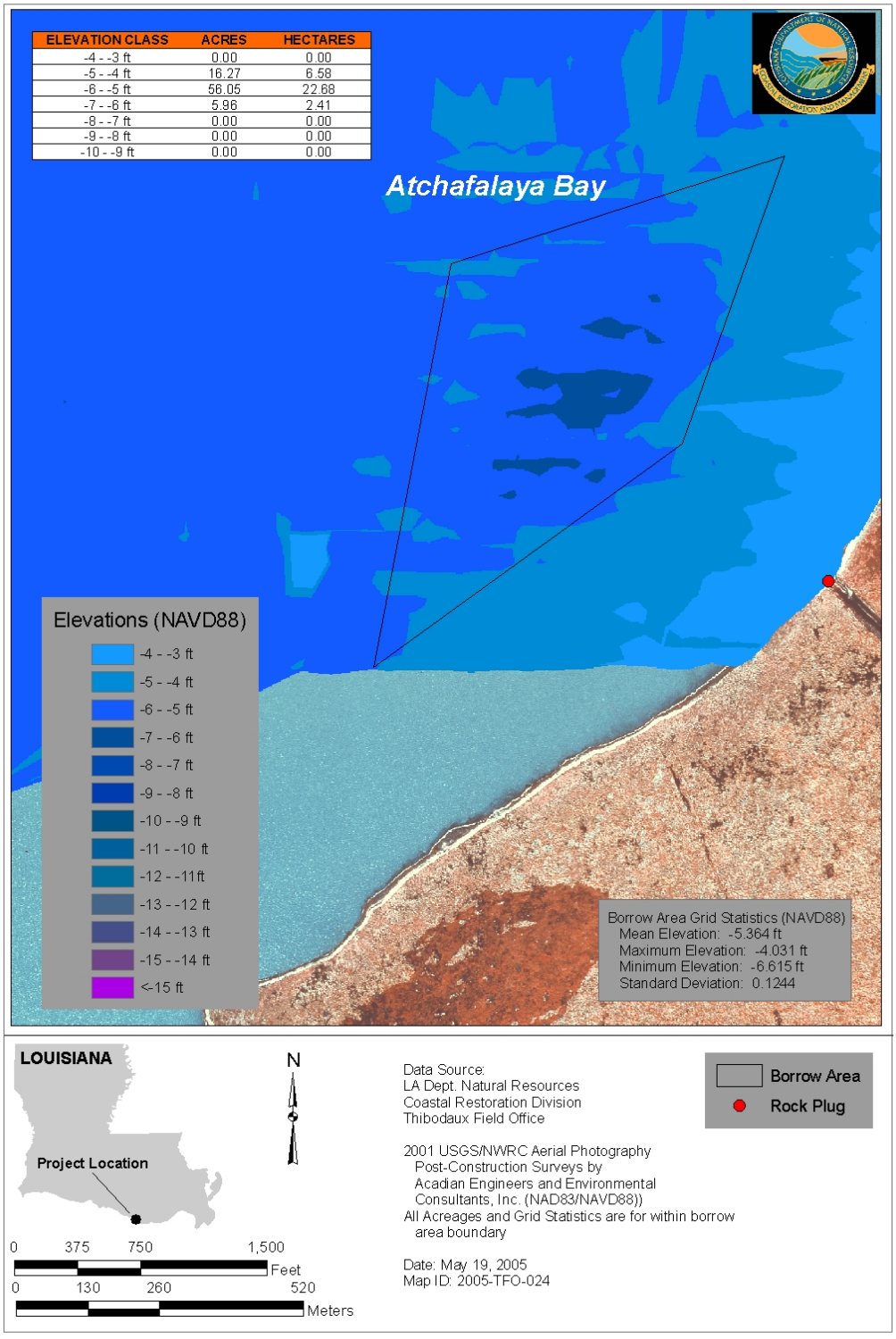

Figure 9. Contour elevation acreage for the post-construction elevation survey of the borrow area for the Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project.