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Coastal Protection and Restoration of Louisiana

Office of Coastal Protection and Restoration

2010 Operations, Maintenance, and Monitoring Report

for

Humble Canal Hydrologic Restoration (ME-11)

State Project Number ME-11
Priority Project List 8

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Lafayette Parish

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Operations, Maintenance and Monitoring Report
For
Humble Canal Hydrologic Restoration (ME-11)

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Preface

The 2010 OM&M Report format is a streamlined approach which combines the Operations and Maintenance annual project inspection information with the Monitoring data and analyses on a project-specific basis. This new reporting format includes monitoring data collected through December 2009, and annual Maintenance Inspections through October 2009.

The 2010 report is the 2nd report in a series of reports. For additional information on lessons learned, recommendations and project effectiveness please refer to the 2003 Operations, Maintenance, and Monitoring Report on the LDNR web site (Price and Guidry, 2004).

I. Introduction

The Humble Canal Hydrologic Restoration project area encompasses 4,030 acres (1,228 ha) of fresh marsh in Cameron Parish, Louisiana (figure 1). The project area is bounded by Little Chenier Ridge to the south, the Mermentau River to the east, and oilfield canals to the north and west.

Land loss data indicate that, from 1932 to 1990, approximately 826 acres (334 ha) of land were converted to open water in the Humble Canal project area. Land alteration, including the construction of Humble Canal in the 1950's and dredging of the Mermentau River to facilitate greater commercial use, has resulted in excessive water levels in some areas and saltwater intrusion from the south and east.

To aid in the removal of excess water without permitting saline water into the project area, five 48-inch culverts with variable crest weir inlets and flap gated outlets were constructed in an oilfield access canal north of Marseillais Bayou. Construction began in September 2002 and ended with implementation in March 2003.

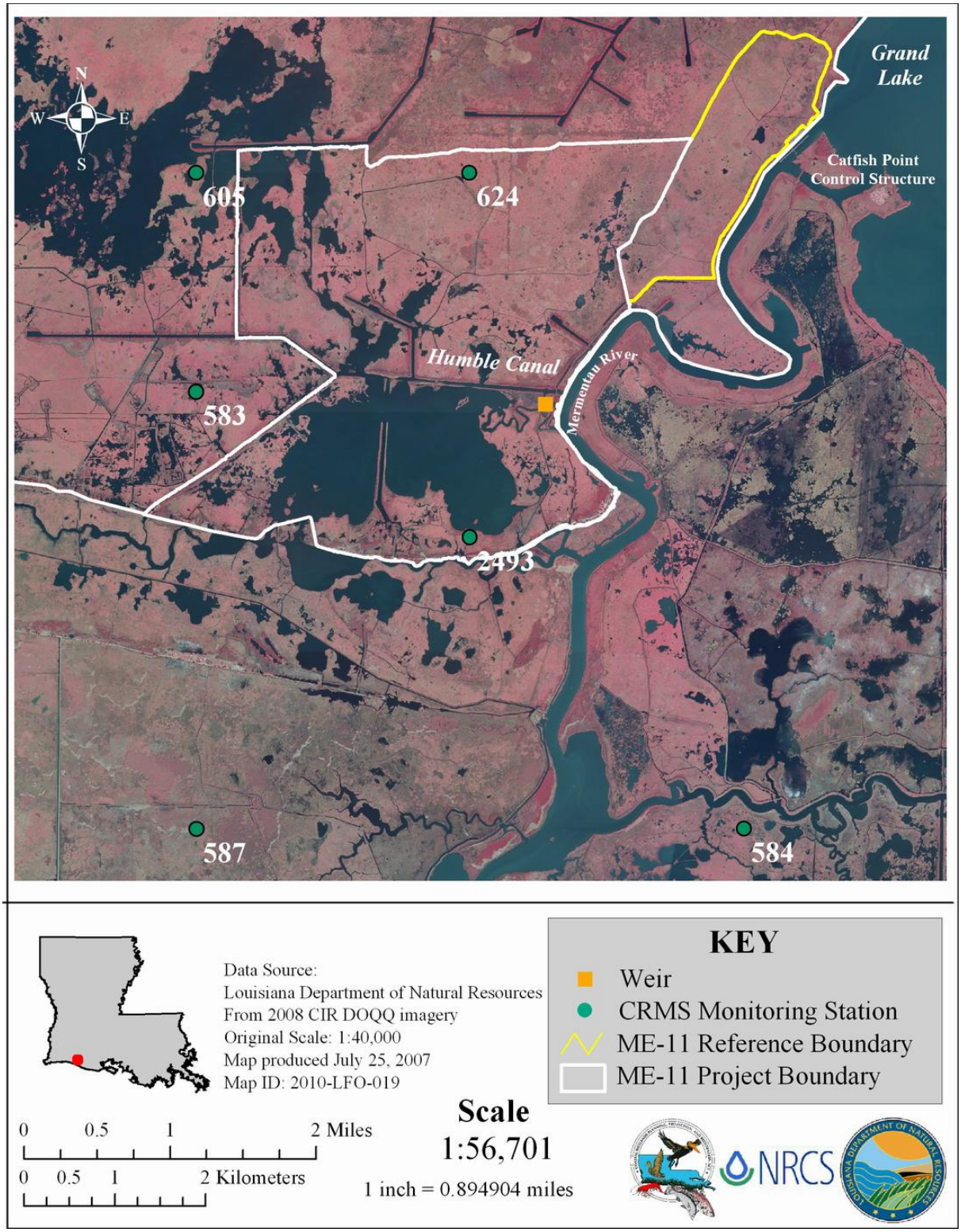

Figure 1. Humble Canal Hydrologic Restoration Project (ME-11); project and reference areas, weir location, and CRMS sites.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Humble Canal Hydrologic Restoration Project (ME-11) is to evaluate the constructed project features, 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, OCPR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs (O&M Plan, 2003). The annual inspection report also contains a summary of maintenance projects, if any, 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. The three (3) year projected operation and maintenance budget is shown in Appendix B.

An inspection of the Humble Canal Hydrologic Restoration Project (ME-11) was held on November 6, 2009 under sunny skies and mild temperatures. In attendance were Mel Guidry from OCPR, along with Dale Garber representing NRCS, Dave Foster with Acadian Engineers and Tal McCain with M&M Electric. All parties met at a boat launch off of Little Chenier Road, and traveled north to the Humble Canal Project Site. The annual inspection began at approximately 8:00 a.m. at the marine barrier on the juncture of the Humble Canal Project Outfall Channel and the Mermentau River.

The field inspection included a complete visual inspection of all project features. Staff gauge readings where available were used to determine approximate elevations of water, earthen embankments, water control structure and other project features. Photographs were taken at each project feature (see Appendix A) and Field Inspection notes were completed in the field to record measurements and any notable deficiencies (see Appendix C).

b. Inspection Results

<u>Marine barrier fence</u>

The structure is in excellent condition and the warning signs were recently replaced as part of a maintenance event. (Photos: Appendix A, Photo 1)

Hyacinth guard

This feature is in good condition and also was part of the recent maintenance event to replace all of the wire fence material as well as repair of the hyacinth wooden pilings and bracing. (Photos: Appendix A, Photo 2)

Water control structure

Overall, the structure is in good post construction condition. As part of the recent maintenance event rock armor was placed on the ends of the wingwalls on the inlet and outlet side of the structure. Crushed stone aggregate was also placed on the top portion of the structure. M & M Electric hired the services of a diver to check and clear out all flapgates. Several items were found wedged in the gates including a portion of an old lifting arm. Miscellaneous repairs were made to the flap gates, stoplogs and locking arms. Southside Machine fabricated an aluminum storage box for locking arms and stoplogs and was placed on Miami Corporation property off of Little Chenier Road. This storage box was added to the contract as a means to prevent vandalism. (Photos: Appendix A, Photos 3-5)

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

ii. Programmatic/ Routine Repairs

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since March 2003, the construction completion date of the Humble Canal Hydrologic Restoration Project (ME-11).

2009 M & M Electric – Repairs were made to the structure to repair storm damage as well as routine maintenance repairs. Forty five (45) tons of rock rip rap were placed around the wingwalls. Sixty tons (60) tons of crushed stone aggregate were placed on top of the structure along with five-hundred (500) square yards of geotextile fabric. Repairs were made to the hyacinth guard, flap gates, locking arms and stop logs. Two warning signs were replaced at the marine vessel barrier. The costs associated with this maintenance event were as follows:

E & D, Construction Oversight, As Builts	$15,314.00
Construction Contract (Incl. C.O. # 1)	$59,300.00

TOTAL	**$74,614.00**

III. Operation Activity

a. Operation Plan

Operation, Maintenance, and Monitoring Plan

Funding of the Humble Canal project includes funds specifically dedicated for operation and maintenance. The La DNR will be responsible for the maintenance, monitoring, and replacement of project elements through the 20-year life of the project. Operation of the structure will be done by Miami Corporation without CWPPRA funding.

Structure Operational Scheme

18" diameter marine ingress structure with screwgate	< 6 ppt at structure	Screw gate open
	≥ 6 ppt at structure	Screw gate closed
Five 48" diameter water control structures with stoplogs and flap gates	1.2' NA VD88 (marsh elevation)	Flaps operating stoplogs adjusted to achieve water level at marsh elevation

Safety Factors:

1) If interior *Panicum hemitomon* marsh has salinity reading exceeding 2 ppt, the 6 ppt structure closing criteria will be adjusted downward accordingly to insure protection of the marsh resource.
2) If excessive water levels occur as a result of rainfall or other event, the stoplogs will be lowered as necessary to allow excess water to be removed until water level reaches 1.2' NA VD88 (marsh level).

b. Actual Operations

In accordance with the operation schedule outlined in the Operation and Maintenance Plan, the structure was operated as required, by Miami Corporation personnel at no cost to LDNR. At present, Miami Corporation continues to operate the structure according to the permitted operational plan at no cost to OCPR. However, an amended land rights agreement is being prepared which will allow OCPR to bid out the operations of the structure to an outside contractor. Post Hurricane IKE, the Cameron Drainage District had to breach the levee to remove excess water.

IV. Monitoring Activity

a. Monitoring Goals

The objective of the Humble Canal Hydrologic Restoration Project is to improve removal of excess water without permitting saline water into the freshwater marsh of the project area.

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

1. Increase present (yr 2000) land to water ratio.

2. Maintain mean water levels in the project area between 6 in below and 2 in above marsh level.

3. Maintain mean monthly salinity (0–3 ppt) in the project area after construction and prevent salinities from exceeding 7 ppt.

4. Increase or maintain the occurrence and cover of fresh marsh vegetation species in the project area.

5. Increase frequency of occurrence of submerged aquatic vegetation (SAV) in the project area.

b. Monitoring Elements

Aerial Photography:
Near-vertical color-infrared aerial photography (1:12,000 scale) was used to measure land to open water ratios and land change rates for the project and reference areas. The photography was obtained in 2000 prior to project construction and post construction in 2005. Closeout photography will be obtained in 2017. Aerial photography was checked for flight accuracy, color correctness, and clarity, and was scanned, mosaicked, and geo-rectified by USGS/NWRC personnel according to standard operating procedures (Steyer et al. 1995, revised 2000).

Water level:
To monitor water levels, two continuous data recorder and staff gauge stations were deployed; one in the project area and one in the Mermentau River (figure 2). Water level data were used to determine if project area water level was being maintained within the target range. Monitoring of project area ceased in April, 2004 and CRMS monitoring in the project area began in November, 2006.

Salinity:
Salinity was monitored monthly at permanent discrete sampling stations within the project area until 2003 and with continuous data recorders in the project and reference areas as well as at CRMS sites. Discrete salinity data were used to characterize the spatial variation in salinity throughout the project area, and to determine if project area salinity was being

maintained within the target range. Continuous recorders at ME11-01R and CRMS sites were used to monitor target salinity after November, 2006.

Emergent Vegetation:

To assess the impact of the project on vegetation, vegetation monitoring stations were established systematically along transects throughout the project and reference area (figure 2). Stations were monitored using a modified Braun-Blanquet sampling method as outlined in Steyer et al. (1995). Percent cover, height of dominant species, and species richness was documented in 4 m^2 sampling plots. Vegetation was evaluated at the sampling sites in the fall of 2000 (pre construction) and in the fall of 2003 (post construction). A subset of the vegetation stations were sampled after Hurricane Rita in 2005, 2006, 2007 and 2008. Beginning in 2006 vegetation was monitored at CRMS sites.

Individual species' cover data from project specific monitoring and CRMS stations were summarized according to the Floristic Quality Index (FQI) method utilized by CRMS (Cretini et al. 2009) where cover is qualified by scoring species according to whether they are generally associated with disturbance or stability.

Submerged Aquatic Vegetation (SAV):

The effect of the project on SAV abundance was determined by comparing SAV abundance before and after project construction. Three ponds were sampled in the project area and three in the reference with two transects sampled in each pond (figure 2). Frequency of SAV occurrence was determined by methods described in Chabreck and Hoffpauir (1962) and Nyman and Chabreck (1995). SAV was evaluated in the fall of 2000 (pre construction) and in the fall of 2003 (post construction).

CRMS Supplemental

Additional data was collected at CRMS-*Wetlands* stations (figure 1). Data types collected at CRMS sites include hydrologic, emergent vegetation, physical soil characteristics, discrete porewater salinity, marsh surface elevation change, vertical accretion, and land:water analysis of 1 km^2 area encompassing the station (Folse et al., 2008). For this report, hydrologic and vegetation data were used to assess project goals and soil characteristic data were used to provide contextual information for the project. Data were utilized from two sites within the project area (CRMS0624 – northern project area and CRMS2493 – southern project area) and from CRMS reference sites adjacent to the project area (CRMS0583 and CRMS0605) and a CRMS reference site in the region under similar hydrologic conditions but without management (CRMS0584).

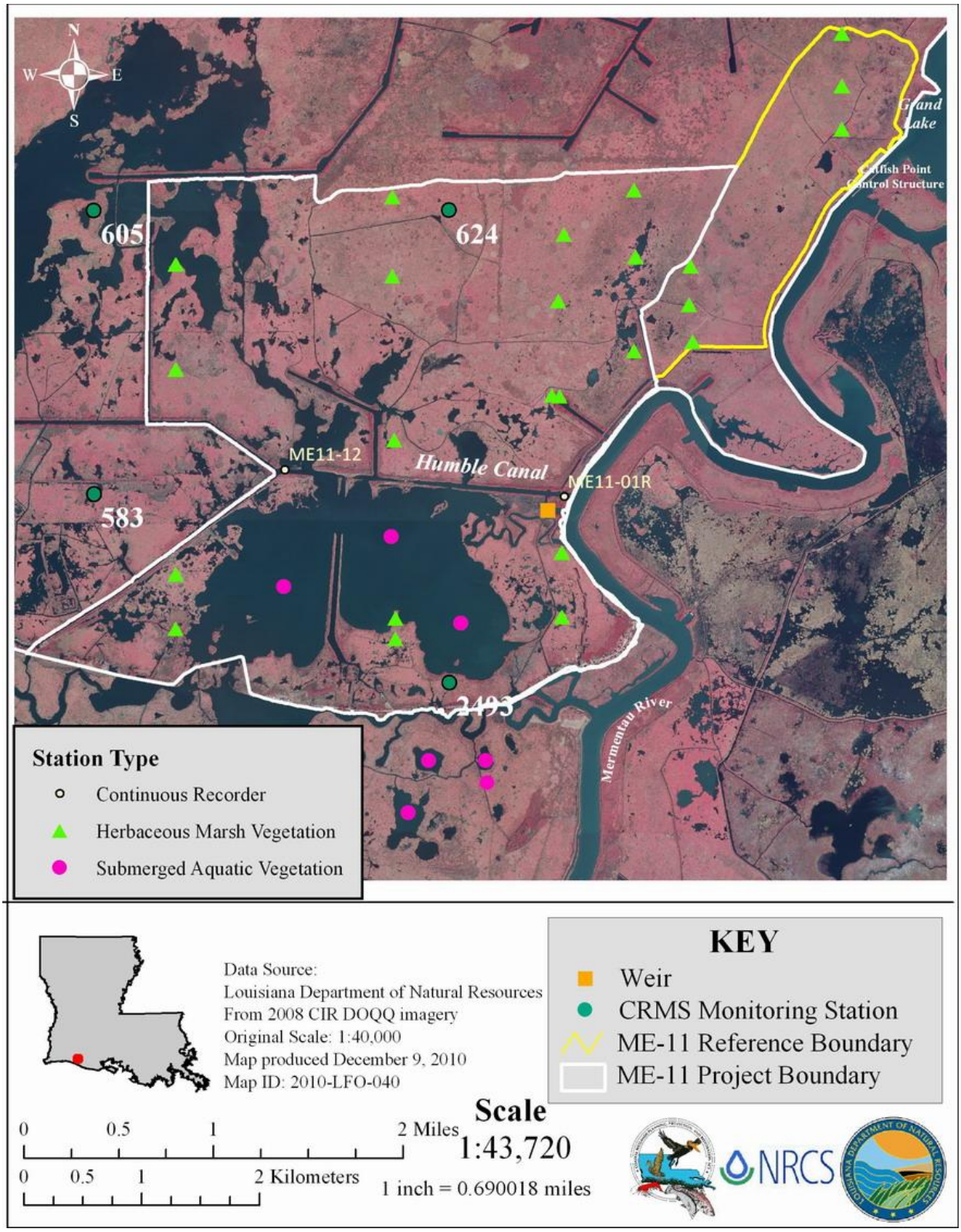

Figure 2. ME-11 project and reference area with locations of continuous data recorders, vegetation and SAV stations, and CRMS sites.

IV. Monitoring Activity (continued)

c. Preliminary Monitoring Results and Discussion

Aerial photography:

Land:Water analysis of project and reference areas was conducted on November 20, 2000 (figure 3) and October 25, 2005 (figure 4). The project goal was to increase the Land:Water ratio from 2000 to 2005 but the project area lost 7 acres of land and the reference area lost 2 acres (Table 1). Both values represent less than 1% of the respective areas. Note that the post construction photography was taken right after Hurricane Rita which could've affected the values.

Table 1. Land:Water acreages from 2000 (pre construction) and 2005 (post construction) in the project and reference areas.

		Project			Reference		
Year		Acres	Hectares	%	Acres	Hectares	%
2000	Land	2993	1211	68	683	276	99
2000	Water	1401	567	32	9	4	1
2005	Land	2986	1208	68	681	276	98
2005	Water	1408	570	32	11	4	2

Water Level:

The goal for water level was to maintain flooding between six inches below and two inches above marsh elevation. The monitoring plan called for BACI analysis of whether the proportion of time water levels were within the target range varied pre and post construction in the project and reference area. The proportion of each week within the target range was calculated from project and reference recorders from 2000 to 2004. Concurrent data were used in non parametric one-way ANOVA tests which revealed that there was no significant difference between the areas pre and post construction (χ^2 = 0.3205, p<0.5713) (figure 5). Water level was beyond the target range around 70% of the time in the project area and 60% of the time in the reference area both pre and post construction.

In the project area, water levels were below the target in dry years (2000 and 2002) and were above targets more often than the reference in other years (2001, 2003, and 2004) suggesting the weirs were not sufficient to maintain target water levels (figure 6). The project area sonde was removed in 2004 and CRMS sondes came online in 2006 and 2007. The project area sites showed more flooding above the target range which occurred more often than the reference site in 2008 and 2009 (figure 7). The project area sondes had more flooding above the target than the CRMS reference sites as well suggesting that the project area continues to hold more water than the region. In fact, a plug in an oilfield canal just north of the weirs was cut by the gravity drainage district at least four times; once for Hurricane Rita, for Hurricane Ike, and for at least two other large rain events. High water floods homes on Little Chenier Rd on the southern boundary of the project area.

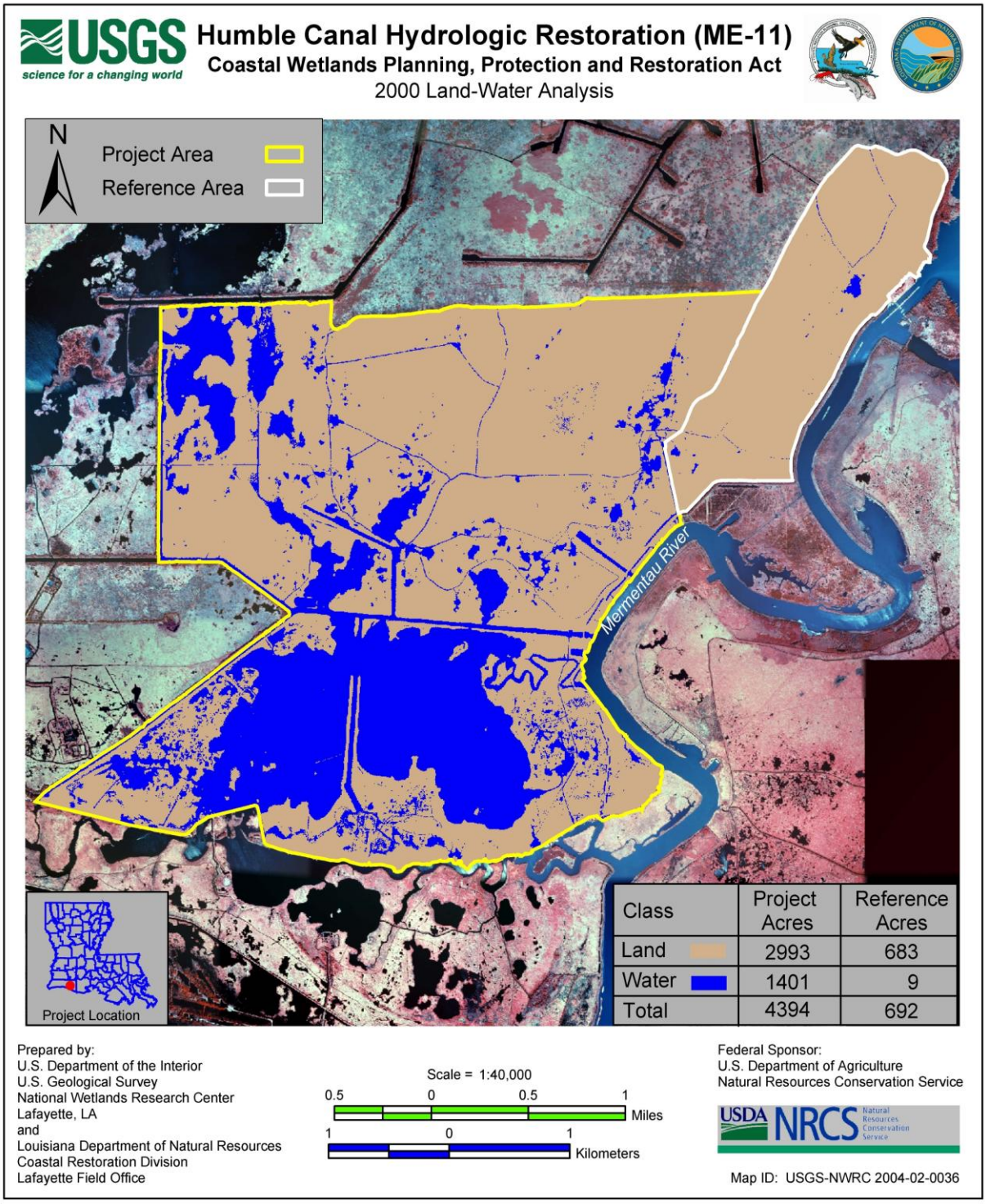

Figure 3. Land:Water analysis of aerial photography collected November 20, 2000.

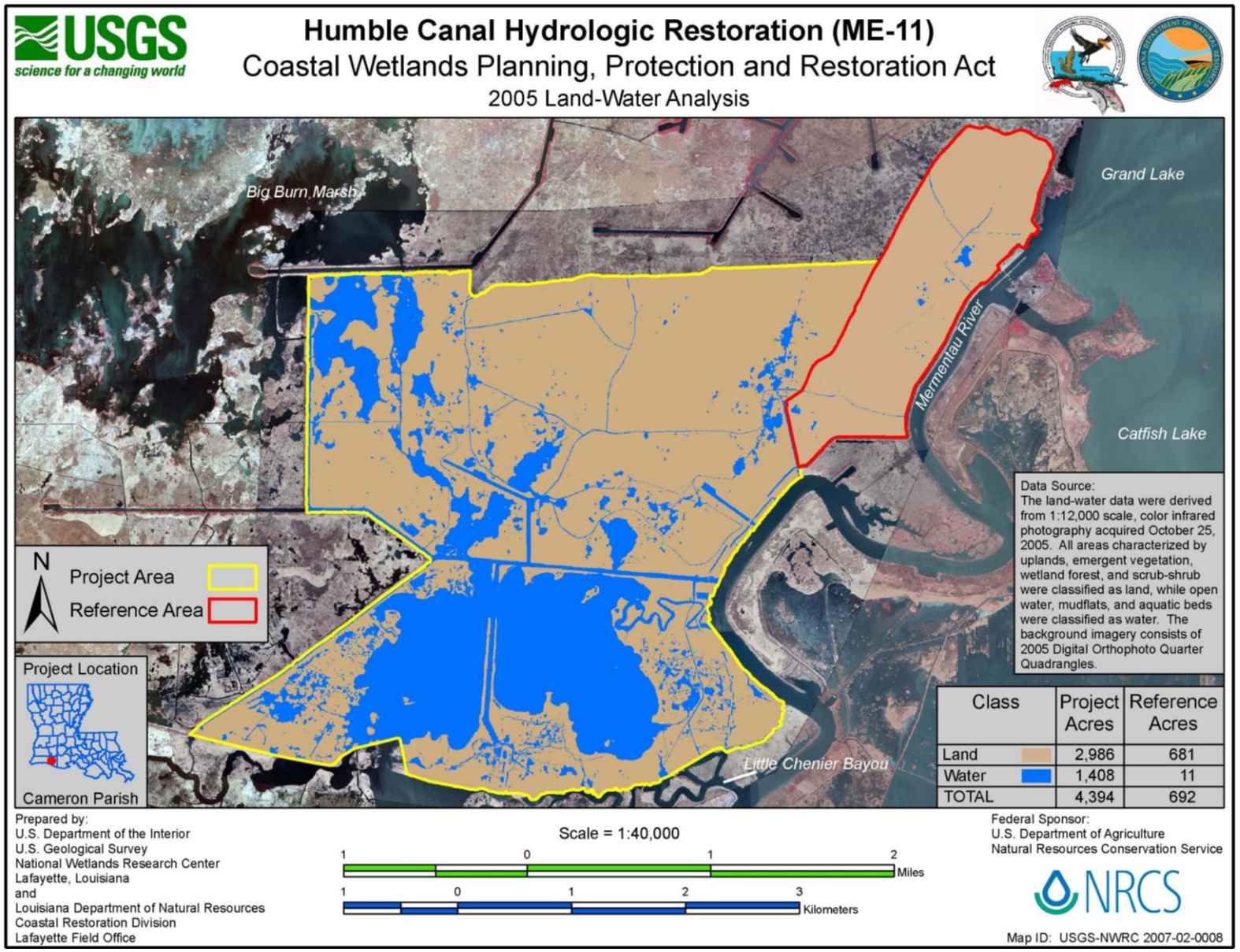

Figure 4. Land:Water analysis of aerial photography collected October 25, 2005.

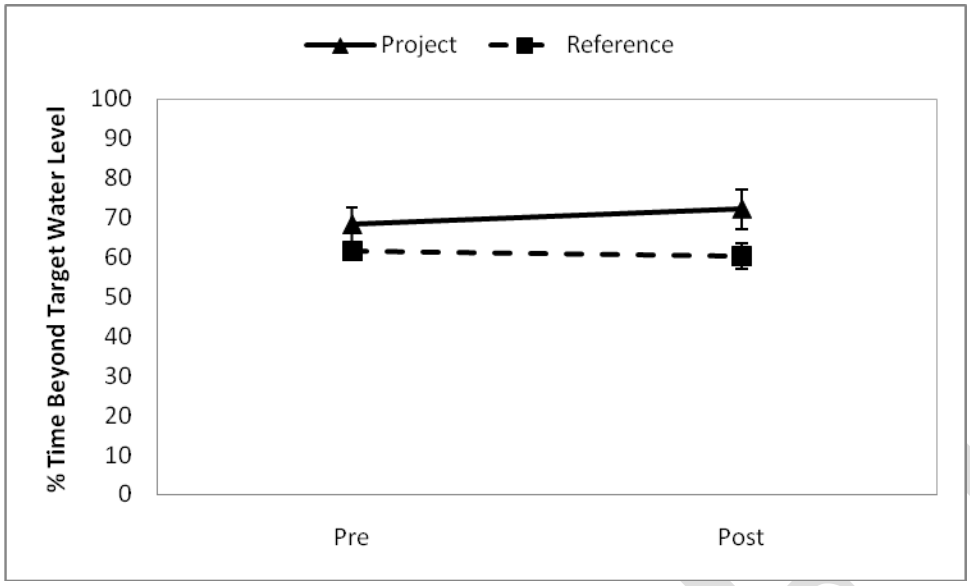

Figure 5. Results of BACI model where the project and reference area were beyond target water level the same amount of time pre and post construction.

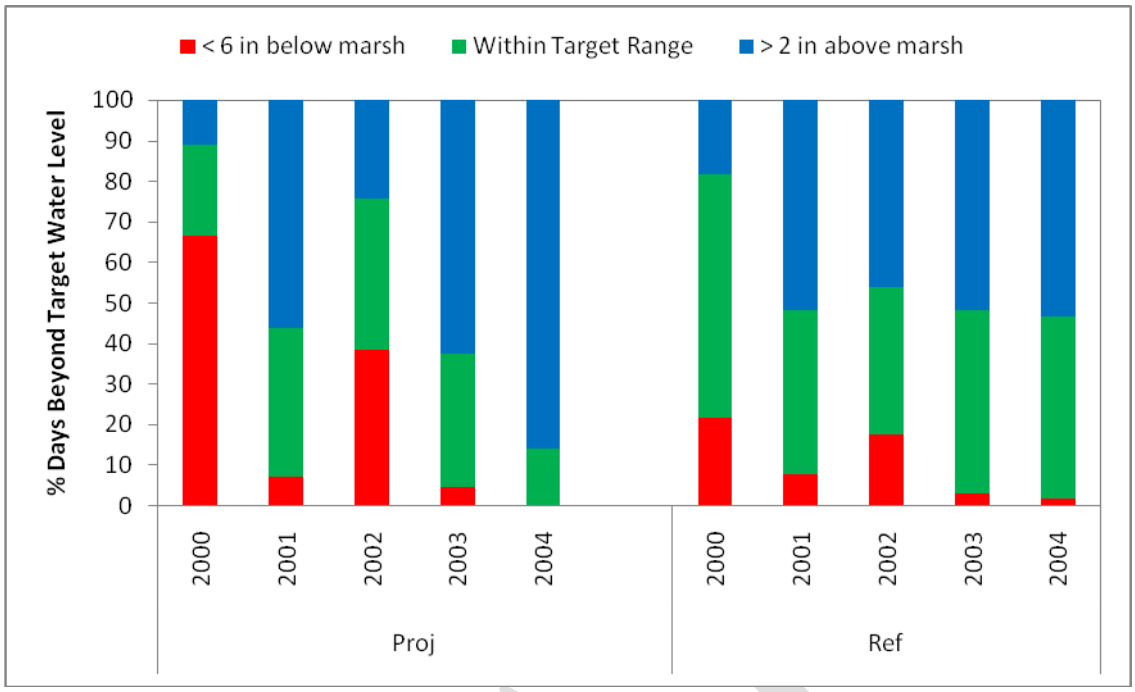

Figure 6. Percent of days water level beyond target range by year for ME-11 from 2000 to 2004. Note that only days where both recorders ran concurrently were used.

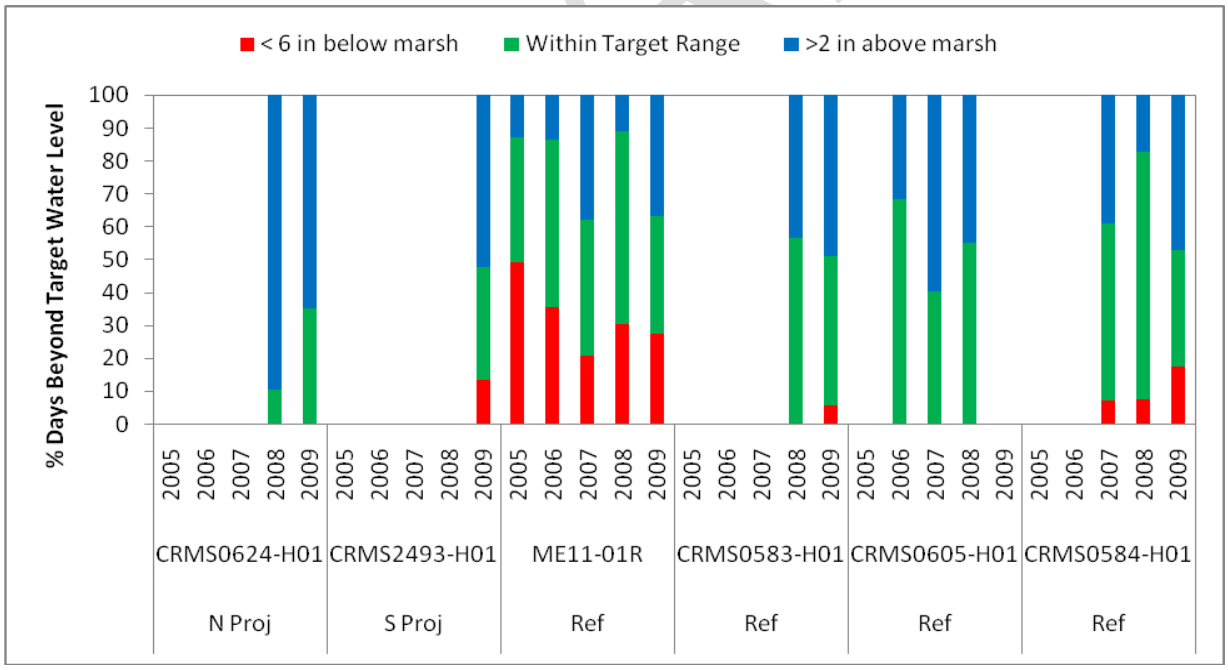

Figure 7. Percent of days beyond water level targets at CRMS sites and ME11-01R from 2005 to 2009. Note that for each year, only days where all recorders ran concurrently were used.

Water Salinity:

The distribution of salinities in the project area were mapped for one month (July – September) from 2000 to 2003 (figure 8). Salinities were high throughout the project and reference areas in 2000 and were low in both areas in both 2001 and 2002. In 2003, post-construction, salinities were elevated south of the project area and in the southeastern corner of the project area. The recorders in the project and reference area showed that salinities were rarely above two ppt from September 2001 through 2004 in the project area while spikes above 10 ppt regularly occurred at the reference station (figure 9). From construction through Hurricane Rita in 2005, the project weirs appear to have effectively prevented saltwater intrusion into the project area.

The goal for salinity was to maintain salinity in the project area under 3 ppt and to prevent peaks over 7 ppt. Specific tests prescribed in the monitoring plan called for BACI analysis of salinities and the proportion of time salinities were beyond the target range in the project and reference areas pre and post-construction. Weekly mean salinities were compared in the project and reference area pre and post construction using nonparametric one-way ANOVA. Differences in weekly project and reference salinities from continuous data recorders deployed concurrently from 5/2000 to 4/2004 were compared pre and post construction. There was a significant difference where project area salinities were 1.3 ppt higher than reference area salinities pre construction and were 2.3 ppt lower than reference salinities post construction (χ^2 = 52.16, $p<0.0001$) (figure 10). Similarly, the percent of hourly data per week outside the target range of 3 ppt was 10% higher in the project area than in the reference area pre construction and 24% lower than the reference post construction (χ^2 = 23.47, $p<0.0001$) (figure 11). These tests indicate that the project had the desired effects of reducing salinities in the project area relative to the reference area from May, 2000 through April, 2004. In fact, salinities weren't beyond the 3 ppt target range in the project area from 2002 to 2004 but they were occasionally above the target at the reference recorder in 2002 and 2003 (figure 12 and 12) suggesting the project did successfully limit saltwater access before Hurricane Rita.

The recorder within the project area at CRMS0624 and the ME-11 reference station were measured from 2006 through 2009 (figure 13). During that time, spikes in salinity above 7 ppt regularly occurred in the project area. Salinity control was compromised by Hurricanes Rita and Ike. A plug in the eastern levee was mechanically breached after each storm and two other high water events leaving the area open to tidal saltwater exchange. The gravity drainage district is working towards installing a permanent spillway structure to prevent the need to cut the plug during high water which should allow salinities to be controlled in the project area more effectively.

Data from CRMS sites and the ME-11 reference sonde with concurrent data from 2006 through 2009 were summarized relative to the 3 and 7 ppt target values (figure 14). The CRMS site in the north project area, CRMS0624, was over the 3 ppt target 20% of the time in 2007 and almost 40% of the time in 2008 and 2009. The site in the project area generally had fewer days above the 3 ppt target than the other reference sites with the exception of CRMS0605.

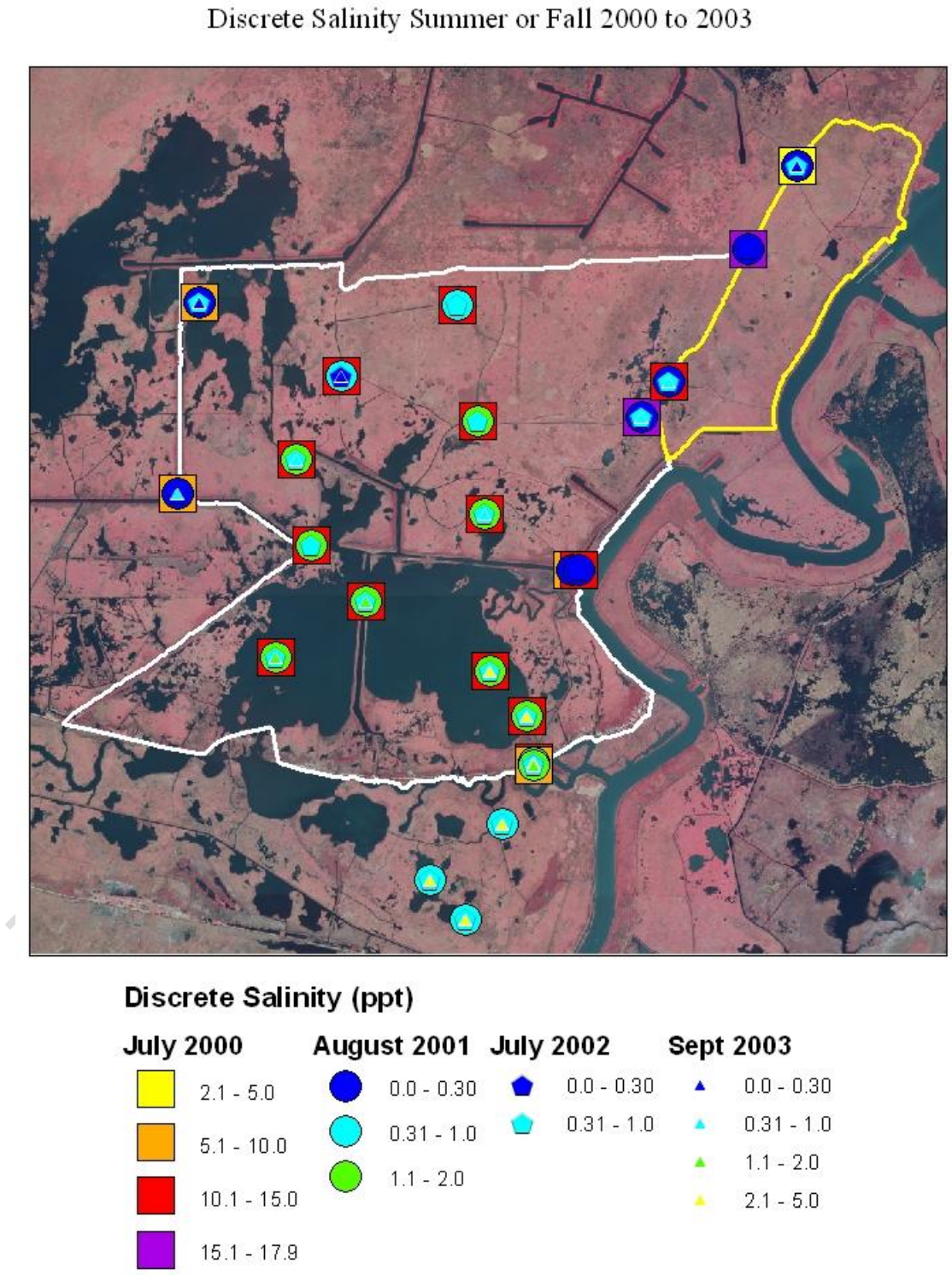

Figure 8. Discrete salinity in the ME-11 project and reference areas in 2000, 2001, 2002, and 2003.

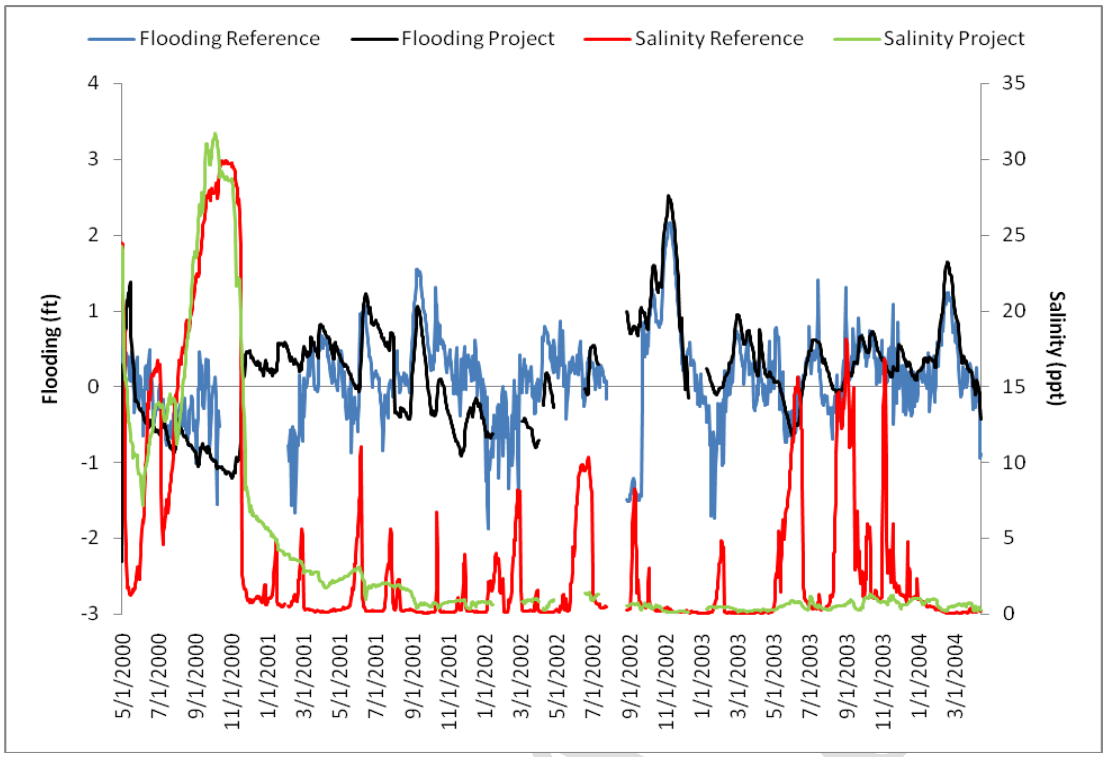

Figure 9. Daily mean salinity and flooding at the project area and reference recorders in ME-11.

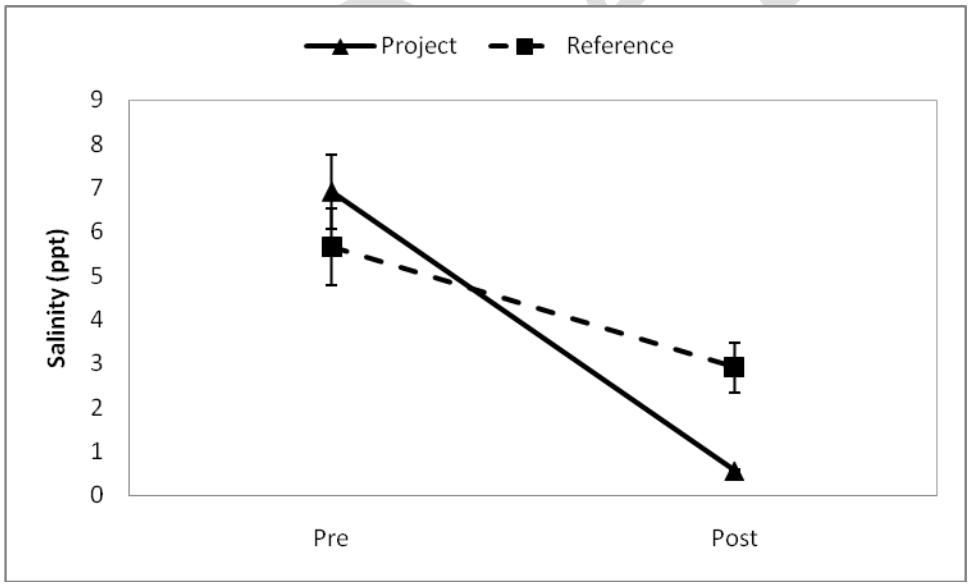

Figure 10. Mean weekly salinity pre and post construction by area. Mean ± SE.

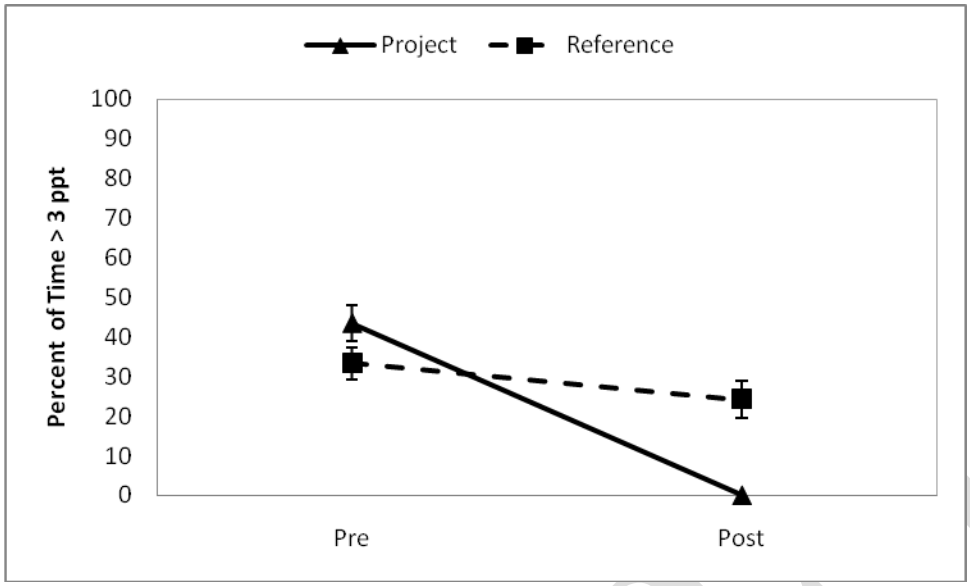

Figure 11. Mean percent of time salinity greater than 3 ppt pre and post construction. Mean ± SE.

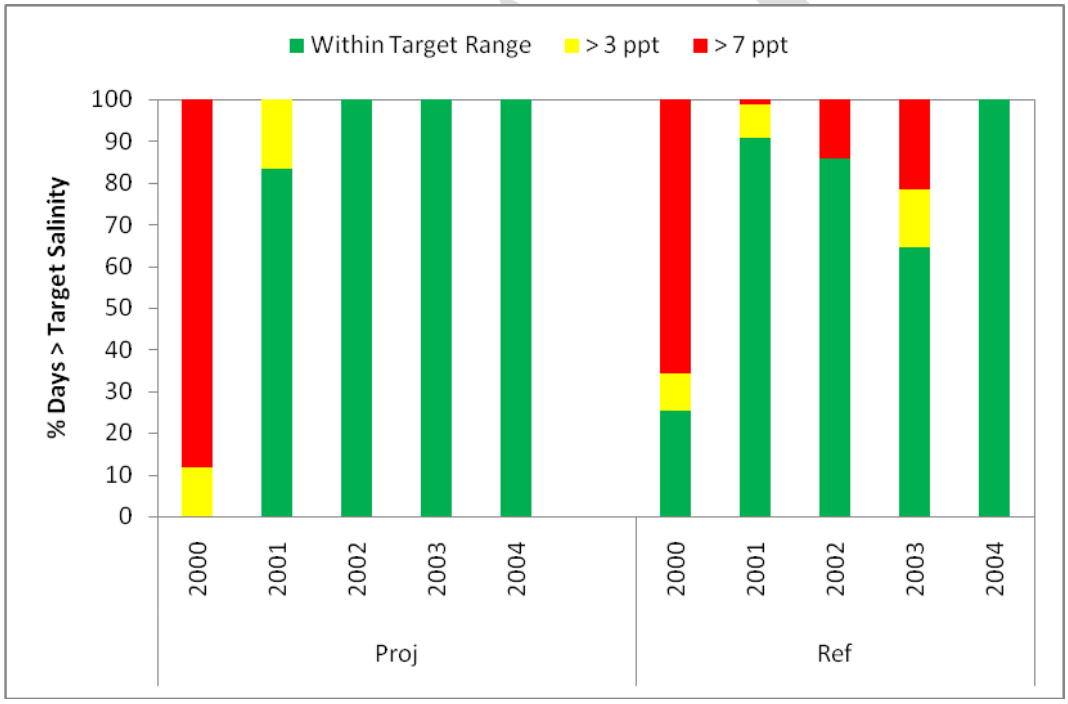

Figure 12. Percent of days beyond salinity targets at ME-11 project recorders from 2000 to 2004. Note that only days where both recorders ran concurrently were used.

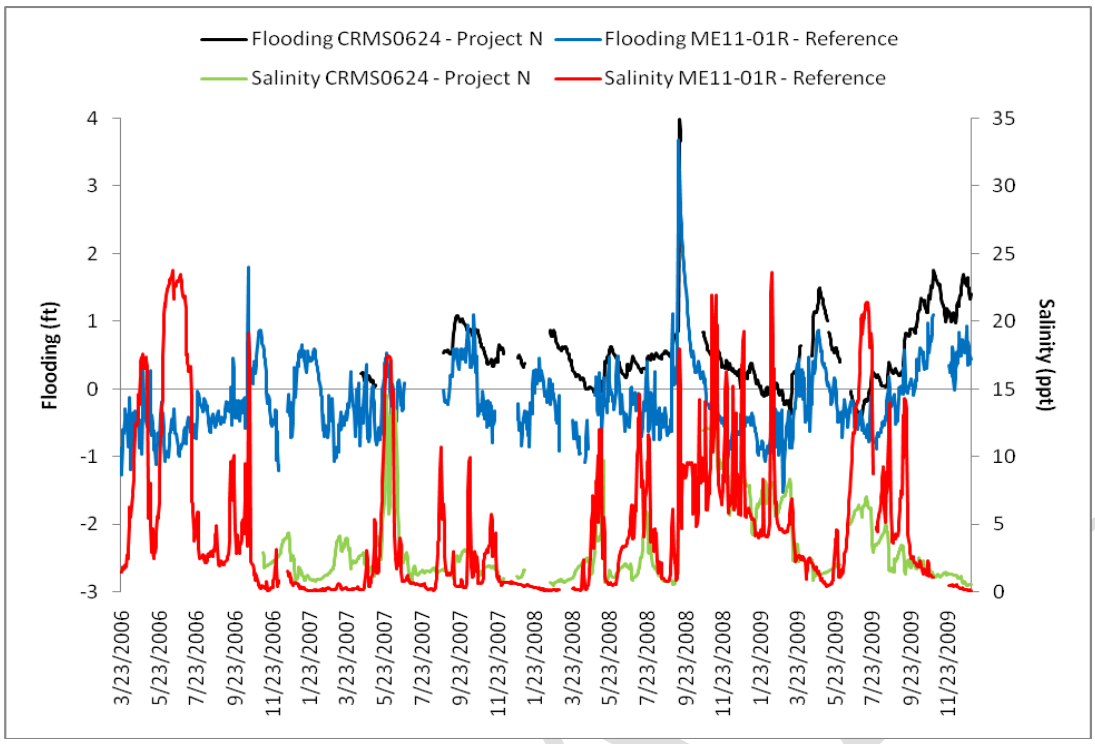

Figure 13. Daily mean salinity and flooding at CRMS0624 in the project area and the reference recorder ME11-01R.

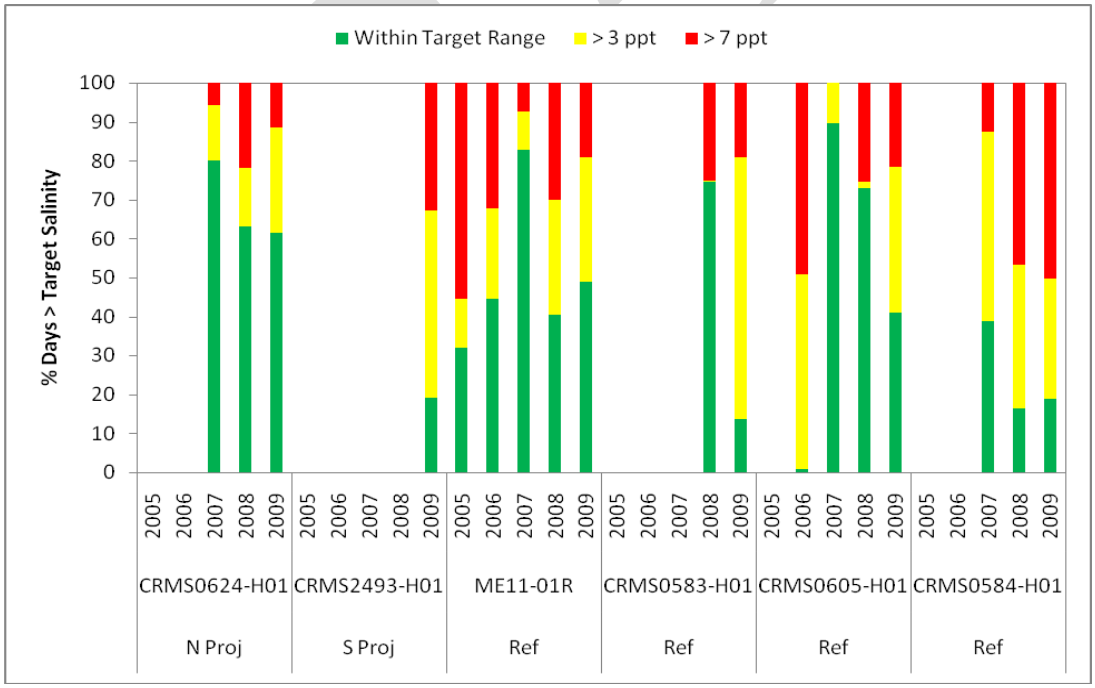

Figure 14. Percent of days beyond salinity targets at CRMS sites and ME11-01R from 2005 to 2009. Note that for each year, only days where all recorders ran concurrently were used.

Emergent vegetation:

Emergent vegetation data was collected pre construction in 2000, post construction in 2003 and as part of a broader post Hurricane Rita assessment at half of the vegetation stations in 2005, 2006, 2007, and 2008. The project goals were to increase the cover and occurrence of fresh marsh species in the project area. Species were classified as fresh, fresh-intermediate, intermediate and so on using classifications provided by Jenneke Visser. The 2000 and 2003 data were tested for project effects on the occurrence and cover of fresh species as per the monitoring plan. Cover of fresh and fresh-intermediate species increased between 2000 and 2003 but there was not a significant difference in the rate of increase between the project and reference area ($F_{1,42}$=1.80, p=0.1874) (figure 15). The number of fresh species occurring in the project and reference area both declined between 2000 and 2003 and did so at the same rate ($F_{1,42}$=0.05, p=0.8256) (figure 16). It is not surprising that there was no vegetation effect between 2000 and 2003 considering project construction was completed in March 2003.

All available vegetation data from ME-11 project specific sites and from CRMS sites selected for this assessment were summarized according to marsh type classifications over time. The subset of ME-11 stations sampled through 2008 showed that after Hurricane Rita there was higher percent cover in the project area than the reference but the project area wasn't necessarily composed of fresher species than the reference area (figure 17).

The CRMS site in the northern project area (CRMS0624) had less cover and saltier species than the rest of the ME-11 project area from 2006 to 2009 (figure 18). The CRMS site in the southern project area (CRMS2493) had fresher species than in the northern portion of the project area. CRMS reference sites adjacent to the ME-11 project boundary (CRMS0583 and CRMS0605) show both salty and more intermediate conditions. The site further from the project but open to similar hydrologic conditions as exist in the basin without structural control (CRMS0584) had a greater proportion of salty species and less cover each year than the other CRMS project or reference sites. It appears that the project does effectively shelter the marsh from conditions that would encourage the growth of more brackish species.

It is now possible to assess the quality of species that inhabit sites and to interpret what that might indicate about site stability using the Floristic Quality Index (Cretini et al., 2009). The ME-11 project and reference areas had modest FQI values before Hurricane Rita (around 70), fell in 2006, and recovered to the pre-Rita levels in the project area but not in the reference area (figure 19). The region held storm surge water from Hurricane Rita for several months after the storm allowing more salt damage to occur. The CRMS site in the northern project area (CRMS0624) had lower FQI values and cover than in the southern project area (CRMS2493) (figures 20 and 21). The adjacent CRMS reference site CRMS0583 had much higher FQI scores and a fresher species assemblage than CRMS0605 or CRMS 0584 (figures 22, 23, and 24).

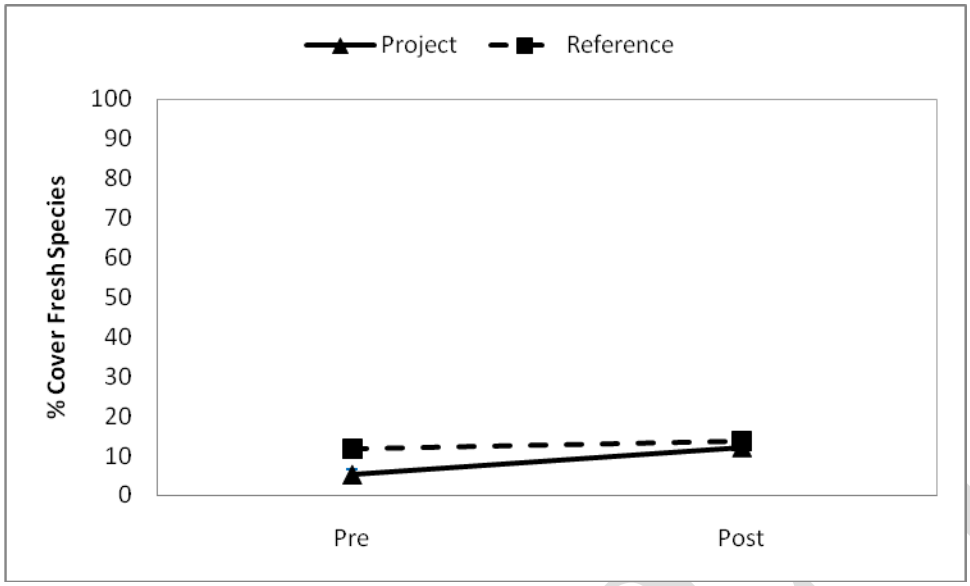

Figure 15. Comparison of the percent cover of fresh species in the project and reference area pre and post construction in 2000 and 2003.

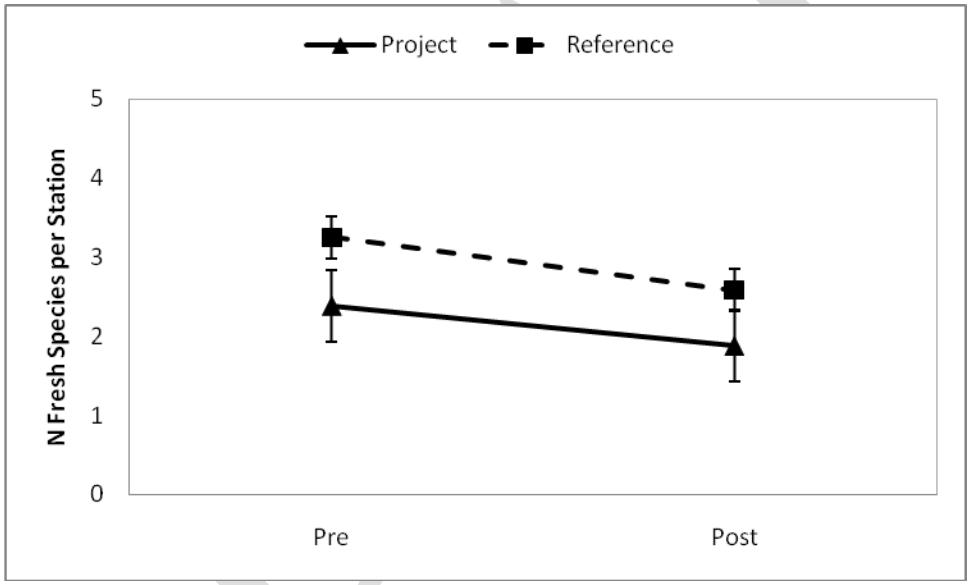

Figure 16. Comparison of the number of fresh species occurring in stations in the project and reference area pre and post construction in 2000 and 2003.

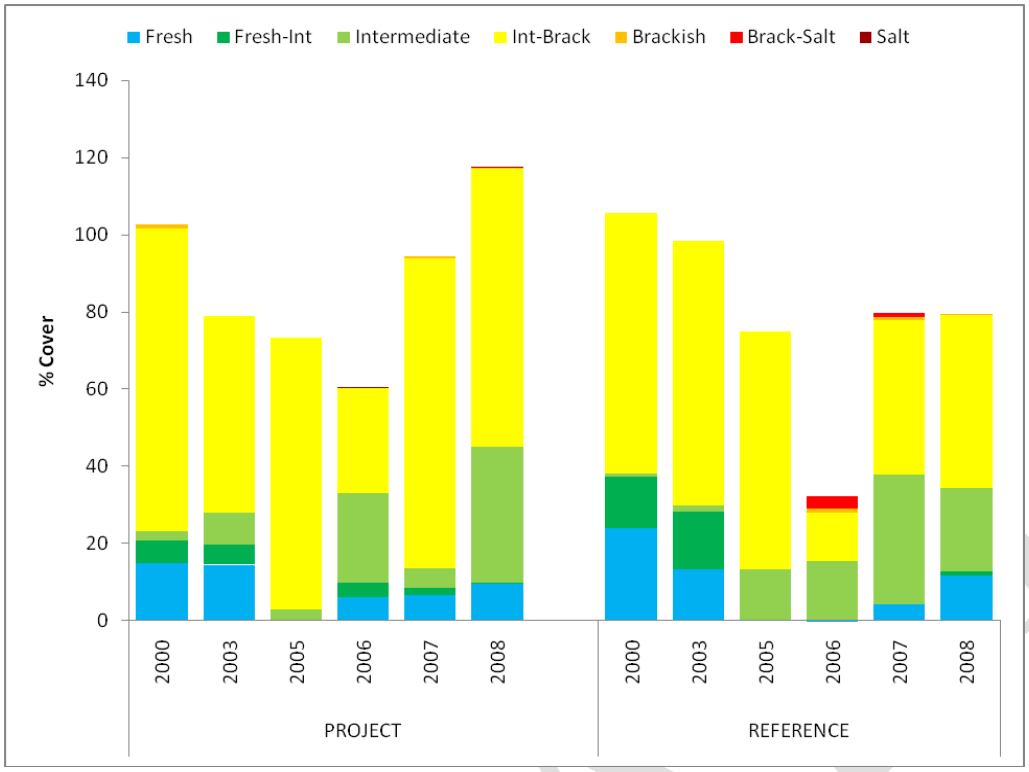

Figure 17. Percent cover by vegetation type in the project and reference area over all years sampled cover. Data represent a subset of ME-11 vegetation stations.

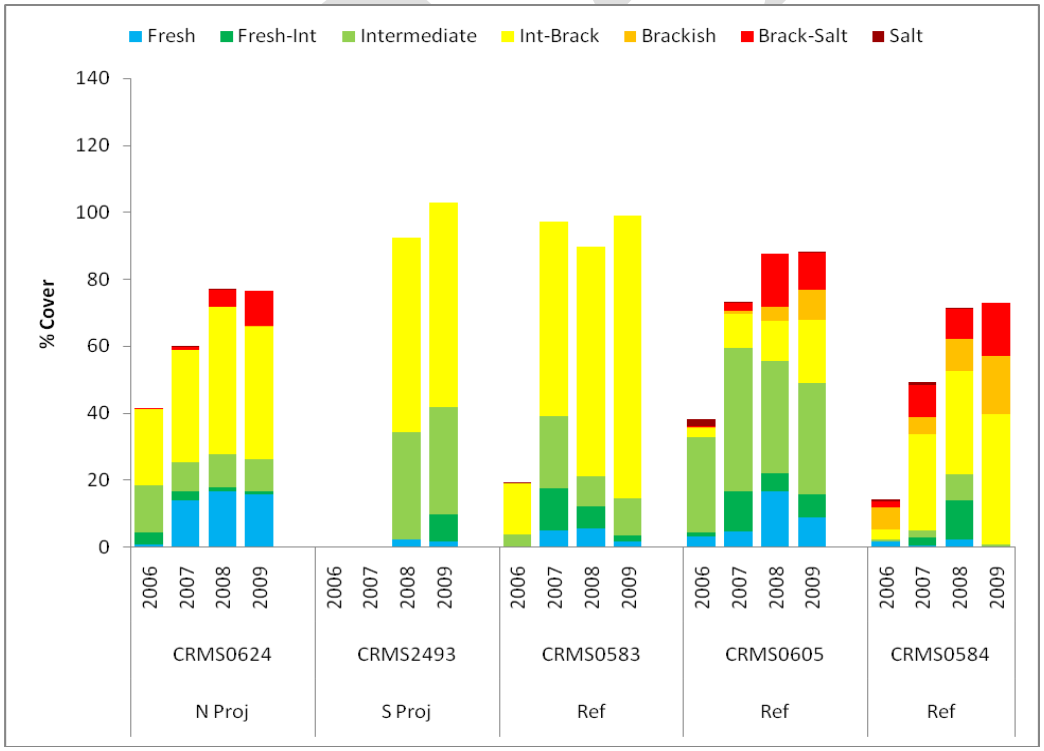

Figure 18. Percent cover by vegetation type at selected project and reference CRMS sites.

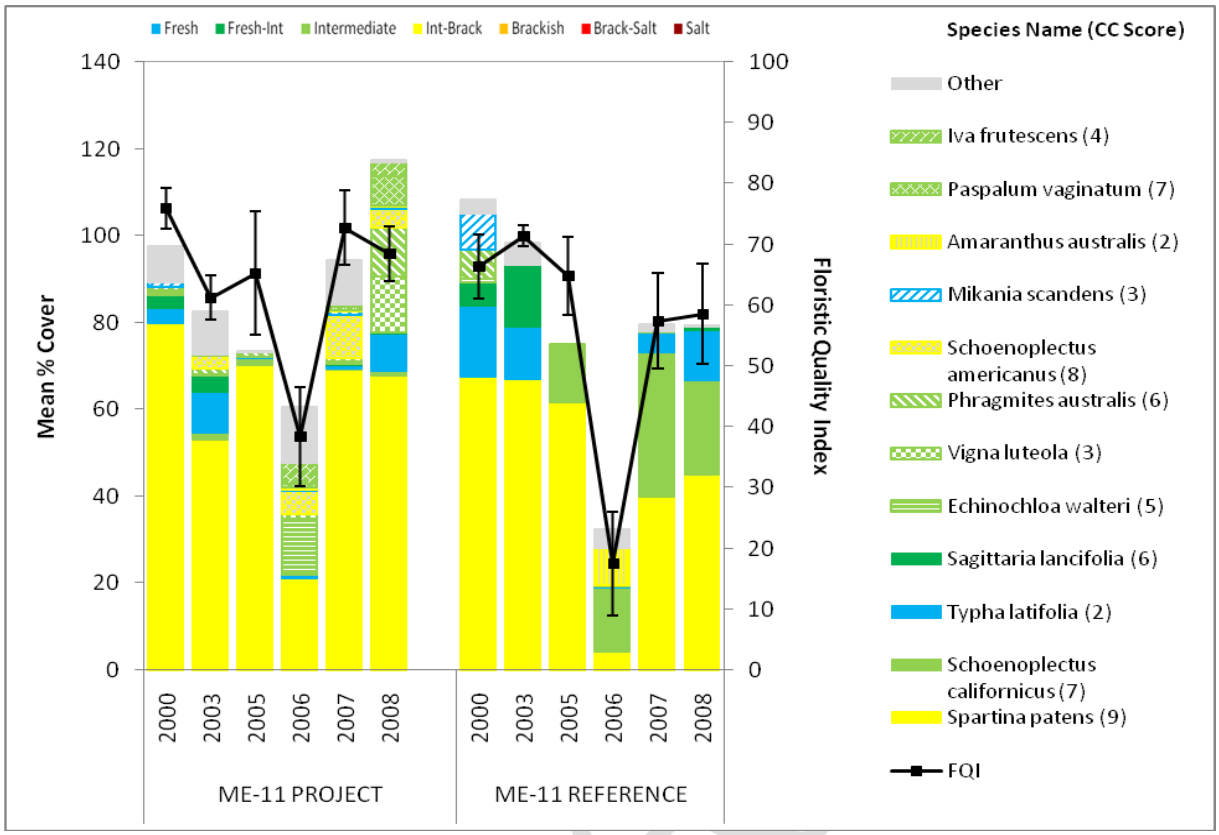

Figure 19. Percent cover of species in the ME-11 project and reference areas and FQI score for each year. The CC Scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stability.

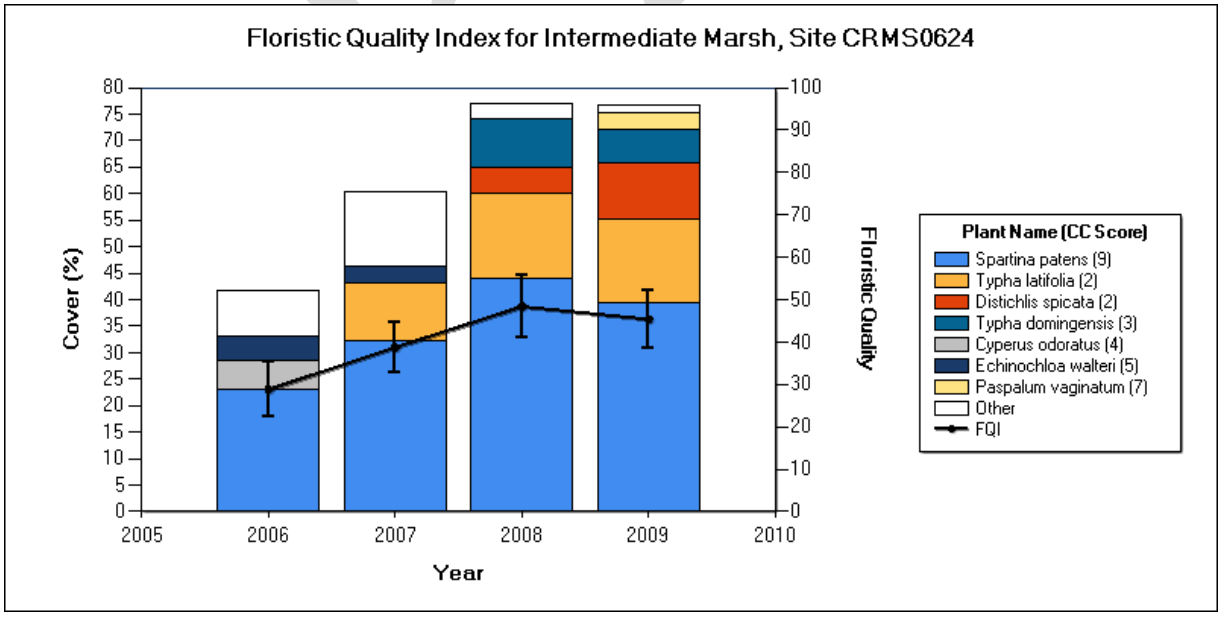

Figure 20. Percent cover and FQI score for each year at CRMS0624.

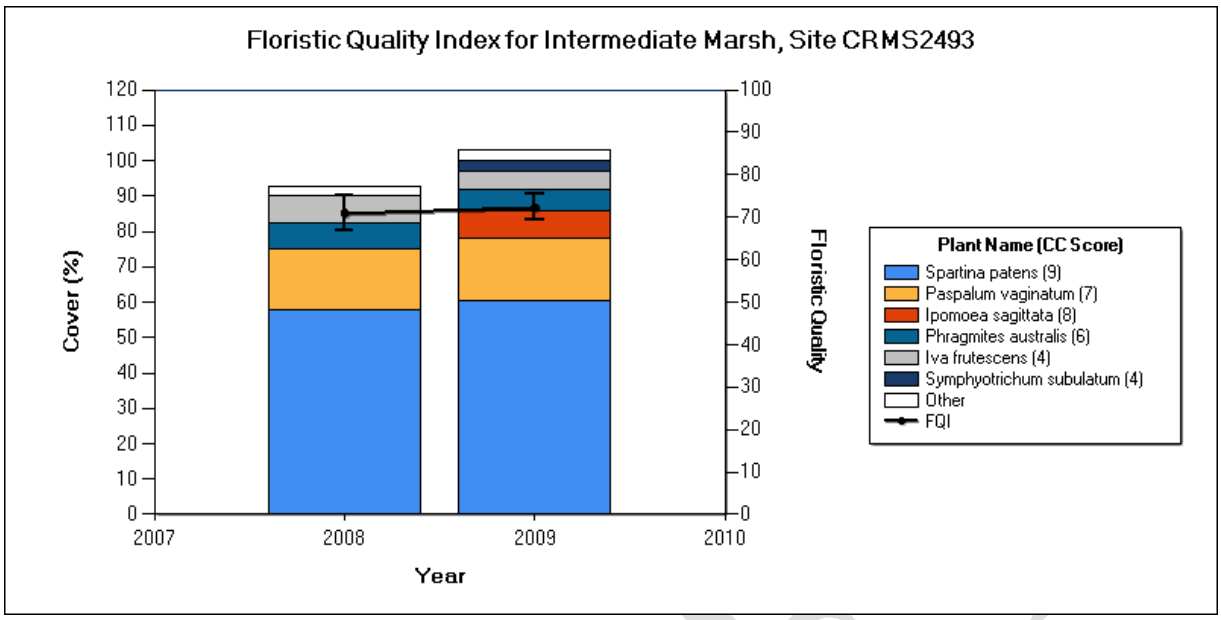

Figure 21. Percent cover and FQI score for each year at CRMS2493.

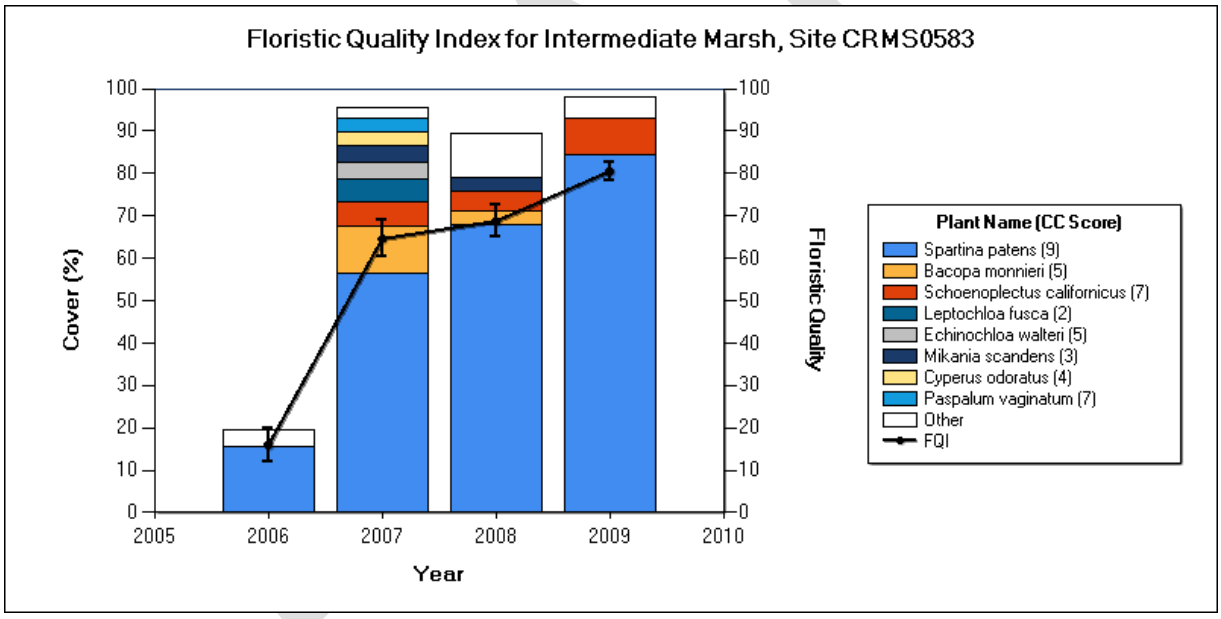

Figure 22. Percent cover and FQI score for each year at CRMS0583.

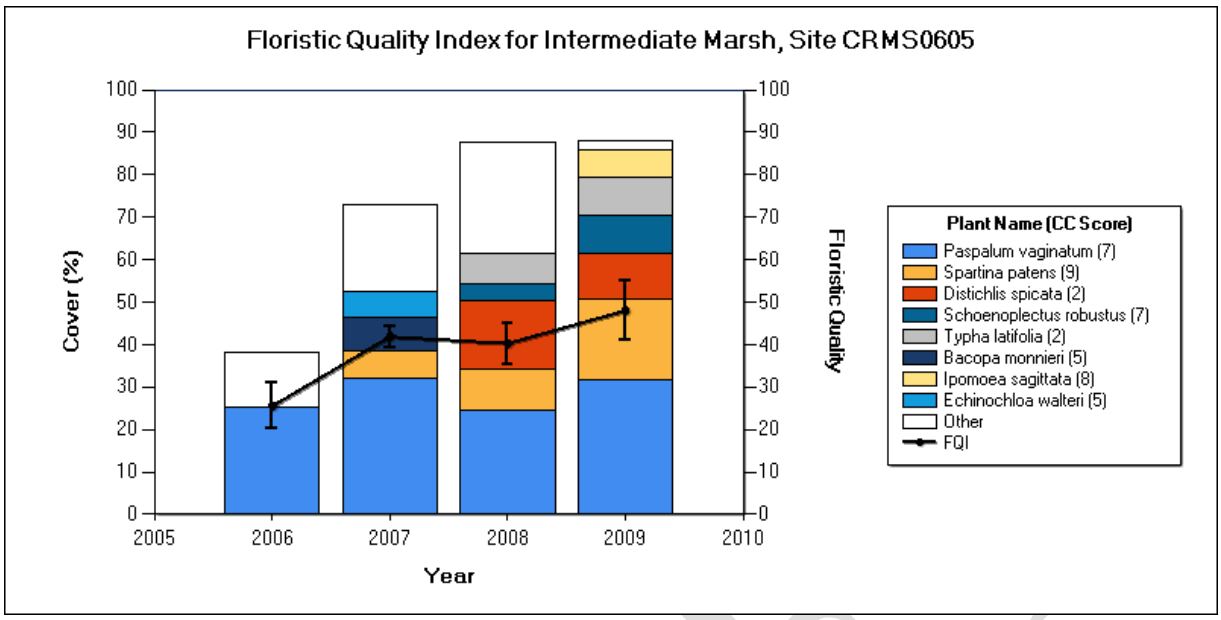

Figure 23. Percent cover and FQI score for each year at CRMS0605.

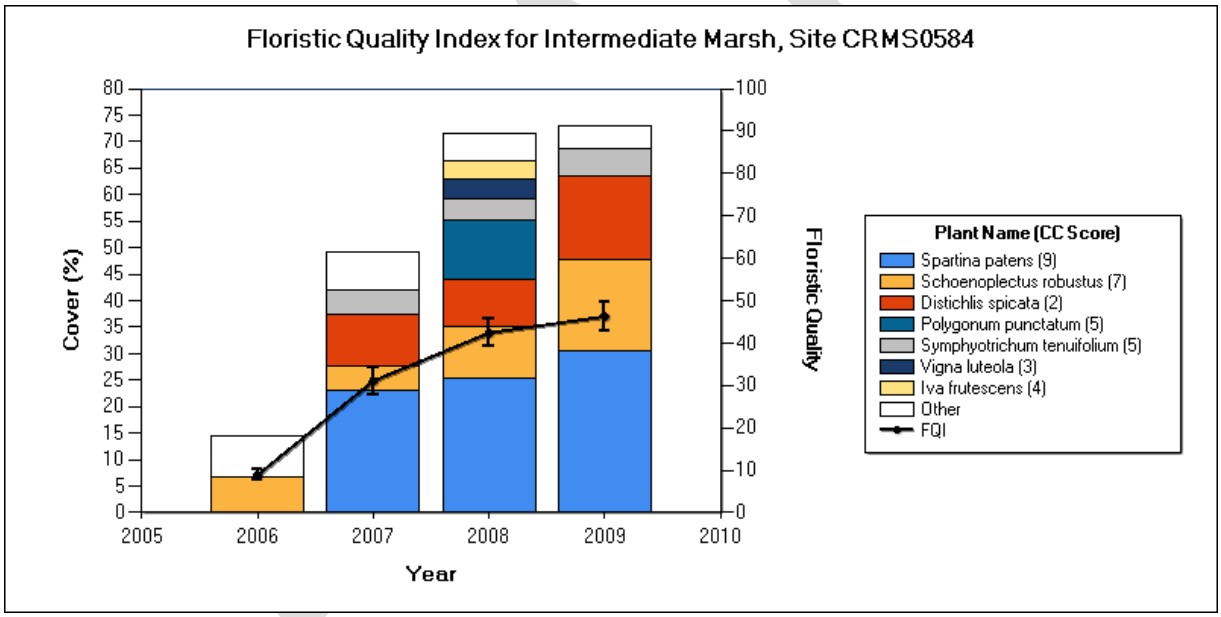

Figure 24. Percent cover and FQI score for each year at CRMS0584.

Submerged aquatic vegetation:

Frequency of occurrence of SAV was quantified pre and post construction in September 2000 and October 2003. Frequency of occurrence is defined as the percent of samples SAV was found in per transect. From 2000 to 2003, frequency of occurrence of SAV increased in the project area from 0% to around 50% and in the reference area from 70% to 100%. As per the monitoring plan, Analysis of Variance was used to determine whether there was a significant difference in the interaction of project/reference area and time and there was not ($F_{1,16}$=1.56, p=0.2260). SAV frequency of occurrence increased in both areas at approximately the same rate (figure 25).

SAV species richness increased from 0 to 7 species in the project area and from 2 to 6 species in the reference area (excluding Algae). The difference in SAV presence between sampling years can be attributed to salinity, which was around 20 ppt during sampling in both areas in 2000 (a drought year) and was less than 5 ppt in 2003. The SAV that was present in the reference area in 2000 was mostly salt tolerant *Ruppia maritima* with some *Ceratophyllum demersum* (figure 26). In 2003, the project area was dominated by *Najas guadalupensis* while the reference area was co-dominated by Potamogeton spp., *Najas guadalupensis, Vallisineria americana, and C*hara spp. *Cabomba caroliniana* and *Nelumbo lutea* were found in the project area and not the reference area.

CRMS Supplemental Data:

Soil Properties:

Three soil cores were extracted from each site sometime during construction (mostly in 2006) and were analyzed in four cm increments down to 24 cm. For this summary, bulk density and percent organic matter (OM%) of the top and bottom 12 cm were averaged (figures 27 and 28). Bulk density was lower and OM% was higher in the northern project area (CRMS0624) than the southern project area (CRMS2493). CRMS2493 had more dense soil in the bottom half of the core than any other site. Of the reference sites, CRMS0584 had the highest bulk density and lowest OM% while CRMS0583 had the lowest bulk density and highest OM%. CRMS0583 was the only site with much higher organic matter in the bottom half of the core suggesting the soils there are very organic. Marsh elevation change and vertical accretion data are being collected at all CRMS sites but the current estimates are preliminary and will not be presented at this time.

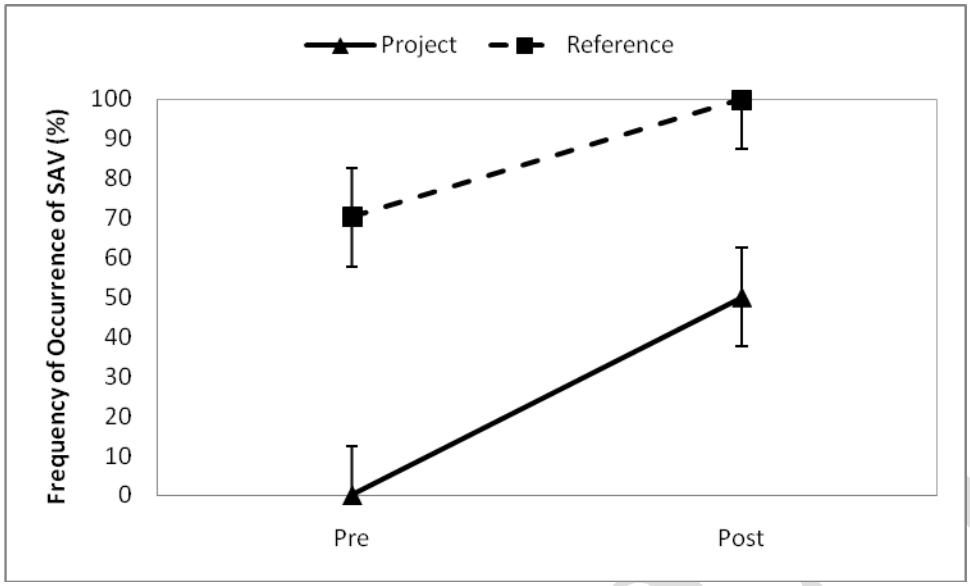

Figure 25. Mean frequency of occurrence of SAV in project and reference ponds pre and post construction. LSMean ± SE.

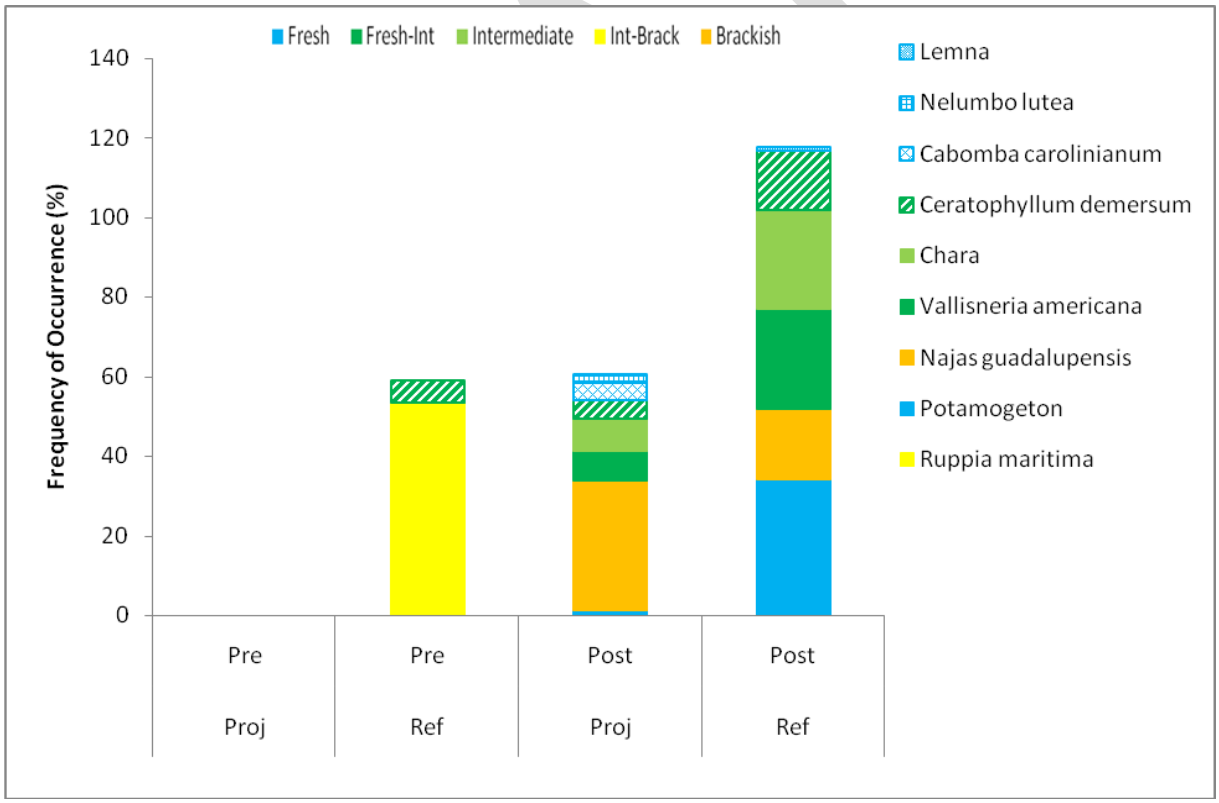

Figure 26. Mean frequency of occurrence of SAV species in the project and reference area pre and post construction. Frequency for transects averaged by area and year.

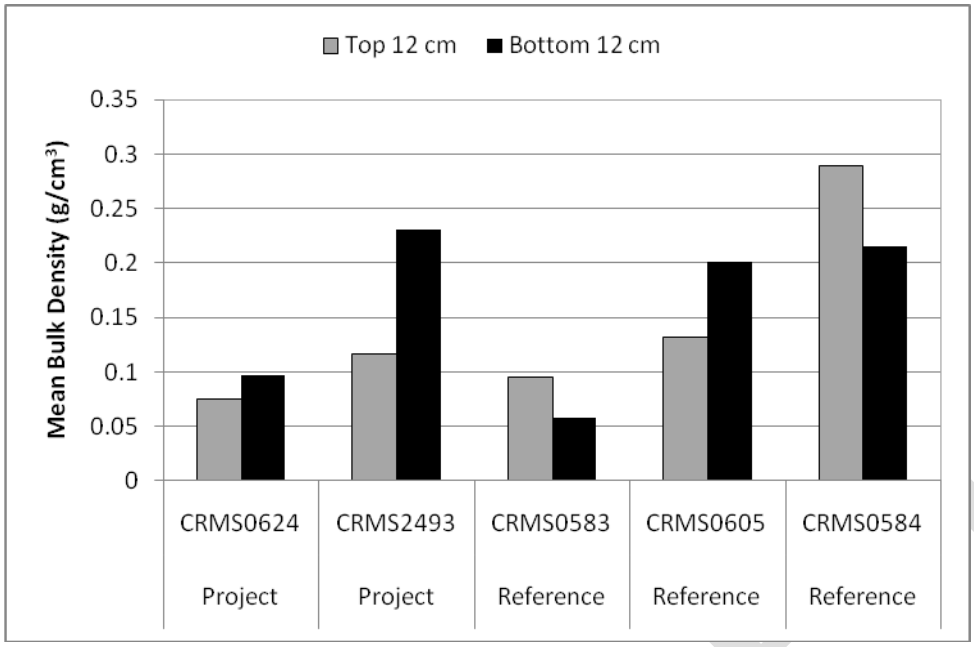

Figure 27. Mean soil bulk density in the top and bottom 12 cm of cores taken at CRMS sites in and near ME-11.

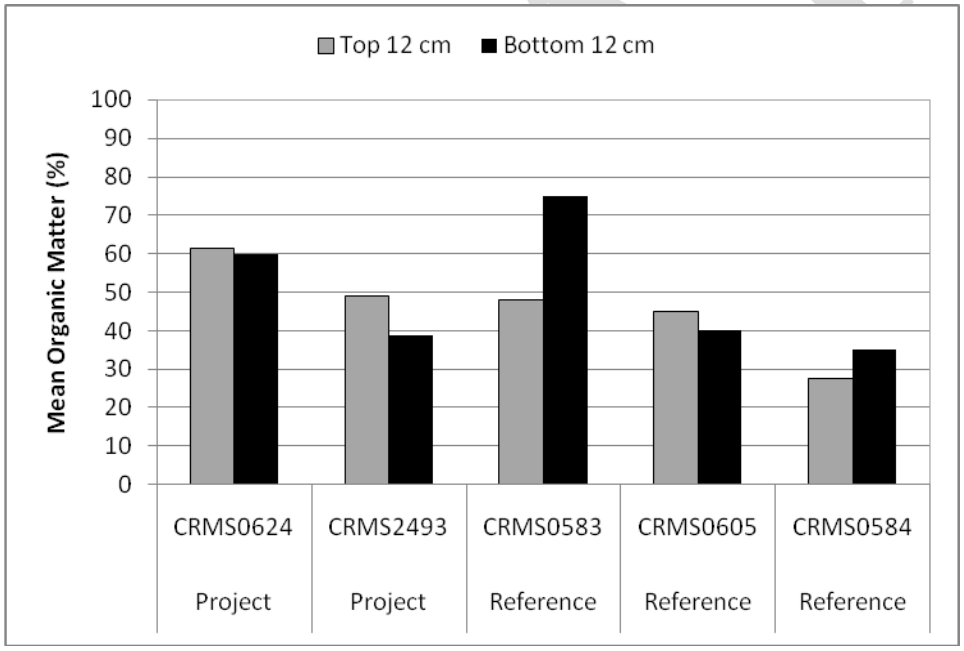

Figure 28. Mean soil percent organic matter in the top and bottom 12 cm of cores taken at CRMS sites in and near ME-11.

V. Conclusions

a. Project effectiveness

The project met its goals to maintain salinity between 0 and 3 ppt and increase the occurrence of SAV but not its goals to increase Land:Water, maintain water level between six inches below and two inches above marsh level, or increase/maintain cover of fresh marsh vegetation species. Prior to Hurricane Rita in 2005, the project appeared to be effectively preventing saltwater intrusion and SAV responded accordingly. We would have expected the vegetation to respond in time but for the disturbance caused by Hurricane Rita and by repeatedly cutting the plug north of the project structure. The plug was cut for Hurricanes Rita, Ike, and two other high water events. The project weirs were functioning properly when the plug had to be cut suggesting the need for additional drainage capacity in the project area. In order to achieve vegetation, flooding, and Land:Water goals, the plug cutting issue needs to be resolved. The gravity drainage district's proposed spillway should help solve the problem.

b. Recommended improvements

The ME-11 project features are functioning properly but all project goals are not being met. The Cameron Parish Gravity Drainage District's plan to create a permanent spillway north of the project structures should help.

c. Lessons learned

Five 48" culverts are not sufficient to remove excess water from the 4000 acre ME-11 project area during large storm events.

REFERENCES

Cretini, K.F., Visser, J.M., Krauss, K.W., and Steyer, G.D., 2009, CRMS Vegetation Analytical Team Framework: methods for collection, development, and use of vegetation response variables: U.S. Geological Survey National Wetlands Research Center, Lafayette, La., 64 p.

Folse, T. M, J. L. West, M. K. Hymel, J. P. Troutman, L. A. Sharp, D. Weifenbach, T. McGinnis and L. B. Rodrigue. 2008. A Standard Operating Procedures Manual for the Coast-wide Reference Monitoring System-*Wetlands*: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Office of Coastal Protection and Restoration. Baton Rouge. LA. 191 pp.

Price, J. and M. Guidry 2004. Operations, Maintenance, and Monitoring Report for Humble Canal Hydrologic Restoration (ME-11), Louisiana Department of Natural Resources, Coastal Restoration Division, Lafayette, Louisiana

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller, and E. Swenson 1995, 2000. Quality management plan for coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program. Open-file report no. 95-01. Baton Rouge, La.: Louisiana Department of Natural Resources Division. 97pp. Plus appendices.

APPENDIX A
(Inspection Photographs)

Photo 1, Marine barrier with signage.

Photo 2, Inlet side showing repairs to hyacinth fence.

Photo No. 3, Inlet side of structure

Photo No. 4, Outlet side of structure

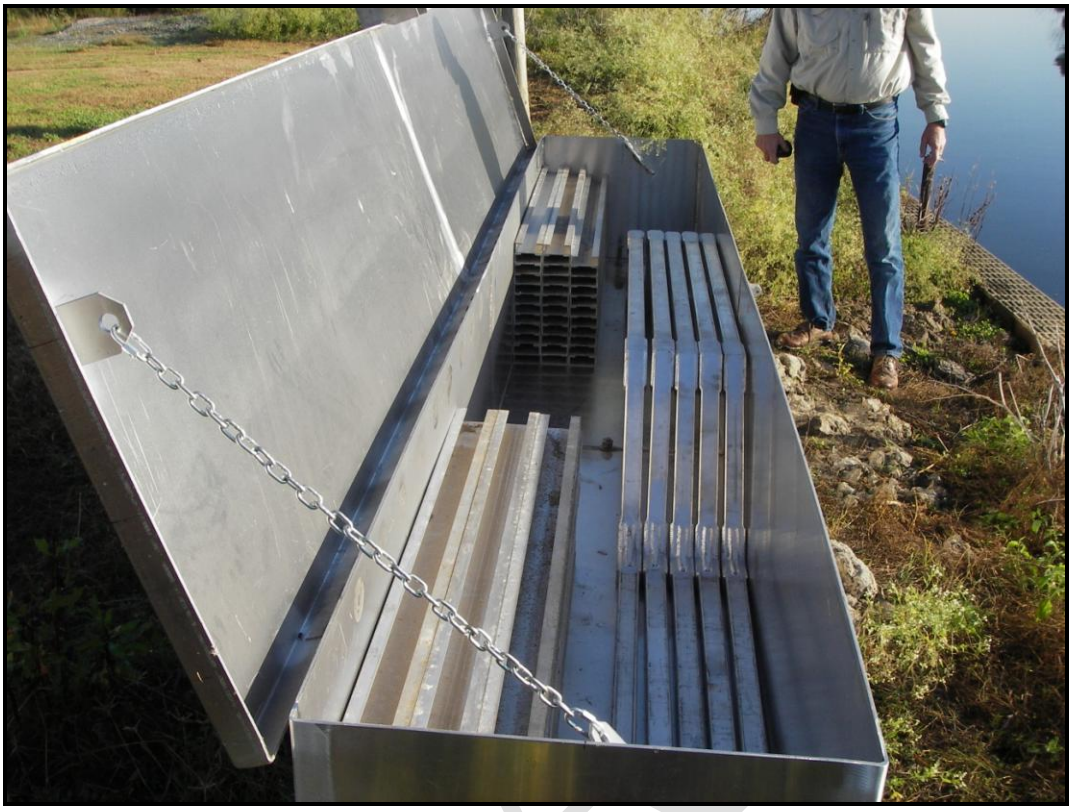

Photo No. 5, Storage box for locking arms and stop logs

Appendix B
(Three Year Budget Projection)

HUMBLE CANAL / ME-11 / PPL8

Three-Year Operations & Maintenance Budgets 07/01/2010 - 06/30/2013

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Mel Guidry*	*NRCS*	*Mel Guidry*

	2010/2011	2011/2012	2012/2013
Maintenance Inspection	$ 5,909.00	$ 6,086.00	$ 6,269.00
Structure Operation	$ -	$ -	$ -
Administration			$ -
Maintenance/Rehabilitation			

10/11 Description:

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

11/12 Description:

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

12/13 Description:

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

	2010/2011	2011/2012	2012/2013
Total O&M Budgets	**$ 5,909.00**	**$ 6,086.00**	**$ 6,269.00**

O &M Budget (3 yr Total)	**$ 18,264.00**
Unexpended O & M Budget	**$ 165,484.00**
Remaining O & M Budget (Projected)	**$ 147,220.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2010 - 06/30/2011

HUMBLE CANAL HR PROJECT / PROJECT NO. ME-11 / PPL NO. 8

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$5,909.00	**$5,909.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Rip rap	0	0.0	45	$0.00	$0.00
Aggregate Surface Course	0	0.0	60	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$5,909.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2011 - 06/30/2012

HUMBLE CANAL HR PROJECT / PROJECT NO. ME-11 / PPL NO. 8

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,086.00	**$6,086.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Rip rap	0	0.0	0	$0.00	$0.00
Aggregate Surface Course	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,086.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2012 - 06/30/2013

HUMBLE CANAL HR PROJECT / PROJECT NO. ME-11 / PPL NO. 8

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,269.00	**$6,269.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Rip rap	0	0.0	0	$0.00	$0.00
Aggregate Surface Course	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,269.00**

APPENDIX C
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: ME-11 Humble Canal

Date of Inspection: November 6, 2009 Time: 8:00am

Structure No. N/A

Inspector(s): OCPR- Mel Guidry, Tal McCain (M&M Electric)
NRCS- Dale Garber, Dave Foster(Acadian Engineers)

Structure Description: 5 - 48" x 50' corrugated aluminum pipe with weir type drop inlets and flap gated outlets/ 1 1 - 18" x 50' corrugated alum.pip

Water Level Inside

Type of Inspection: Annual

Weater Conditions: Sunny and mild

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	good				
Steel Grating	good				
Stop Logs Storage Box	good good			3 & 4 5	
Hardware	good			3 & 4	
Timber Piles	good				
Timber Wales	good				
Galv. Pile Caps	good				
Cables/ lifting device	good				
Signage /Supports	N/A				
Rip Rap (fill) (foreshore dike)	good				
Eathern Embankment Inlet Channel/Plug	good good			3 & 4	

What are the conditions of the existing levees? Stable on both the inlet and outlet channels.
Are there any noticable breaches? No
Settlement of rock plugs and rock weirs? N/A
Position of stoplogs at the time of the inspection? Unkown
Are there any signs of vandalism? No

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: ME-11 Humble Canal

Date of Inspection: November 6, 2009 Time: 8:00am

Structure No. N/A

Inspector(s): OCPR- Mel Guidry, Tal McCain (M&M Electric)
NRCS- Dale Garber, Dave Foster(Acadian Engineers)

Structure Description: Marine Barrier Fence

Water Level Inside

Type of Inspection: Annual

Weater Conditions: Sunny and mild

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	good				
Steel Grating					
Stop Logs	N/A				
Hardware	good				
Timber Piles	good				
Timber Wales	good				
Galv. Pile Caps	good				
Cables	N/A				
Signage /Supports	good			1	
Rip Rap (fill)	N/A				
Eathern Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: ME-11 Humble Canal

Date of Inspection: November 6, 2009 Time: 8:00am

Structure No. Hyacinth Fence

Inspector(s): OCPR- Mel Guidry, Tal McCain (M&M Electric)
NRCS- Dale Garber, Dave Foster(Acadian Engineers)

Structure Description:

Water Level Inside

Type of Inspection: Annual

Weater Conditions: Sunny and mild

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	good				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	good				
Timber Piles	good			2	
Timber Wales	fair			2	
Galv. Pile Caps	good				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	N/A				
Earthen Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?