



Coastal Protection and
Restoration Authority of Louisiana

State of Louisiana
Coastal Protection and Restoration Authority
(CPRA)

2020 Short Summary Report

for

East Marsh Island Marsh Creation

State Project Number TV-21
Priority Project List 14

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Prepared by:
Mark Mouldous
and
Jody White, P.E.

Operations Division
Lafayette Regional Office
635 Cajundome Boulevard
Lafayette, LA 70596



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I. Preface

The East Marsh Island Marsh Creation Project (TV-21) 2020 short summary report includes monitoring data collected through December 2019.

This report is intended to update NRCS and EPA on the latest land/water, hydrographic, vegetation and elevation change data. For more detailed analyses, see the previous comprehensive OM&M reports (2013 and 2018) online at <http://lacoast.gov/new/Projects/Info.aspx?num=TV-21>. A future summary report is planned for 2025 and comprehensive OM&M reports are planned for 2022 and 2030.

II. Monitoring Activity

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System-*Wetlands* (CRMS) for CWPPRA, the TV-21 Monitoring Plan was written to merge it with CRMS and provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. In this report, three CRMS sites (outside of the project area) are to be used to assess the effectiveness of the project along with the project-specific monitoring.

a. Monitoring Goals

The East Marsh Island Marsh Creation Project (TV-21) was designed to restore areas that were previously lost due to lateral marsh erosion. The project was designed to target the areas of the island exhibiting the most land loss due to Hurricane Lili (EPA 2008). The marsh nourishment component of the TV-21 project was designed to deposit new sediments into uncontained marsh areas in the project and provide an influx of nutrients, as well as the benefit of increased elevation.

The objectives of the East Marsh Island Marsh Creation project are:

1. Create approximately 362 acres of emergent marsh in shallow open water and mud flats.
2. Create/nourish an additional 797 acres of brackish marsh with unconfined dredged sediment.
3. Reduce the future loss rate of new and existing marsh in the project area by 50%.

b. Monitoring Elements

Aerial Photography

Aerial photography will be collected for the entire coast through CRMS-*Wetlands* and will be used to evaluate TV-21 along with project specific photography. Land:Water analysis of the 1 km CRMS-like sites will be done using an automated classification methodology using only minimal manual delineation. Photography for the CRMS-like sites within the project area was acquired in 2016 and 2018.

Salinity

Salinity data from both continuous recorder and discrete soil porewater stations are monitored to characterize the spatial variation in salinity throughout the project area. Hourly salinity and water levels (ft, NAVD88) are monitored with continuous recorders in one containment area and one nourishment area at two CRMS-like sites (TV21CR01 and TV21CR02). The CRMS-like sites were installed in September 2011 (Adequate settlement of the containment areas was required prior to construction) and ran continuously until 2017. The recorder at TV21CR01 was pulled on 2/16/2017 due to its similarity to TV21CR02 and to save project funds. The TV21CR02 recorder was again deployed from 2018-2019. CRMS0523 was selected to be the hydrologic reference site. At each rod-surface elevation tables (RSET)/accretion data collection, a measurement of

interstitial water salinity is collected at the boardwalk in the marsh at 10 and 30 cm. Interstitial water salinity is also determined at each of the vegetation plots, when vegetation is surveyed.

Water Level

Water level within the marsh is measured at the CRMS-like sites and reference sites listed above every hour with a water-level gauge installed within an area that is hydrologically connected to the surrounding water body. The gauge is surveyed relative to the top of the RSET (NAVD 88). Water level data is used to document the variability in water levels and duration of inundation in project and reference areas.

Emergent Vegetation

Emergent vegetation parameters are evaluated at each CRMS-like site using techniques described in Folse et al. (2018) to describe species composition, richness, and relative abundance. Annually in late summer at each site, data are collected from ten, 4-m² sample plots randomly established along a 282.8 m transect that crosses diagonally through a 200-m × 200-m sampling area in the middle of the site.

Individual species' cover data were summarized according to the Floristic Quality Index (FQI) method (Cretini et al. 2011). The FQI assigns a low score to invasive species indicative of disturbance and a high score to native species indicative of stability. The two CRMS-like sites inside and 3 CRMS sites outside (522, 523, 524) the project area were used for this report. Data from 2011 - 2019 will be presented. Vegetation was not sampled at the TV-21 sites in 2017. Vegetation sampling was not originally scheduled for 2019, but was added to determine the effects of Hurricane Barry.

Soil Surface Elevation Change

Soil surface elevation change utilizing a combination of RSET and vertical accretion from feldspar horizon markers are being measured twice a year at each site. These data will be used to describe general components of elevation change and establish accretion/subsidence rates. The RSET was surveyed to a known elevation datum (ft, NAVD 88) so it could be directly compared to other elevation variables such as water level. Data collected over at least 5 years was used to calculate rates for the project sites and reference CRMS sites; therefore, the displayed elevation change rates are an estimation of that temporal trend. RSET and vertical accretion were not sampled at the TV-21 sites in 2017. RSET sampling was originally not scheduled for 2019, but was added to determine the effects of Hurricane Barry.

c. Monitoring Results and Discussion

i. Aerial Photography

For the two CRMS-like sites in the project area, land/water analysis was completed for the 2016 and 2018 digital imagery (Table 1). A slight loss of land occurred at TV21-CR01, primarily due

to Gulf of Mexico shoreline erosion. A gain of approximately three acres occurred at TV21-CR02 due to infilling of some of the small interior ponds.

Table 1. Land:Water acreages for 2016 and 2018 at CRMS-like sites in the project area.

CRMS-like Site		2016		2018		Change 2016 to 2018
		acres	%	acres	%	acres
TV21-CR01	Land	210.2	85.07	208.6	84.42	-1.6
	Water	36.9	14.93	38.5	15.58	
	Total	247.1		247.1		
TV21-CR02	Land	208.1	84.22	211.5	85.59	3.4
	Water	39.0	15.78	35.6	14.41	
	Total	247.1		247.1		
Total change						1.8

ii. Salinity

Salinities at the project and reference area recorders were very similar in 2012-2019, averaging around 5 ppt (Figure 1a). Seasonal spikes in salinity occurred in the late summer/fall months occasionally elevating salinities in the project area to 7-10 ppt, but otherwise, salinities primarily remained below 5 ppt. In August of 2012 Hurricane Isaac made landfall near the mouth of the Mississippi River, elevating salinities above 25 ppt in the project area. By the beginning of 2013, salinities dropped back down to normal. A drought in the summer of 2018, coupled with high south winds, raised salinities to 20 ppt in the project area. Salinities remained elevated until mid-August. Hurricane Barry made landfall on Marsh Island on July 13, 2019. There was not a project-specific recorder deployed at the time, but the recorder at CRMS0523 did not detect an increase in salinity during this event.

Average weekly salinities were compared between the project stations to determine if a difference in salinity occurred between the two. A non-parametric one-way median analysis showed that salinities were not statistically different across the period of record between TV21CR01 and TV21CR02 ($\chi^2=0.0378$, $p=0.8459$). This same test also showed there was not a significant difference between salinities at TV21CR02 and the recorder at the reference site CRMS0523 ($\chi^2=0.0078$, $p=0.9297$).

Yearly means of interstitial water salinity for the project stations and CRMS reference sites 522, 523 and 524 are presented in Figures 1b and 1c. Porewater salinities have consistently been

between 5 and 10 ppt through all years at the reference CRMS sites. Nourishment area site TV21CR02 saw elevated salinities in 2011 and 2012 but has since tracked well with the CRMS sites. Salinities at TV21CR01 in the containment area rose continuously through 2014 to above 10 ppt, but have since dropped to the level of the other sites. Slightly higher interstitial salinities at the project sites, particularly in the containment area until 2014, may be due to leaching of salts from the soil due to the soils being dredged from the East Cote Blanche Bay bottom. Increased rainfall in recent years has benefited the project area and worked to freshen the porewater salinities. Soil salinities rose slightly due to the drought in 2018, but dropped to below 5 ppt within the project and reference sites in 2019 for the first time since monitoring began.

iii. Water Level

Water levels were nearly identical in both project sites and CRMS0523 (Figure 2). A non-parametric one-way median analysis determined there was not a significant difference in water between the two project sites ($\chi^2=0.3381$, $p=0.5609$), nor between the project site TV21CR02 and reference site CRMS0523 ($\chi^2=0.3047$, $p=0.5809$). The recorder at CRMS0523 recorded a maximum water level of ~7 ft NAVD 88 during Hurricane Barry's landfall. Water levels receded to normal within 3 days.

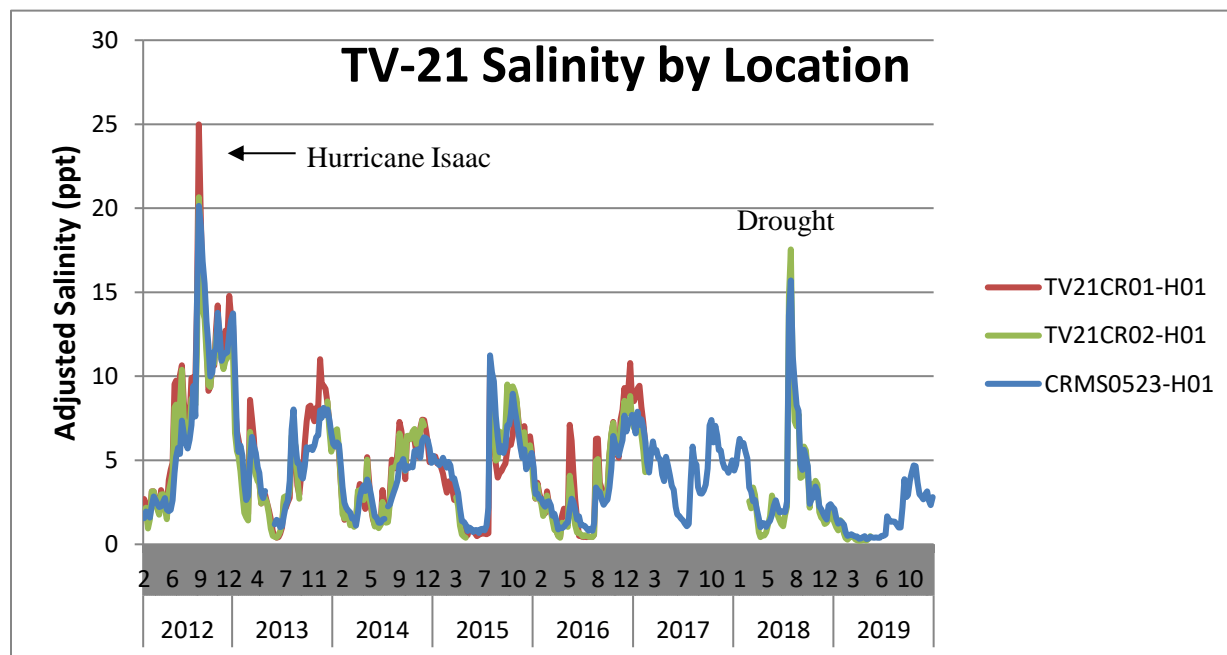


Figure 1a. Weekly means of salinity data collected at project and CRMS reference sites.

Hurricane Isaac

Drought

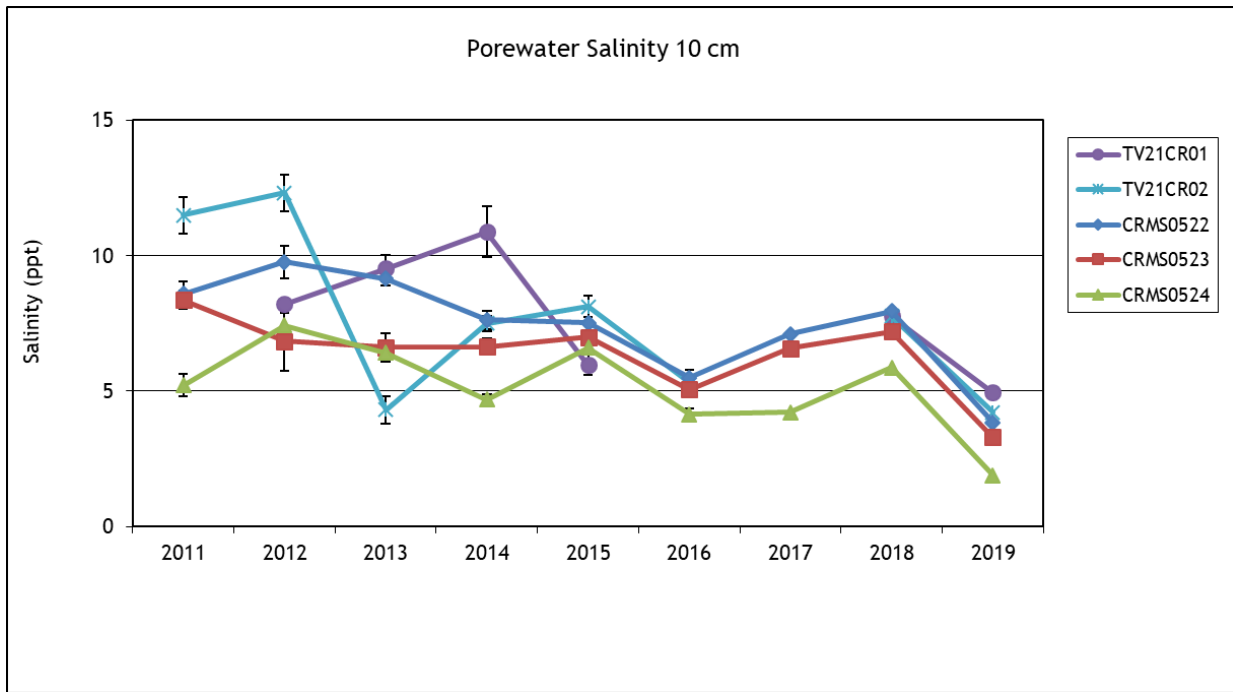


Figure 1b. Yearly Means of Interstitial water salinity at 10 cm below the soil surface at project and CRMS reference sites. Mean \pm SE.

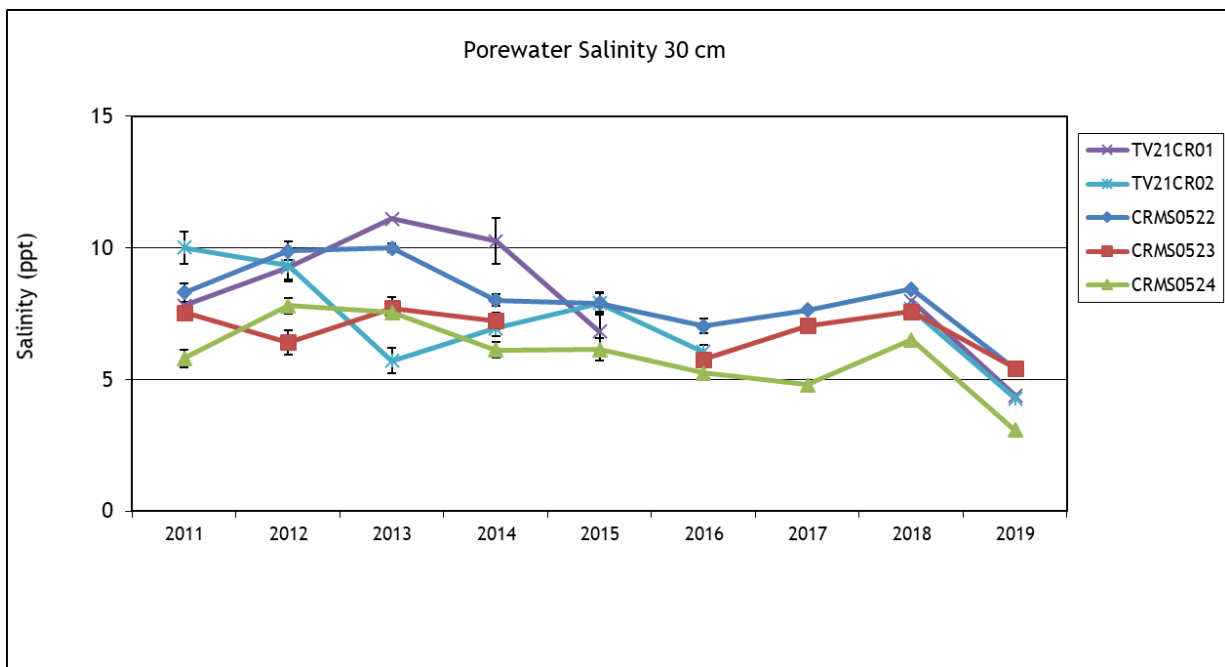


Figure 1c. Yearly Means of Interstitial water salinity at 30 cm below the soil surface at project and CRMS reference sites. Mean \pm SE

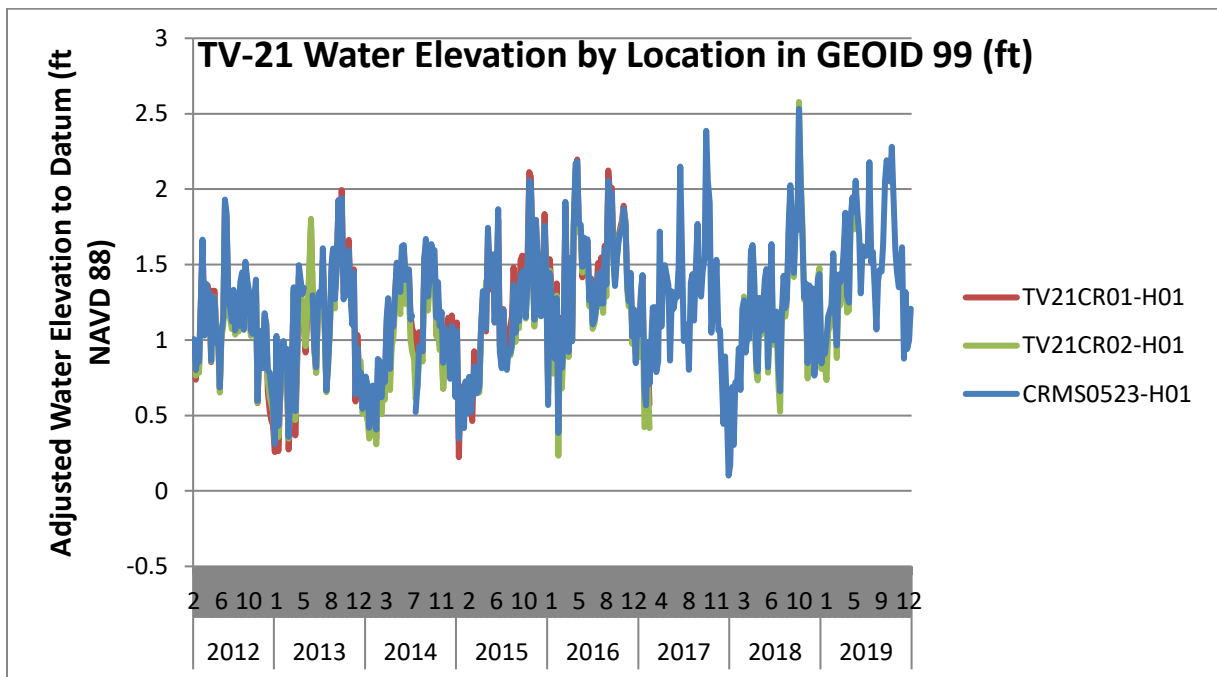


Figure 2. Weekly means of water level data collected at project and CRMS reference sites.

iv. Emergent Vegetation

Containment area 2 (TV21-CR01) slowly vegetated through 2013, then increased in cover to above 70% in 2014-2019 (Figure 3a). A subset of the vegetation stations was surveyed in 2019. The presence of large amounts of wrack from Hurricane Barry prevented access to some of the plots. Other than the wrack, though, the storm did not appear to have a negative impact on the vegetation. The containment area is transitioning into a monoculture of *Phragmites australis*. Vegetation in nourishment area 2 (TV21-CR02) was doing quite well in the first year after construction, but declined drastically in both cover and FQI in 2012 due to heavy herbivory damage from nutria (Figure 3b). By 2012, the nutria had eliminated almost all of the *Schoenoplectus americanus* (a preferred food source) and *Spartina alterniflora* from the area, which were dominant species in the 2011 survey. By 2013, the area had recovered in percent cover of *Spartina patens* and *S. americanus* and also saw the appearance of a large amount of *Eleocharis parvula*, though this species disappeared from the area by 2014. A minor decrease in cover and FQI again occurred in 2016, likely due to the heavy flooding in August immediately prior to the vegetation survey. The cover and quality of vegetation remained high through the 2018 and 2019 surveys with no detrimental impacts noted from Hurricane Barry. Muskrat herbivory and nesting activity were noted in the 2019 survey at the nourishment area, but was not widespread or heavily impactful.

Vegetation at the reference stations has been mostly stable since 2008, with cover values above 70% through most years sampled (Figures 3c – 3e). Like the project nourishment area site, nutria did considerable damage to the CRMS reference sites as well in 2012. Like the project site,

recovery had taken place by 2013 at CRMS0523 and 0524, but not until 2014 at CRMS0522. CRMS0524 saw a large drop in cover and FQI score in 2017. Large amounts of standing dead vegetation were noted on the survey and was likely a delayed response to the flooding in 2016, though none of the other reference sites experienced this. Hurricane Barry appeared to have an effect on all sites in 2019, with reduced cover, though the impacts were very minimal. The vegetation assemblages at the reference sites are similar to the vegetation at TV21-CR02 and are indicative of a brackish marsh, being dominated by *S. patens* and *S. americanus* with small amounts of *Distichlis spicata*.

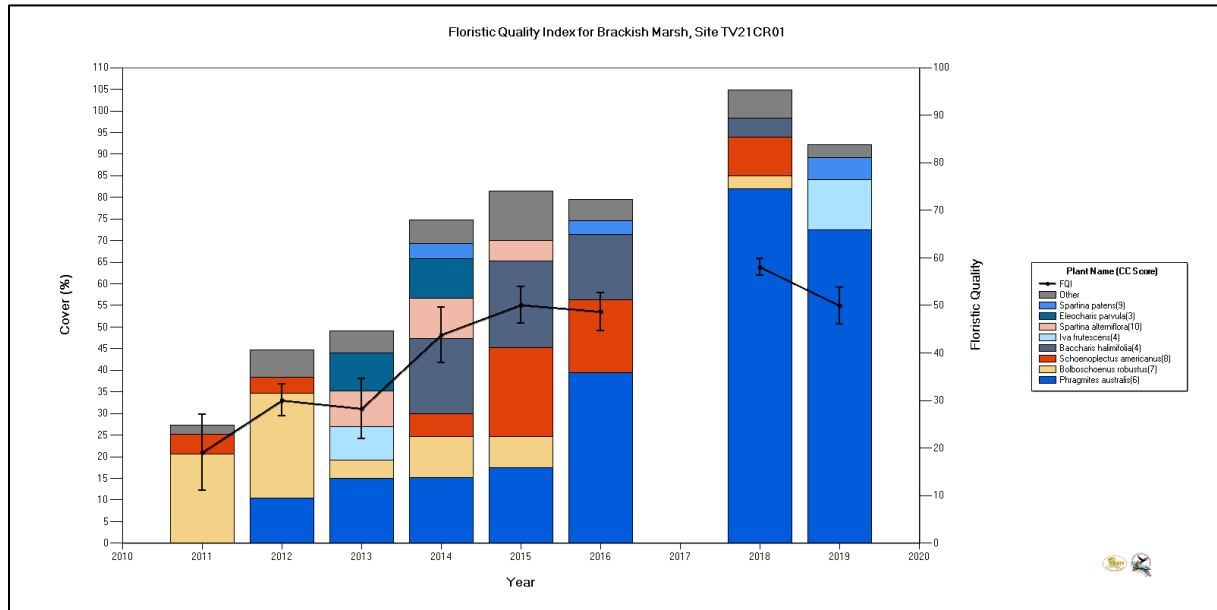


Figure 3a. Percent coverage and floristic quality index of species collected from station TV21-CR01 within the project area in years 2011-2019. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stability.

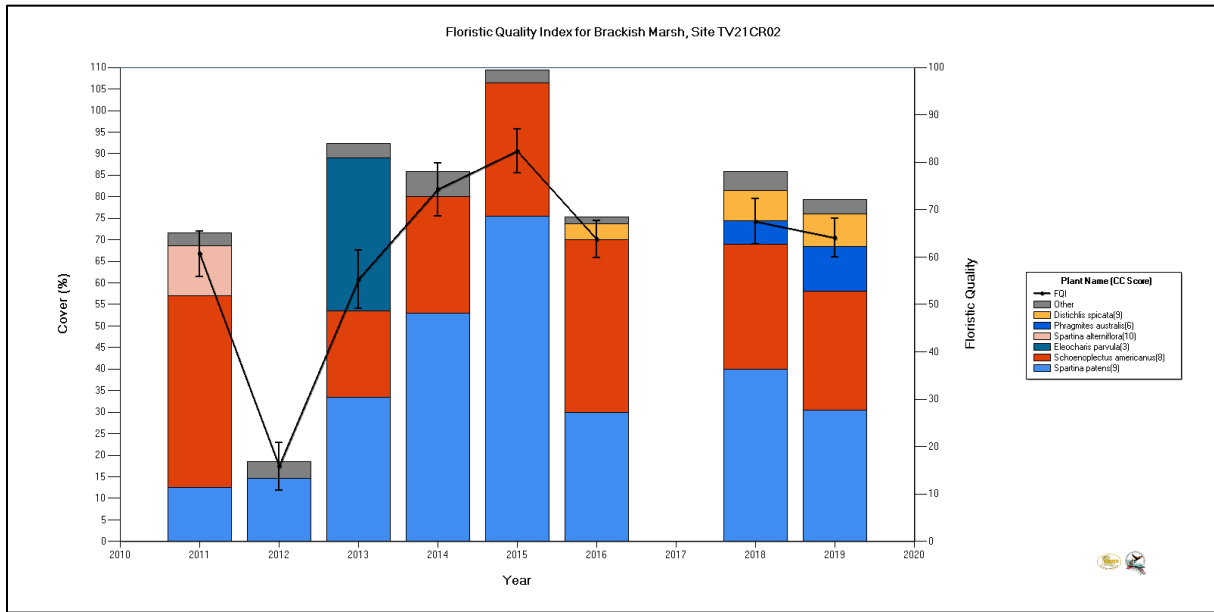


Figure 3b. Percent coverage and floristic quality index of species collected from station TV21-CR02 within the project area in years 2011-2019. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stability.

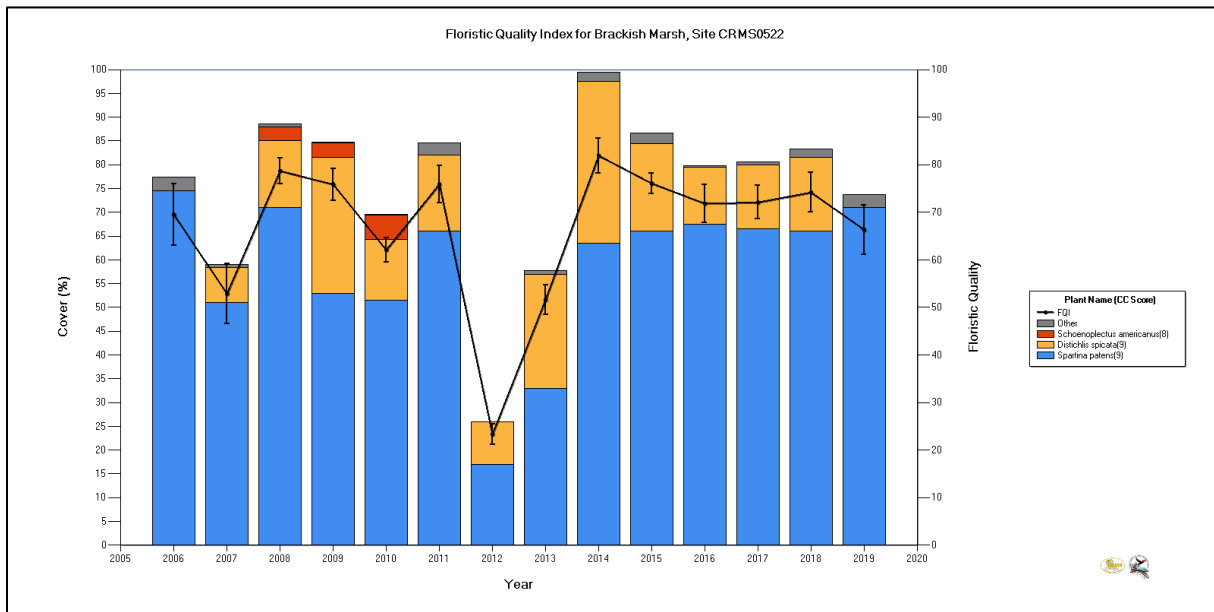


Figure 3c. Percent coverage and floristic quality index of species collected from reference site CRMS0522 in years 2006 - 2019. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stability.

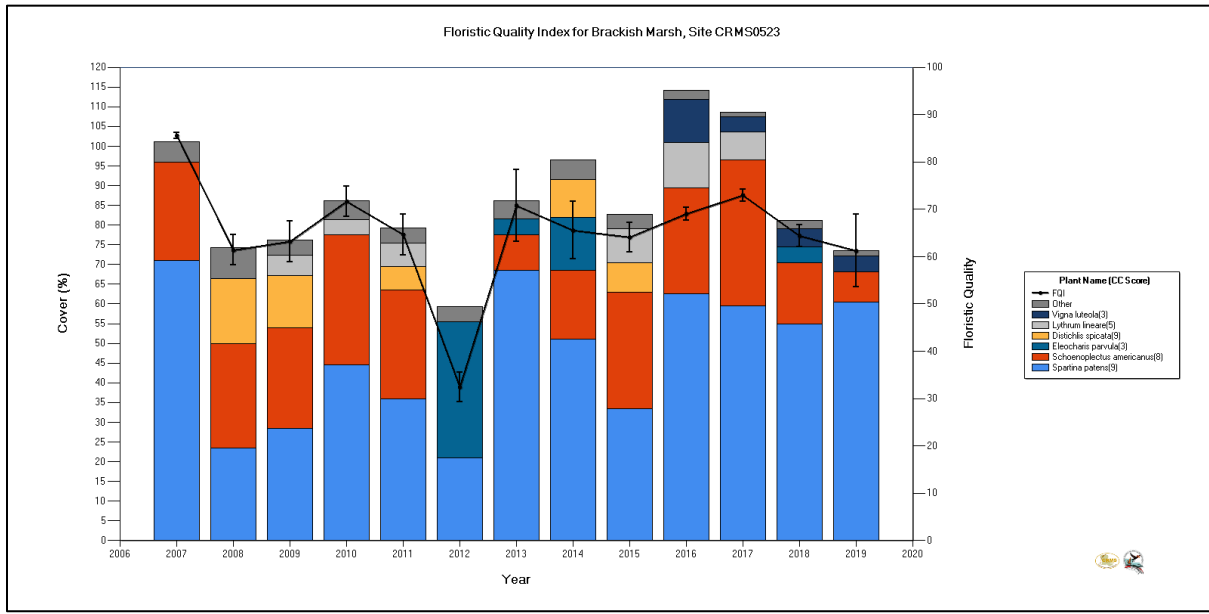


Figure 3d. Percent coverage and floristic quality index of species collected from reference site CRMS0523 in years 2007 - 2019. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stability.

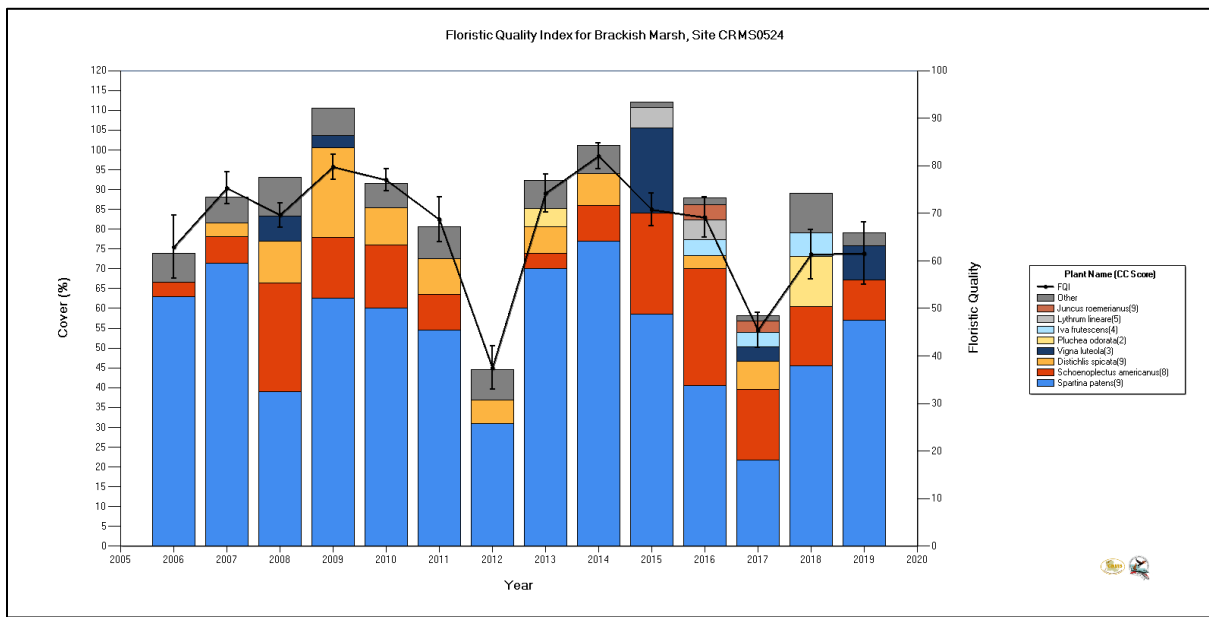


Figure 3e. Percent coverage and floristic quality index of species collected from reference site CRMS0524 in years 2006 - 2019. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stability.

v. **Soil Surface Elevation Change**

The cumulative surface elevation change (SEC) rate within containment area 2 (TV21CR01), as expected, has been negative over the entire monitoring period, due to the settlement of the fill material (Table 2). The settlement period lasted through the spring of 2016, with overall settlement being approximately 12 cm (Figure 4). The spring to fall 2016 time period showed a positive gain in elevation with an associated positive vertical accretion (VA) rate for the first time since monitoring on the project began. SEC rates were stagnant through 2018, but showed a depositional event from Hurricane Barry of approximately 3 cm. SEC within nourishment area 2 (TV21CR02) showed an initial loss in elevation from fall 2012 to spring 2013 that could be attributed to both consolidation of the spoil material and nutria disturbance of the soil surface. Beyond this time period, though, SEC and VA rates have been very similar to the average rates at the three reference CRMS sites (Figure 4). Cumulative SEC, VA, and shallow subsidence rates are also very similar to the average rates of the three CRMS sites (Table 1), suggesting that the nourishment area is behaving functionally like the surrounding area marshes. An elevation gain of approximately 2 cm was also noticed at TV21CR02 following Hurricane Barry.

Table 2. Vertical accretion, surface elevation, and shallow subsidence change rates collected at TV-21 project sites and reference CRMS sites (Rates were averaged for CRMS0522, 523, and 524 ± 1 SE).

Site	Data Collection Period	Rates of Change (cm/yr)		
		Surface Elevation	Vertical Accretion	Shallow Subsidence
TV21CR01	Mar 2012-Oct 2019	-0.95	0.77	1.72
TV21CR02	Mar 2012-Oct 2019	0.46	1.16	0.7
Average of Ref CRMS sites	April 2007-Nov 2019	0.33 ± 0.14	0.94 ± 0.12	0.60 ± 0.03

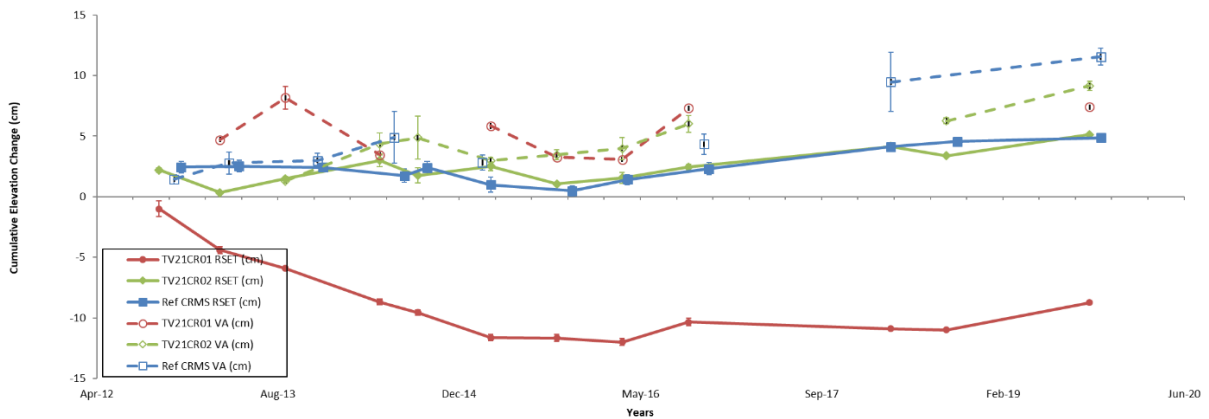


Figure 4. Cumulative elevation change calculated from surface elevation measurements collected at rod-surface elevation tables (RSET) and vertical accretion measurements collected from horizon markers (VA) at TV-21 project and reference sites (CRMS0522, 523, 524) over time. Mean \pm SE.

III. Conclusions

a. Project Effectiveness

Land change, based on land/water analyses at the 1 km CRMS-like sites, showed the containment and nourishment areas to be stable from 2016-2018. Future analyses of the entire project area will allow us to determine if the project is meeting the objective of reducing the marsh loss rate by 50%. Besides a brief spike during the summer of 2018, salinity levels in the project area remained within the intermediate to brackish range in both surface and interstitial water readings. Water levels in the project area did not differ from reference area water levels and reflect the tidal variability of Vermilion Bay. A storm surge of 7 ft was recorded on the island during Hurricane Barry, but resulted in only minor impacts to vegetation. Vegetation in the project area continues to thrive and is reflective of the surrounding natural brackish marshes, particularly in the nourishment area. Elevation change within the containment area has been stagnant since a positive gain during the fall of 2016 while the nourishment area continues to gain elevation at a rate equal to the surrounding marshes. Both the nourishment and containment areas saw small gains in elevation following Hurricane Barry.

IV. Literature Cited

Cretini, K.F., and Steyer, G.D. 2011, Floristic Quality Index-An assessment tool for restoration project and monitoring sites in coastal Louisiana: U.S. Geological Survey Fact Sheet 2011-3044, 4p.

Folse, T. M., L. A. Sharp, J. L. West, M. K. Hymel, J. P. Troutman, T. McGinnis, D. Weifenbach, W. M. Boshart, L. B. Rodrigue, D. C. Richardi, W. B. Wood, and C. M. Miller. 2018. [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. 228 pp.

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