Coastal Protection and Restoration Authority of Louisiana

State of Louisiana
Coastal Protection and Restoration Authority

2023 Operations, Maintenance, and Monitoring Closeout Report

For the

Hopedale Hydrologic Restoration (PO-0024) Project

State Project Number PO-0024
Priority Project List 8

August 2024
St. Bernard Parish

Prepared by:
Theryn Henkel, Ph.D., Connor Hannan, and Melissa Hymel

Coastal Protection and Restoration Authority
New Orleans Regional Office
CERM, Suite 309
2045 Lakeshore Dr.
New Orleans, LA 70122

Suggested Citation:

Henkel, T, C. Hannan, and M. Hymel 2024. *2023 Operations Maintenance and Monitoring Closeout Report for Hopedale Hydrologic Restoration (PO-0024) Project*, Coastal Protection and Restoration Authority of Louisiana, New Orleans, Louisiana. 47 pp.

2023 Operations, Maintenance, and Monitoring Closeout Report
for the
Hopedale Hydrologic Restoration (PO-0024) Project

Table of Contents

Preface

The Hopedale Hydrologic Restoration (PO-0024) Project was funded through the Coastal Wetlands Planning and Protection Act (CWPPRA) on the 8th Priority Project List with the National Oceanic and Atmospheric Administration (NOAA) as the federal sponsor. This report includes monitoring data collected and site assessments conducted through December 2022. The 2023 Operations, Maintenance, & Monitoring (OM&M) Report is the fourth and last in a series that includes monitoring data and analyses presented previously in the 2007, 2010, and 2014 OM&M reports (Carter et al. 2007, Carter et al. 2010, Gossman et al. 2014), plus additional project-specific and CRMS data collected since the previous report. These reports will be made available for download at the following website: https://cims.coastal.louisiana.gov/outreach/projects/ProjectView?projID=PO-0024.

I. Introduction

The 4,656-acre (1,884-ha) Hopedale Hydrologic Restoration Project (PO-0024) is located southeast of Yscloskey, Louisiana, and is bordered by LA Hwy 46 to the west, the Mississippi River Gulf Outlet (MRGO) spoil deposition area to the north, and Louisiana Highway 624 and Bayou La Loutre to the south and east (Figure 1). This area was formed as part of the St. Bernard Delta Lobe approximately 3,000 years ago when the Mississippi River flowed through what is now Bayou La Loutre, laying the foundation for present day St. Bernard Parish. At the time of project design, the project area was predominately brackish marsh (3,086 acres) and open water (719 acres) with a small amount of saline marsh, bottomland hardwoods and bottomland scrub/shrub.

Wetlands in the project area have been adversely impacted by altered hydrology and semi-impoundment due to construction of the MRGO in the 1950's and LA Hwy 624. From 1958 to 1968, the Mississippi River Gulf Outlet (MRGO) channel was constructed, which cut through the relic delta and Bayou La Loutre and provided a direct route for high salinity intrusion into the upper basin. As part of the construction of the MRGO, a spoil containment dike was constructed to allow placement of material from the MRGO dredging operation. The dike almost completely impounded the surrounding marsh with the exception of the Back Dike Borrow Canal which directly connected to Bayou La Loutre. A plug and water control structure (S-1, Figure 1) was placed in the Back Dike Borrow Canal approximately 400 ft from its intersection with Bayou La Loutre. This structure consisted of three iron culverts with flap gates and provided drainage from the area while limiting tidal increases in minimal storm events; however, by the mid 1990's the flap gates had been removed, one culvert had completely collapsed, and the other two culverts had partially collapsed.

Figure 1: Hopedale Hydrologic Restoration (PO-0024) project location and features.

During construction of LA Hwy 624, the Louisiana Department of Transportation and Development (LDOTD) installed four sets of non-gated culverts (S-2 through S-5, Figure 1) under the roadway. Those structures allowed uncontrolled high salinity influx from Bayou La Loutre into the project area. As part of an LDOTD reconstruction project to increase the elevation of LA Hwy 624, those culverts were replaced in 2000. The replacement structures consisted of three, plastic, 36-inch culverts at S-2 through S-4 and two, plastic, 36-inch culverts at S-5.

By the time of project design, wetlands in the PO-0024 project area were being adversely impacted by increases in flood durations due to the near complete impoundment from LA Hwy 624 and the MRGO, and the reduced drainage capacity associated with the deteriorated water control structures. Hydraulic modeling (BC&G 2001) and pre-construction monitoring indicated that water levels in the project area were inundating the marsh for up to a month at a time. Repeated prolonged inundation of the project area was expected to reduce land acreage and vigor of less tolerant plant species over time (Hartman et al. 1998). It was anticipated that over the 20-year project life, about 135 acres of emergent wetlands would be converted to shallow open water without the project, and that wetland loss rates in the project area would increase from 0.12% per year to 0.48% per year over the 20-year period.

In January 2004, construction began on the Hopedale water control structure at the junction of the Back Dike Borrow Canal and Bayou La Loutre. This involved removal of the 3 existing corrugated metal pipes and rock structure located within the Back Dike Borrow Canal and replacing them with a sheet pile/pipe pile gated structure, along with associated walkways, fish gates, and riprap protection. The structure, which was completed in November 2004, also required construction of temporary closure dams for dewatering the existing canal.

The goals of the Hopedale Hydrologic Restoration Project (PO-0024) were to restore natural drainage patterns, to sustain or enhance the deteriorating marsh, and maintain or improve fisheries transport within the area. The combination-gated structures of this project were expected to significantly reduce the tidal influx of higher salinity water from the MRGO and Bayou La Loutre into the project area, and reduce marsh inundation intensity and duration. Fish-access slots would maintain organism exchange between Bayou La Loutre and the project area.

The principle project features include:

- A sheet pile/pipe pile wall, which spans the channel and extends past both banks with an overall length of 137.9’. The top of cap plate elevation is set at +8.0’ NAVD88.

- Three 82” diameter Whipps combination gates (flap/sluice gates) and two 24”x 84” Whipps fisheries access slots (fish gates) with the invert elevation at –7.0’ NAVD88.

- A walkway across the structure with guardrails and warning signs on each side of the

structure for operating the gates safely and for prohibiting unwanted access. The channel spans 115’ from the canal banks and is covered with riprap (1’ thick 10-lb. overlain by 1.5’ thick 55-lb.). The top of 55-lb. riprap along the canal bottom is set at elevation –8.0’ NAVD88.

II. Maintenance Activity

a. Summary of Past Maintenance Activities

In 2005, the Hopedale structure suffered minor damage due to Hurricane Katrina. In 2007/2008 the repairs, at a cost of $64,900, were made as follows:

- Repaired and replaced all damaged fence panels on the cross-walk.
- Replaced missing gate stem covers.
- Repaired damaged railing.
- Placed riprap into eroded areas.
- Replaced missing mechanical gate operator.
- Added support beam under walkway.

In 2012 and 2019, the structure suffered minor damage due to Hurricanes Isaac (2012) and Barry (2019). In 2019, repairs were made by St. Bernard Parish Government (SBPG) as follows:

- Replaced missing and damaged gate stem covers.

b. Inspection Purpose and Procedures

The purpose of the annual inspection of the Hopedale Hydrologic Restoration Project (PO-0024) is to evaluate the constructed project features, to identify any deficiencies, and to prepare a report detailing the condition of project features and necessary corrective actions. Should it be determined that corrective actions are needed, CPRA shall provide a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs (LDNR 2005). The annual inspection report also contains a summary of maintenance projects and an estimated projected budget for the upcoming two (2) years for operation, maintenance and

rehabilitation. The two (2) year projected operation and maintenance budget is shown in Appendix B.

c. Inspection Results

An inspection of the Hopedale Hydrologic Restoration Project (PO-0024) was held on April 19, 2023 by CPRA representatives Connor Hannan and Melissa Hymel, NMFS representative Brandon Howard, and SBPG representative Louis Pomes. Photographs from that inspection are included in Appendix A of this report.

Water Control Structure

The fish gates were open at the time of the inspection. During the exercise of one of the gates the gearbox suffered damage rendering it inoperable. The representative with SBPG removed the broken gearbox from the top of the gate to have it repaired (See photo 3 in Appendix A). The gate associated with the broken gearbox will remain closed until the gearbox is repaired and re-installed. CPRA will coordinate with SBPG to ensure the gearbox is repaired and re-installed.

Corrosion was observed at joints between sheet piles and pipe piles near the apparent mean water level at both the main structure as well as the two pipe pile barriers flanking the structure (See photos 1 and 2 in Appendix A). The project team attempted to locate the sacrificial anodes previously placed on the structure but was unable to locate them. The anodes are presumably exhausted.

d. Maintenance Conclusions

The Hopedale Hydrologic Restoration Project (PO-0024) is performing as designed. A final maintenance event which is outlined below in Section e. is to be performed prior to closeout.

e. Maintenance Recommendations

Maintenance prior to closeout to include the following:

- Repair or replacement of broken fish gate gearbox.
- Replacing 26 anodes on the entire structure.
- Clean and treat surficial rust with epoxy coating.

III. Operations Activity

Operation of the structure has been performed by various parties since the Project was implemented. An Operations and Maintenance contract was initiated with the Lake Borgne Basin

Levee District in 2011 to provide regular maintenance and operations for the structure. This contract expired and was replaced with a new Operations and Maintenance contract with St. Bernard Parish Government in 2017, which was then extended in 2020 through November 2024. Operations will continue until the end of Project life in November 2024.

IV. Monitoring Activity

Pursuant to a CWPPRA Task Force decision on August 14, 2003, the Coastwide Reference Monitoring System-Wetlands (CRMS) was adopted, which established a network of monitoring stations across the Louisiana coast. There is one CRMS site located in the project area, CRMS3800, which will be used to supplement existing project-specific data. There are three additional CRMS sites nearby, CRMS4548, CRMS4551, and CRMS4557, which will be used as reference sites. See Figure 1 for CRMS site locations.

a. Monitoring Goals

The objectives of the Hopedale Hydrologic Restoration Project are three-fold: (1) to maintain and enhance existing marsh in the project area by reducing the tidal influx of higher salinity water, (2) to reduce the intensity and duration of marsh inundation, and (3) to maintain organism exchange.

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

1. Maintain 99% of the pre-construction acres of vegetated wetlands over the life of the project.
2. Reduce the number and duration of flooding events.
3. Maintain or improve fisheries ingress and egress.

b. Monitoring Elements

Aerial Photography

To determine ratios of land to open water in the project area, near vertical, color-infrared aerial photography was obtained in November 2000 (pre-construction), October 2012, and November 2021. The imagery was georectified, photo-interpreted, and analyzed to determine land:water ratios using standard operating procedures and techniques described in Steyer et al. (1995, revised 2000). All areas characterized by emergent vegetation, upland, wetland forest, or scrub-shrub were classified as land, while open water, aquatic beds, and mudflats were classified as water. The 2000 photography was acquired specifically for the PO-0024 project at 1:12,000 scale with ground controls. The 2012 and 2021 photography was obtained through the CRMS program (Folse et al. 2023). The CRMS program uses digital imagery (Z/I digital mapping camera) with 1-meter resolution.

Continuous Hydrologic Data – Salinity and Water Level

Three PO-0024 continuous recorder stations (PO24-01, -03, and -05) were located within the project area (project sites) and two PO-0024 recorders (PO24-02 and -04) were located outside the project area (reference sites, Figure 1). Additionally, four CRMS sites will be included in the monitoring data discussions and analyses. CRMS3800 is within the PO-0024 project boundary (project site) and three CRMS sites are located outside of the project area (CRMS4548, 4551, and 4557; reference sites). All of the project specific gauges were removed by 2014. Therefore, for the purposes of this report, new analysis of water level and salinity will only include the CRMS stations, with data through the end of 2022.

Hourly water level, temperature, specific conductivity, and salinity data were collected at each project-specific site. The continuous recorder was mounted on a wooden post in open water environments with sufficient water depths to inundate the recorder year round. Each continuous recorder station was serviced every 1 to 3 months to clean and calibrate the recorder and to download the data. During processing, the data were examined for accuracy and water level data were converted to a common vertical datum in relation to the elevation of a surveyed 'mark' (nail) located on the side of each post. The data were then loaded to the CPRA database and are available for download from the Coastal Information Management System (CIMS) website (https://cims.coastal.louisiana.gov/Default.aspx).

Salinity data collection began in June 2000 at the five PO-0024 stations, and was collected at two of the PO-0024 stations, PO24-02 and PO24-05, through August 2014. Data collection was discontinued at PO24-01 and PO24-03 in April 2011 and at PO24-04 in September 2008 following Hurricanes Gustav and Ike. The CRMS sites included in this report have been active from January 2008 to present. A summary of the hydrologic recorders used for this project is included in Table 1. Data gaps at project specific and CRMS sondes occurred for a variety of reasons, including failed sondes, storms, biofouling, etc. Therefore, data completeness for hydrologic data is shown by year in Table 2. This is especially important in the calculation of time flooded as flooding could have occurred when there was missing data. Therefore, in years with lower completeness, the calculated time flooded may be slightly lower than actual.

Table 1: Summary of PO-0024 hydrologic monitoring stations.

Station	Station Type	Data Collection Period
PO24-01	Project	6/1/2000 - 4/7/2011
PO24-02	Reference	6/1/2022 - 8/11/2014
PO24-03	Project	6/1/2000 - 4/7/2011
PO24-04	Reference	6/1/2000 - 10/28/2008
PO24-05	Project	6/1/2000 - 8/11/2014
CRMS3800	Project	1/10/2008 - Present
CRMS4548	Reference	1/23/2008 - 8/11/2015
CRMS4551	Reference	1/23/2008 - Present
CRMS4557	Reference	1/23/2008 - Present

Table 2: Percent data completeness by year at project monitoring stations.

Percent Annual Data Collection Completeness							
Year	CRMS3800	CRMS4548	CRMS4551	CRMS4557	PO24-01	PO24-03	PO24-05
2001					92.2	94.4	100.0
2002					74.4	79.1	100.0
2003					100.0	79.8	84.1
2004					99.1	96.4	77.5
2005					63.0	66.0	90.1
2006					100.0	94.3	98.4
2007					98.3	92.6	88.7
2008	60.8	87.3	92.4	92.2	100.0	93.2	84.0
2009	69.4	99.6	91.4	98.0	100.0	87.5	100.0
2010	86.3	91.1	89.5	88.6	100.0	98.5	99.8
2011	91.1	93.9	75.2	88.6			100.0
2012	98.0	60.5	92.6	98.5			98.3
2013	77.2	76.7	99.8	99.3			100.0
2014	100.0	67.9	99.0	99.5			
2015	100.0		99.7	99.2			
2016	98.4		99.6	97.6			
2017	92.3		92.3	83.6			
2018	100.0		99.2	86.8			
2019	100.0		99.1	93.3			
2020	100.0		93.1	90.2			
2021	100.0		99.8	90.4			
2022	95.7		90.6	92.5			

The same 9 recorders used to collect salinity data were also used to record water level. All 9 stations were surveyed to the North American Vertical Datum (NAVD 88) to allow the data to be converted to a known elevation. Average marsh elevation, which enables assessment of frequency, depth and duration of marsh flooding, was determined directly adjacent to the three PO-0024 stations within the project area at the time of establishment in 2000 (Table 1). Average marsh elevation was resurveyed in 2003 at PO24-03 and PO24-05 and in 2013 at PO24-05. There was no marsh directly adjacent to the reference sites, PO24-02 and PO24-04, due to the high spoil banks along Bayou La Loutre; therefore, average marsh elevation is unavailable for these stations. Average marsh elevation was surveyed at the four CRMS stations in 2007, 2014, and 2021.

There were numerous meteorological and flood control events that occurred over the project life that likely had an impact on salinity and water level in the project area, over varying time spans. Table 3 lists these events in chronological order.

Table 3: Significant events affecting salinity and water level in the project area.

Event Description	Date
Initial Brown Marsh Event (drought)	Spring 2000 - Early 2001
Hurricane Isidore	September-2002
Hurricane Lili	October-2002
Hurricane Ivan	September-2004
Tropical Storm Matthew	October-2004
PO-24 Control Structure Construction	Jan-Nov 2004
Hurricane Cindy	July-2005
Hurricane Katrina	August-2005
Hurricane Rita	September-2005
High River Event/Bonnet Carre Spillway Opening (160 bays open 31 days)	April-2008
Hurricane Gustav	September-2008
Hurricane Ike	September-2008
MRGO Closure	Jan to Jul-2009
High Discharge through Caernarvon Diversion (Oil Spill Response; mean >8000 cfs)	May-Jun 2010
High River Event/Bonnet Carre Spillway Opening (330 bays open 42 days)	May-2011
Hurricane Isaac	August-2012
High River Event/Bonnet Carre Spillway Opening (210 bays open 22 days)	January-2016
Tropical Storm Cindy	June-2017
Hurricane Nate	October-2017
High River Event/Bonnet Carre Spillway Opening (183 bays open 22 days)	March-2018
High River Event/Bonnet Carre Spillway Opening (206 bays open 43 days)	February-2019
High River Event/Bonnet Carre Spillway Opening (168 bays open 79 days)	May-2019
High River Event/Bonnet Carre Spillway Opening (90 bays open 29 days)	April-2020
Tropical Storm Cristobal	June-2020
Hurricane Zeta	October-2020
Hurricane Ida	August-2021

c. Monitoring Results and Discussion

i. Aerial Photography

Land-water analysis of the aerial photography acquired in 2000 indicates that there were 3,463 ac of land and 1,193 ac of water within the 4,656-ac project area prior to construction (Figure 2). This amounts to 74.4% land and 25.6% water. The 2012 land-water analysis indicates that there were 3,509 ac of land and 1,147 ac of water within the project area, or 75.4% land and 24.6% water (Figure 3). This represents a net gain of 46 ac or 1% of land over the 12-yr period. The 2021 land-water analysis indicates that there were 3,462 ac of land and 1,194 ac of water within the project area or 74.3% land and 25.7% water (Figure 4). This represent a loss of 47 ac since the 2012 analysis and a loss of 1 ac since 2000.

Closer inspection of the 2000 and 2012 land-water analysis reveals that much of the land gain appears in two main areas; 1) north of the back dike borrow canal and 2) an area immediately south of the back dike borrow canal in the eastern portion of the project area. The land gain in the latter area can be attributed to the placement of spoil from a maintenance dredging event of the MRGO that took place in 2005 (Figure 5). The dredged spoil was placed in an area of broken marsh approximately 150 ac in size and has subsequently vegetated. Despite the gains in land acreage, there were land losses in the central portion of the project area between the back dike borrow canal and the Bayou La Loutre Ridge. This land loss is due to the continued degradation of the fragmented marsh in the area.

The 2021 land-water analysis showed that the project area had approximately the same as the original acreage present in 2000, and therefore, the area lost all of the gain observed during the first analysis period from 2000 to 2012. The loss from 2012 to 2022 appears to be from interior marshes that continue to degrade and fragment. There is further evidence of this fragmentation when examining the vegetation data from the CRMS 3800 site. Ten 2m x 2m vegetation plots are surveyed annually at each CRMS site for total percent cover and percent cover by species. These data show that by 2022, two of the ten plots at CRMS 3800 had converted to open water, with degradation and decreasing percent cover observed in other plots (Figure 6). Total percent cover was relatively steady in plots from 2007 to 2020 at approximately 71% and then declined to 41% in 2021 and 34% in 2022. The vegetation data was collected before Hurricane Ida in 2021; therefore, the decline cannot be attributed to that event. It is possible that the recent marsh decline at CRMS 3800 may be associated with a general increase in marsh inundation over time observed at the CRMS sites both within and outside of the project area (see *Water Level and Flooding* section). A similar marsh decline was not observed within the vegetation plots at the three reference CRMS sites outside of the project area, however, these sites have a higher marsh elevation than CRMS 3800 making them more resilient to the rise in inundation.

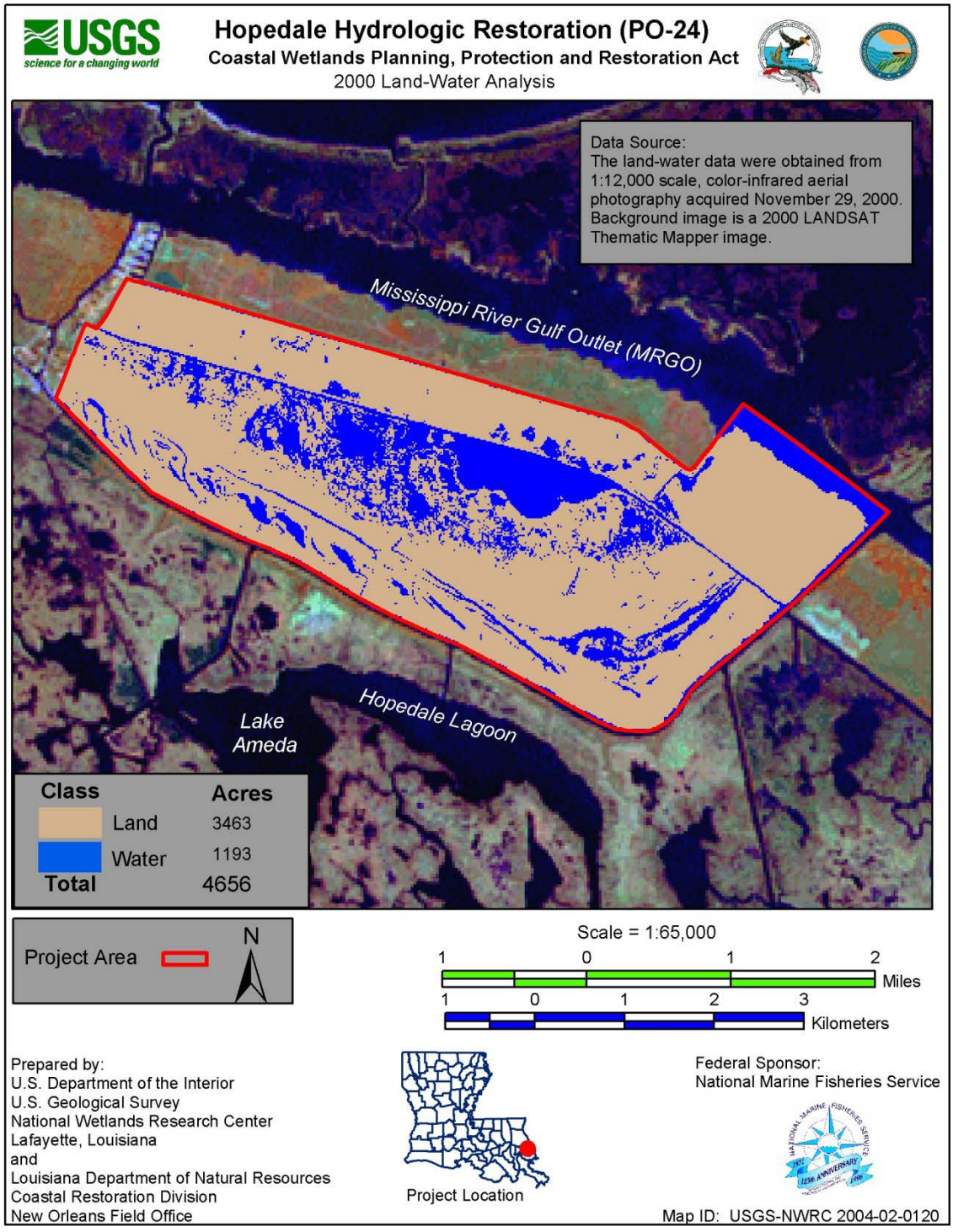

Figure 2: Land/water classification of 2000 aerial photography for PO-0024.

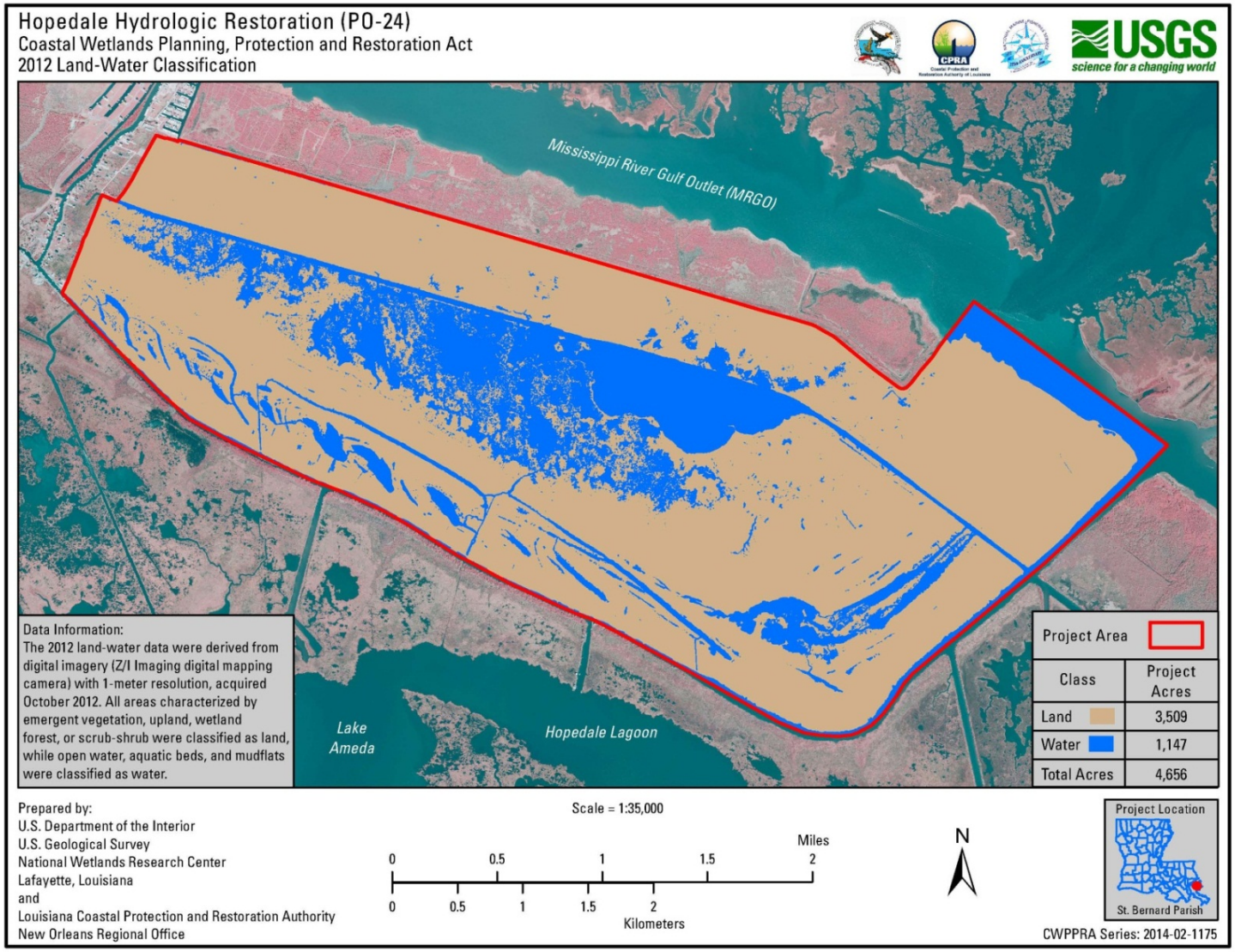

Figure 3: Land/water classification of 2012 aerial photography for PO-0024.

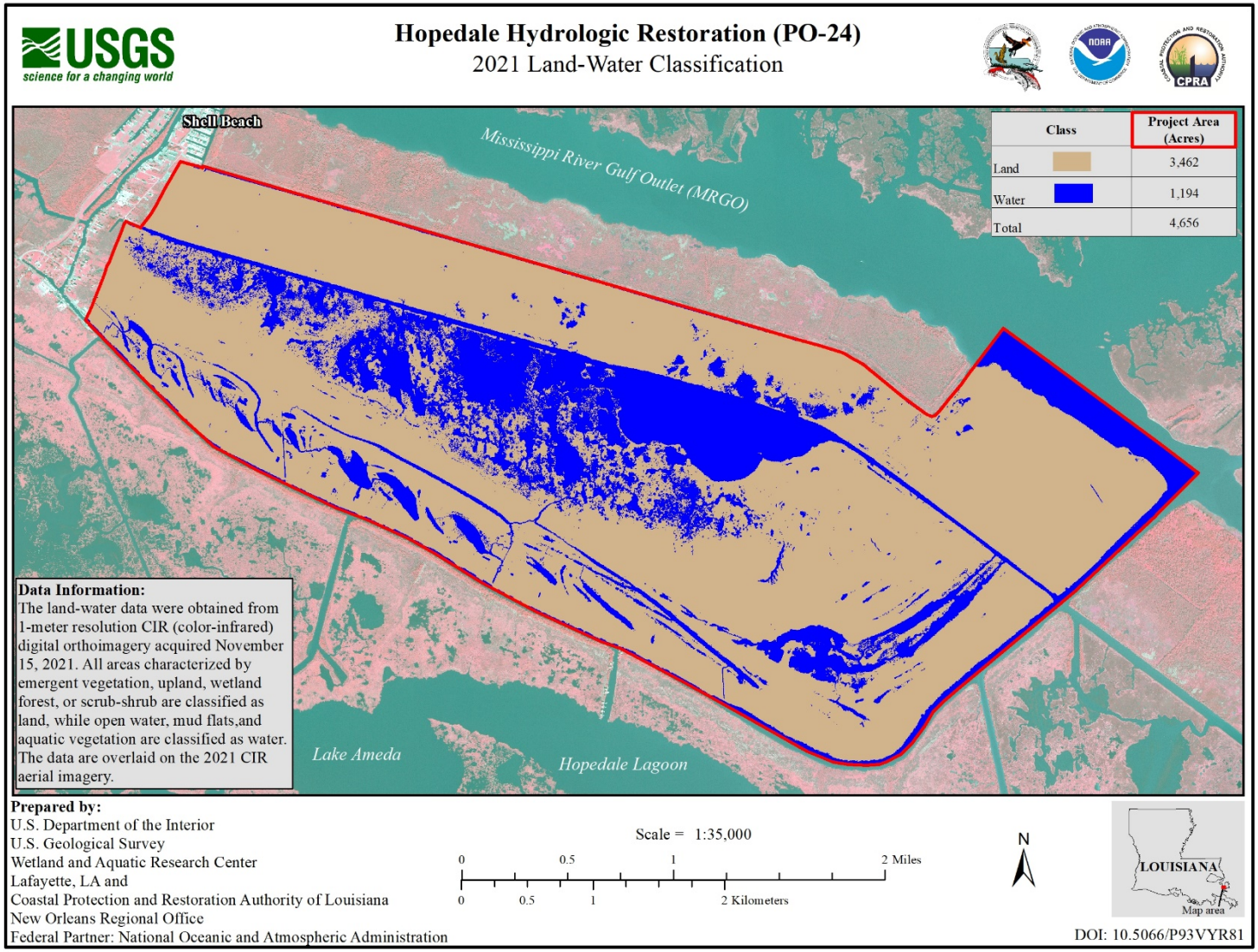

Figure 4: Land/water classification of 2021 aerial photography for PO-0024.

Figure 5: Location of MRGO spoil deposition within the PO-0024 project area in 1998 (left) and 2012 (right).

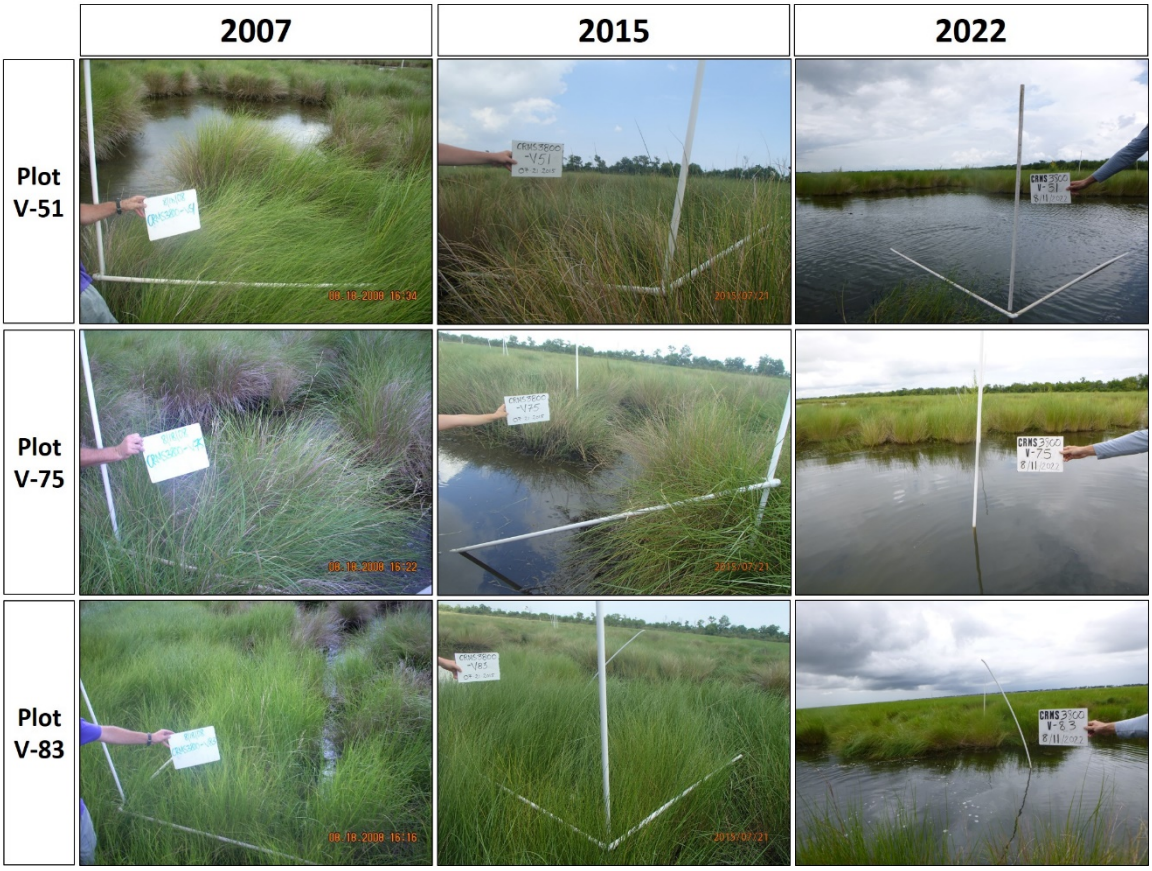

Figure 6: Progression of three of the ten CRMS3800 vegetation plots towards open water over 15 years.

Land-water analyses were also conducted in 2005, 2008, 2012, 2016, and 2018 (Table 4) within a 1-km^2 area surrounding each CRMS site. The 1-km^2 area at CRMS3800 is contained entirely within the PO-0024 project area. Although all of these analyses took place after PO-0024 construction, they still offer a comparison of trends within the project and reference areas. Land:water ratios were generally stable over time at CRMS 3800 and the three CRMS sites outside the project area, but Percent Land was the lowest in 2018 at all four sites. Percent land at CRMS 3800 fluctuated slightly between 2005 and 2012, but showed a net gain overall, until a 2.4% decline from 2016 to 2018. The reference site CRMS4548 exhibits a similar trend as CRMS3800, except that the slight decline began in 2012. There was a net loss in land area at CRMS4551; with land area decreasing slightly with each analysis. Finally, at CRMS4557 land area held steady between 2005 through 2016, then decreased slightly in 2018.

Despite the recent loss of land acreage observed in the PO-0024 project area analysis from 2012 to 2021, the original project goal of maintaining 99% of the vegetated pre-construction acreage was met by the end of the 20-year project life. The net loss of only one acre from 2000 to 2021 represents a 99.97% retention of land within the project area. However, the recent loss of land within the project area and at the CRMS sites in 2018 may be an indication that marsh stress may now be occurring in response to observed increases in inundation. If this inundation trend continues, the PO-0024 water control structure will be increasingly important for effective drainage of the project area to maintain the health of the marsh within the impoundment area.

Table 4: Percent land and water at CRMS sites 3800 (project) and 4548, 4551, and 4557 (reference) in 2005, 2008, 2012, 2016, and 2018.

Year	CRMS3800		CRMS4548		CRMS4551		CRMS4557	
	% Land	% Water	% Land	% Water	% Land	% Water	% Land	% Water
2005	65.6	34.4	35.1	64.9	35.9	64.1	81.2	18.8
2008	67.2	32.8	36.7	63.3	34.8	65.2	81.3	18.7
2012	66.1	33.9	35.9	64.1	33	67	81.1	18.9
2016	66.5	33.5	34.8	65.2	31.3	68.7	81.8	18.2
2018	64.1	35.9	34	66	29.1	70.9	79.9	20.1

ii. Salinity

The Back Dike Borrow Canal, which connects Bayou La Loutre to the project area, was completely blocked during construction to allow for structure placement, thus stopping water exchange. Data collected during the construction period (10 January 2004 – 30 November 2004) were removed from the salinity data set for analyses, but are presented in the time series graphs (Figures 7- 9). Hourly data were averaged to obtain mean weekly salinity readings which were used for all subsequent statistical analyses. Mean weekly observations were used to reduce the effects of diurnal tides and meteorological events in the data.

The initial deployment of the Hopedale Hydrologic Restoration (PO-0024) project continuous recorders occurred during a severe drought. The drought affected southeast Louisiana from August 1999 to December 2000 during which time widespread dieback of marsh vegetation occurred throughout Louisiana's coastal zone (locally known as the Brown Marsh Dieback). Figures 7 and 8 depict salinity signals over the entire data record. The PO-0024 stations recorded the highest salinity levels for the entire 13-year period of record during the drought with salinity values registering up to 10 ppt greater than normal conditions. Salinity incursions also occurred during tropical events and during periods of sustained strong east winds, which can be identified by spikes in Figures 7 through 9. The spikes from these meteorological events were short-lived compared to the increase in salinity associated with the drought at the beginning of data collection.

Visual observation of monthly means indicate that project and reference stations tracked one another fairly closely, even after completion of construction in November 2004. Salinity levels in mid-2010 were the lowest in the period of record at all four sites within the project area. Following the 2010 oil spill, the flow through the Caernarvon Diversion structure was opened to greater than 8,000 cfs in late April through early August in an effort to limit the oil from entering coastal waters. A similar reduction in salinity was observed in 2008 which coincided with another high discharge event at Caernarvon, as well as the opening of the Bonnet Carre Spillway. Freshwater introduced through these structures may have influenced the project area during these high flow periods and to a lesser degree during lower flow periods.

Figure 9 compares salinity data for the period of record containing CRMS data (beginning Jan 2008). Beginning in mid-2009, salinity values at CRMS 4557 diverge from surrounding sites and increase by up to 10 ppt. The closure of the MRGO navigation channel during this same time period appears to have caused this divergence, as CRMS 4557 is the only station southeast of the closure structure. In 2014, the hydrologic station at CRMS 4548 was discontinued. However, the divergence described above remains

through 2022. Porewater salinity data (soil salinity henceforth) is collected at the CRMS sites approximately six times a year, and is collected at 10 cm and 30 cm depth. Soil salinity is less subject to tidal salinity fluctuations than surface salinity and can provide a glimpse into long-term trends at a site. Soil salinity is only collected annually since 2014 at CRMS 4548, therefore, those data are not presented. The trend observed in the surface salinity is also observed in the soil salinity, with CRMS 3800 and 4551 showing both a salinity decrease and less fluctuation after the MRGO was closed (although the pre-closure record is only approximately 2 years long) and CRMS 4557 (down basin or outside of the closure) showing higher soil salinity with no decreasing trend (Figure 10). The surface and soil salinity data indicate that the impact of the closure of the MRGO is permanent, unless there is some future change in hydrologic patterns.

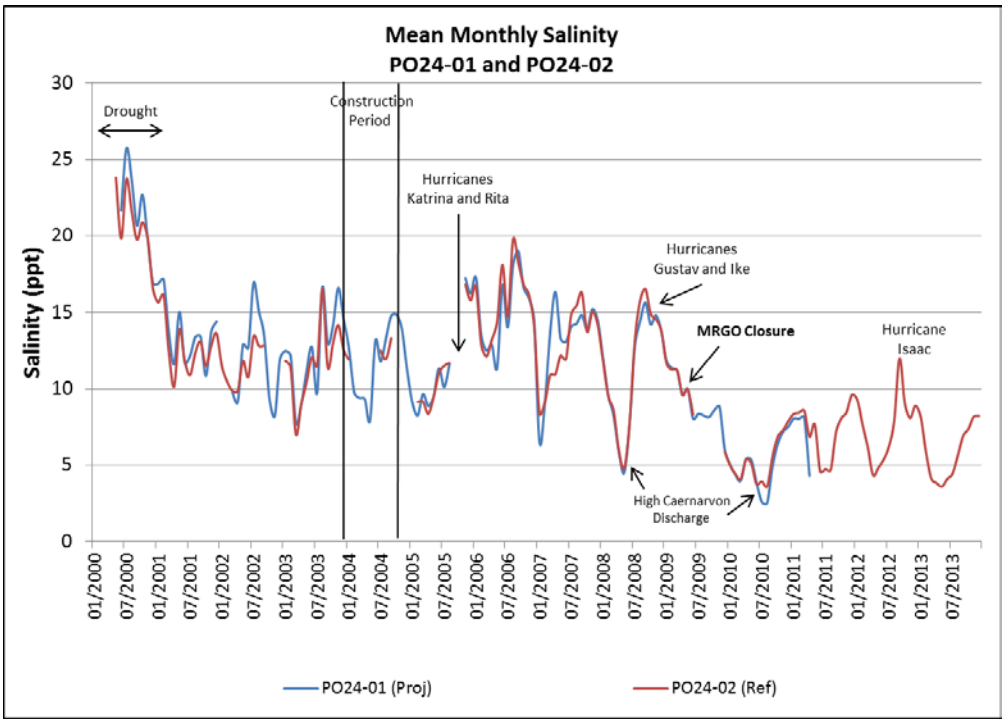

Figure 7: Mean monthly salinity for project station PO24-01 and reference station PO24-02 for the Hopedale Hydrologic Restoration (PO-0024) project.

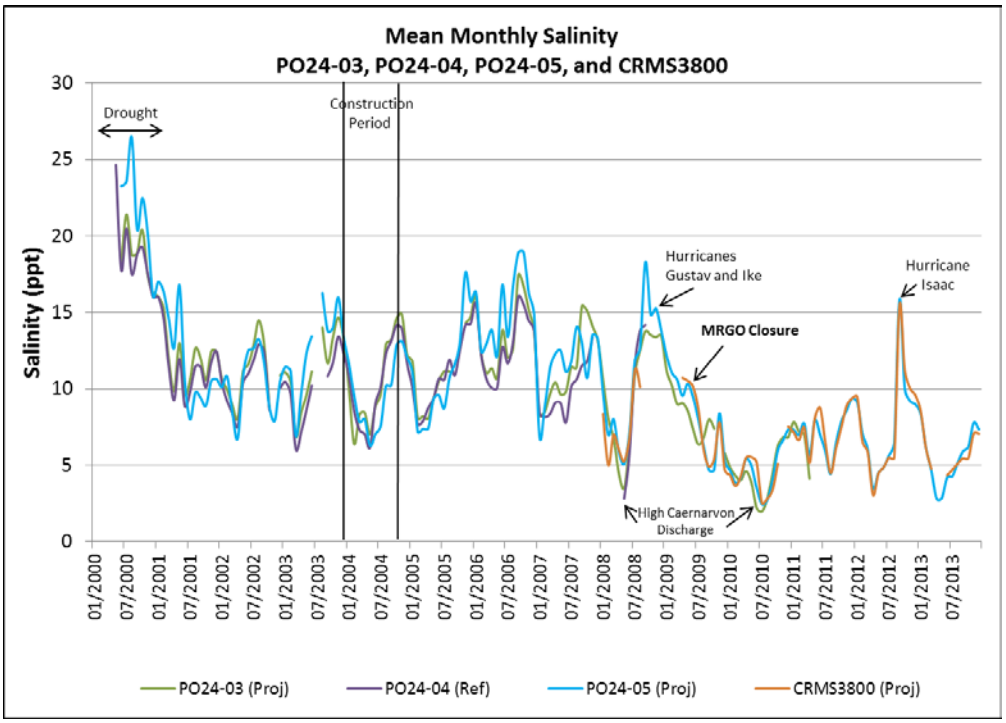

Figure 8: Mean monthly salinity for project stations PO24-03, PO24-05, and CRMS3800 and reference station PO24-04 for the Hopedale Hydrologic Restoration (PO-0024) project.

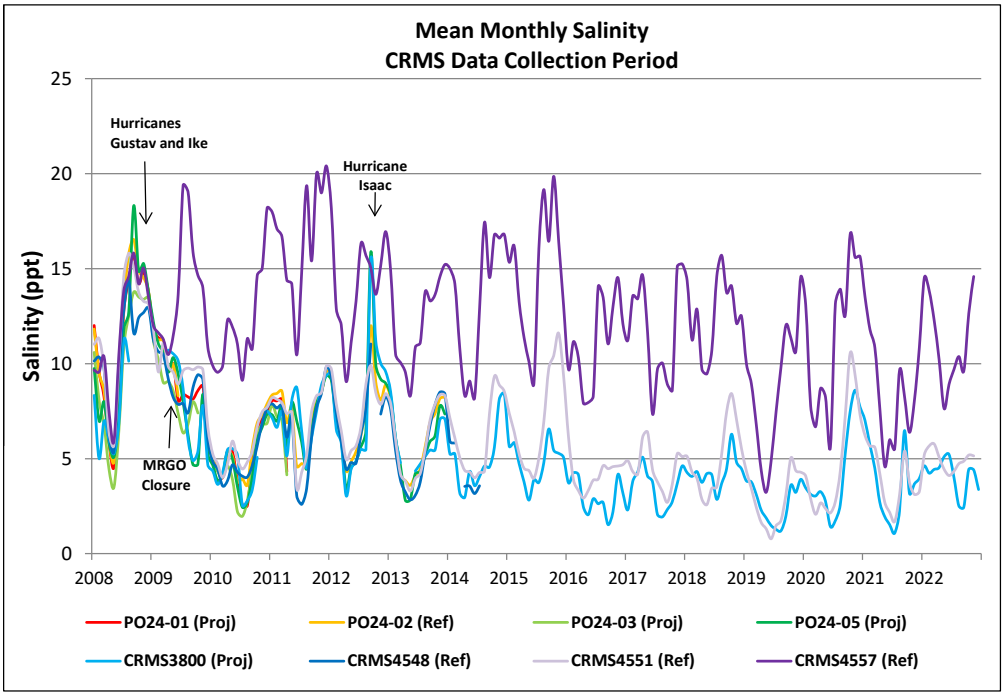

Figure 9: Mean monthly salinity for PO-0024 and CRMS stations near the Hopedale Hydrologic Restoration (PO-0024) project from January 2008 through December 2022.

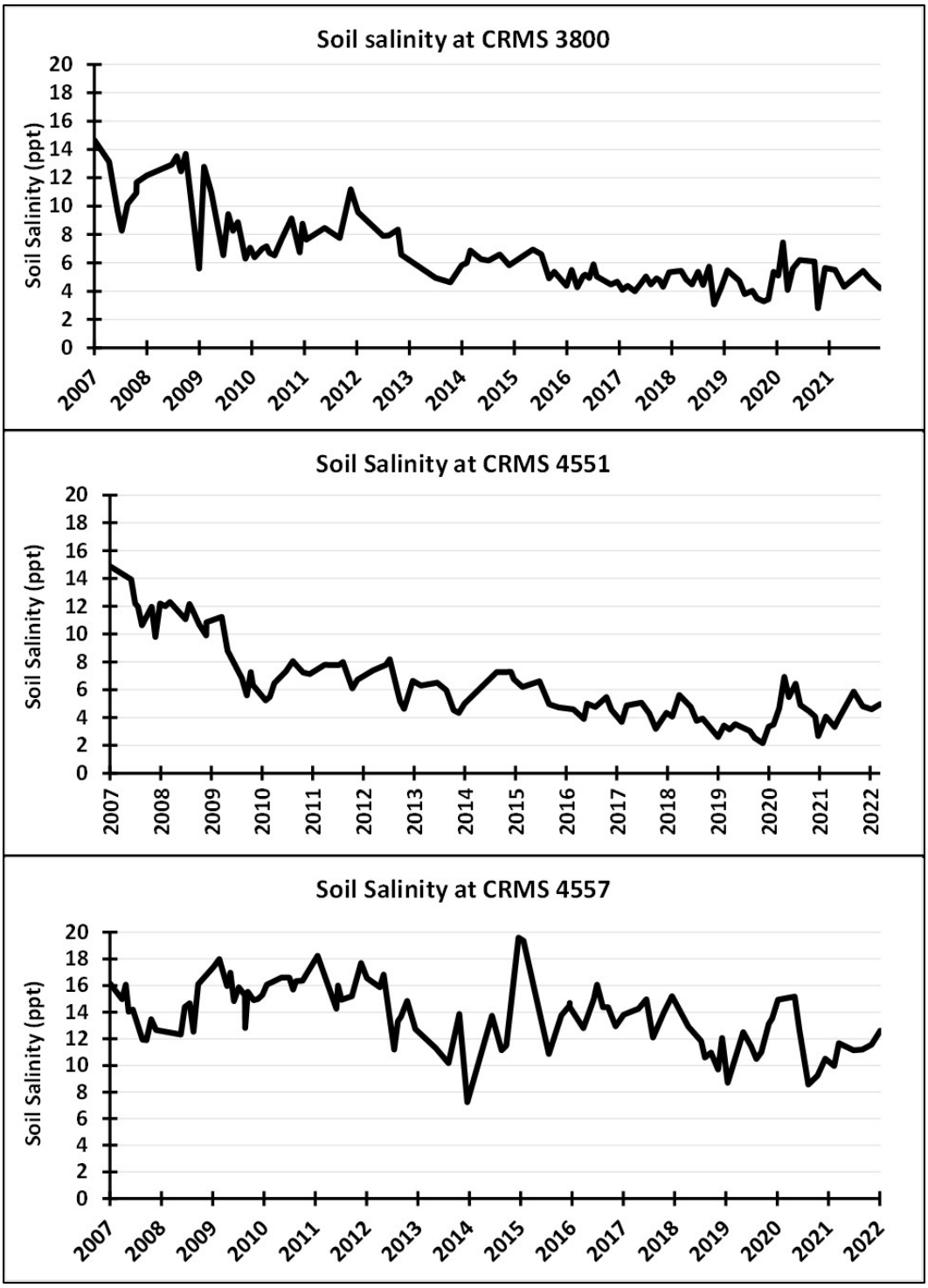

Figure 10: Soil porewater salinity at three CRMS sites over time. CRMS 3800 in is the project area and inside the MRGO closure, CRMS 4551 is outside of the project area but inside the MRGO closure and CRMS 4557 is outside both the project area and the MRGO closure.

Stations PO24-02 and PO24-05 have the longest period of record before and after the closure of the MRGO and were used to compare salinities before and after the MRGO closure. Approximately 5 years pre-closure and 5 years post-closure were compared (1/1/05-4/15/09 (PRE), 4/16/09-12/31/13 (POST). There was a significant decrease in mean weekly salinity of 5-6 ppt in the period following MRGO closure at both sites (ANOVA, $p<0.0001$) (Figure 11). There was no significant difference between the salinity response inside (PO24-05) and outside (PO24-02) of the project area based on a 2-sample median test of paired weekly means ($p=.0750$).

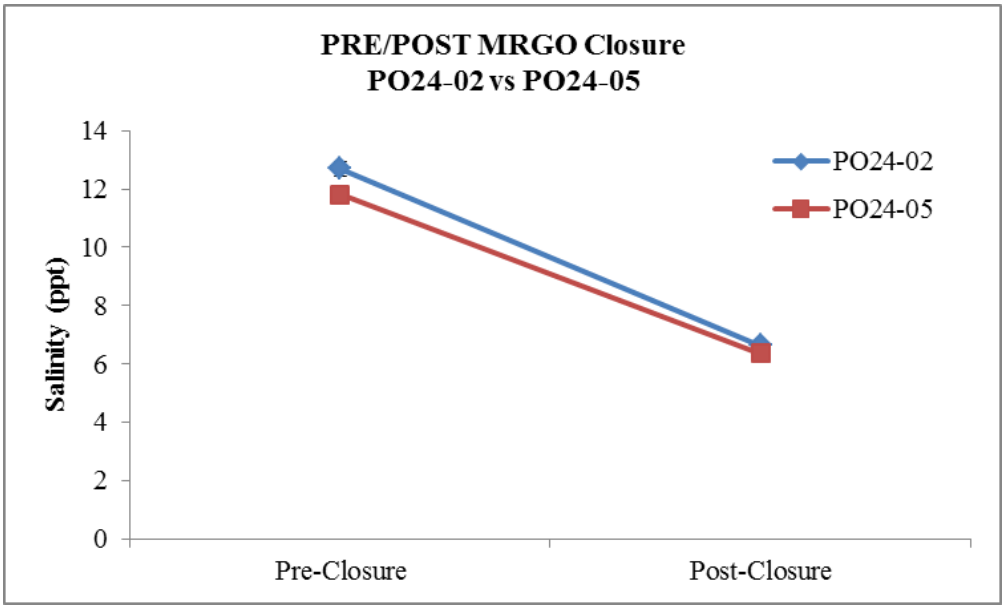

Figure 11: Change in salinity at PO24-02 (reference) and PO24-05 (project) following the closure of the Mississippi River Gulf Outlet (MRGO) in 2009.

To test for PO-0024 project effects in the pre- vs post-construction periods, the pre-construction period was defined as 3/1/2001-12/31/2003 and the post-construction period was defined as 12/1/2004 to 9/15/2008. Data was not included past 9/15/08 because of the effects of the MRGO closure and because that is the end of the data record for PO24-04. The mean weekly salinity concentrations were significantly lower during the post-construction period at all PO-0024 stations except for PO24-02; however, removing the drought from the pre-construction period caused the differences to be no longer significant (Figure 12).

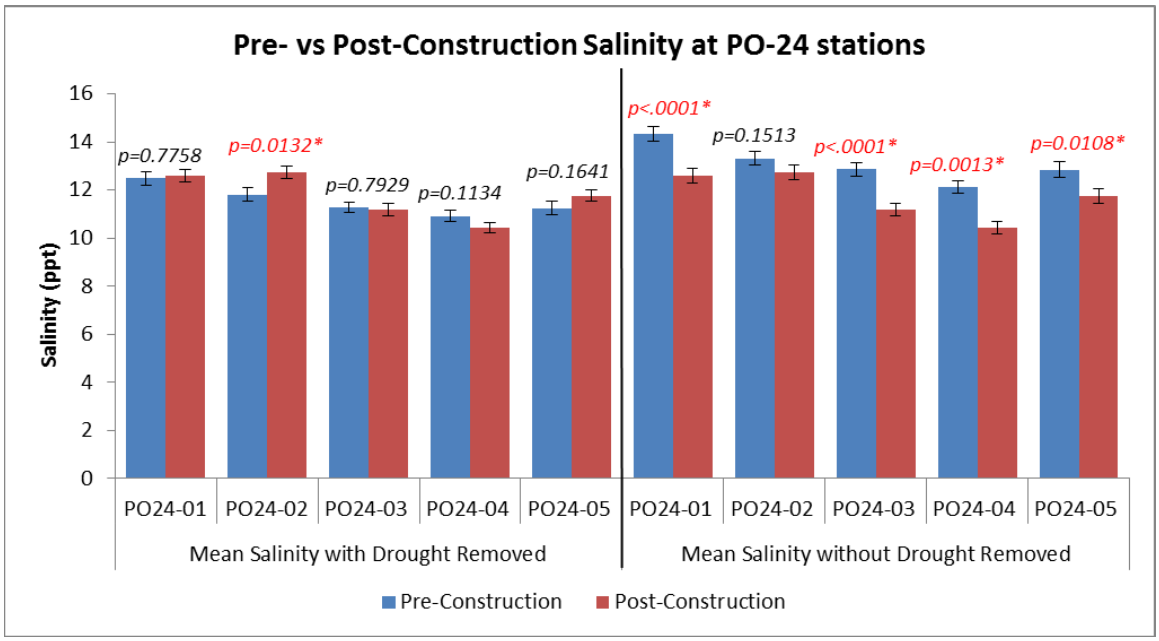

Figure 12: Average of mean weekly salinity for the pre- and post-construction periods of the Hopedale Hydrologic Restoration (PO-0024) project. Removing the drought period caused no significant difference between pre/post periods at four of the stations. Statistics computed using ANOVA. Error bars represent the standard error of the mean.

To test the interaction between project and reference sites in pre-construction and post-construction time periods, non-parametric Before After Control Impact (BACI) paired series analyses were performed. For this analysis, sondes were "paired" based on the field design. Differences were calculated by subtracting mean weekly salinity at the impacted (project) site from the control (reference) site (difference = reference – project). A 2-sample median test (a non-parametric analog of a 2-sample t-test) was used to compare the site differences before and after construction. The test is a non-parametric One-way ANOVA with a median test of Chi Square values, which was run using JMP 11.0.0 statistical software. The statistical model depends on simultaneous measurements among the paired sondes, therefore, only weeks in which there were data available to calculate differences were used in the analysis. In this case, the drought period was not removed because one of the statistical assumptions of the paired design is that the drought would affect both stations equally.

Results of the BACI paired analysis indicate significant interactions between project sites with reference site PO24-02, but no significant interaction between project sites with reference site PO24-04 (Figure 13). PO24-01 and PO24-05 (project sites) both had a significantly greater decrease in salinity in the post-construction period compared to PO24-

02 (reference), which shows up as lines out of parallel in Figure 13. Salinity change in the post-construction period was about 1.2 ppt greater ($p<0.0001$) at PO24-01 and about 0.5 ppt greater ($p=0.0010$) at PO24-05 than the change at PO24-02. The level of decreased salinity was very small compared to the target salinity range for this marsh type (mesohaline, 5-18 ppt) suggesting that a change in marsh community is not likely. There were no significant interactions between project sites PO24-03 and PO24-05 with reference site PO24-04 (Figure 13) with both project sites showing a similar post-construction decrease in salinity as the reference site. Due to its location, reference site PO24-02 was more heavily influenced by the MRGO before its closure and therefore showed the greatest difference from the sites within the project area. In summary, while there was a significant difference in salinity reduction in the project area compared to reference site PO24-02, the ecological significance of this change is small. Future changes in the marsh community within the project area would more likely be attributed to the closure of the MRGO which reduced mean salinities in the area by 5-6 ppt.

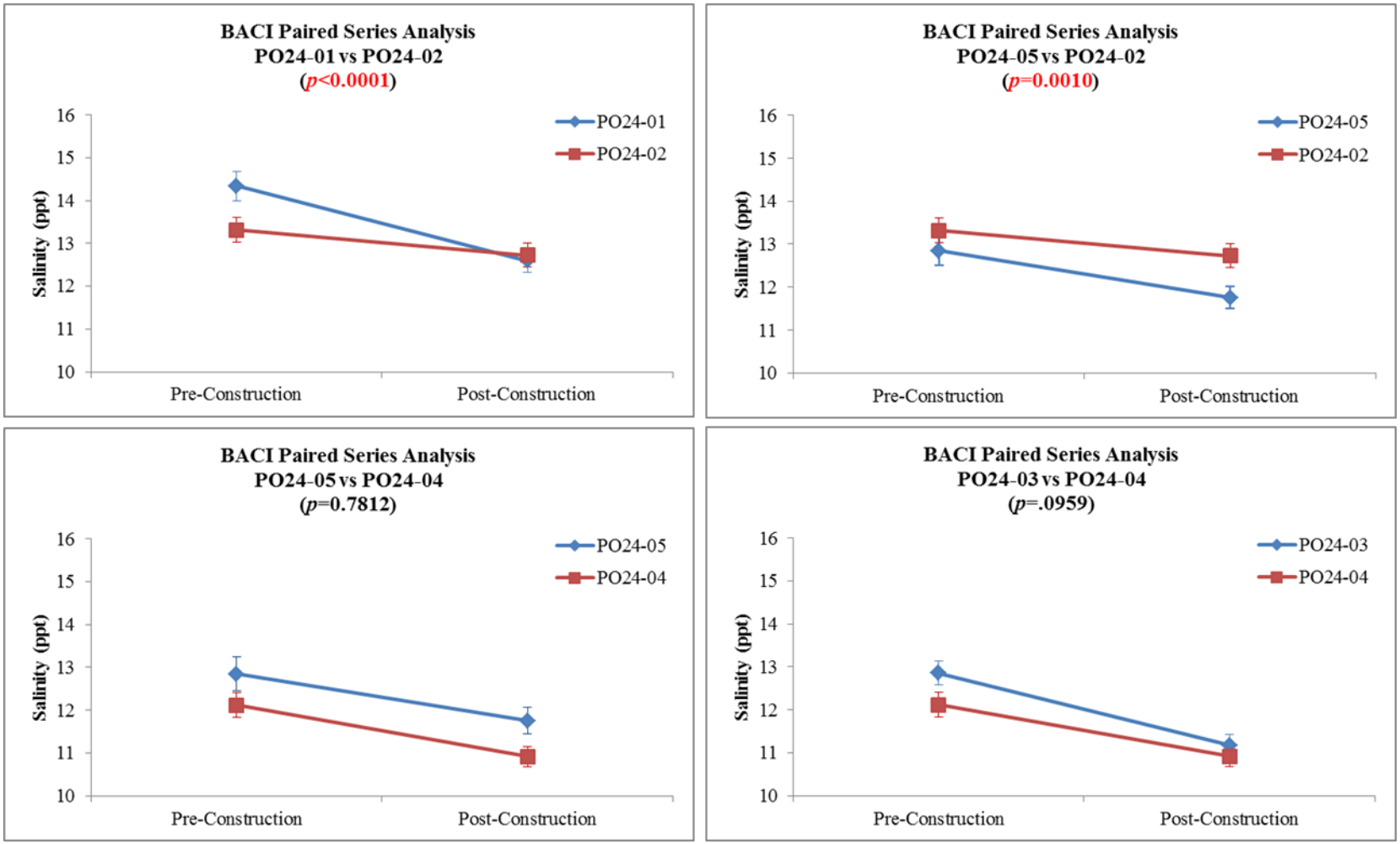

Figure 13: BACI paired series analysis graphs for salinity.

iii. Water Level and Flooding

The Back Dike Borrow Canal, which connects Bayou La Loutre to the project area, was completely blocked during construction to allow for structure placement, thus stopping water exchange. Data collected during the construction period (January to November 2004) were removed from the water level data set for analysis, but are presented in the time series graphs. Hourly data were averaged to obtain mean monthly water level readings which were used for all subsequent statistical analyses unless otherwise indicated. Mean monthly observations were used to reduce the effects of diurnal tides and meteorological events in the data.

Visual observation of mean monthly water level shows project stations, PO24-01 and PO24-05, tracking closely with reference stations during the pre-construction period and then maintaining lower water elevations than reference stations during the post-construction period (Figures 14 and 15). The exception is PO24-03, which tracks closely with nearby reference station PO24-04 before and after construction. Figure 16 shows project and reference stations during the period of CRMS data collection from 2008 to 2022. Project stations PO24-01, PO24-05, and CRMS3800 generally track lower than the other stations during this data period, including project station PO24-03. The CRMS 4548 hydrological station was discontinued in 2014. It also appears that water levels increase over time through 2022 at the CRMS stations.

Impacts from the closure of the MRGO on water levels are visually less evident than impacts on salinity; however, a comparison of weekly mean water level before and after the closure showed a significant increase in water level of 0.22 ft at project station PO24-05 ($p<0.0001$) in the post-closure period, while water level at reference station PO24-02 was not significantly different ($p=0.2978$) in the post-closure period (Figure 17).

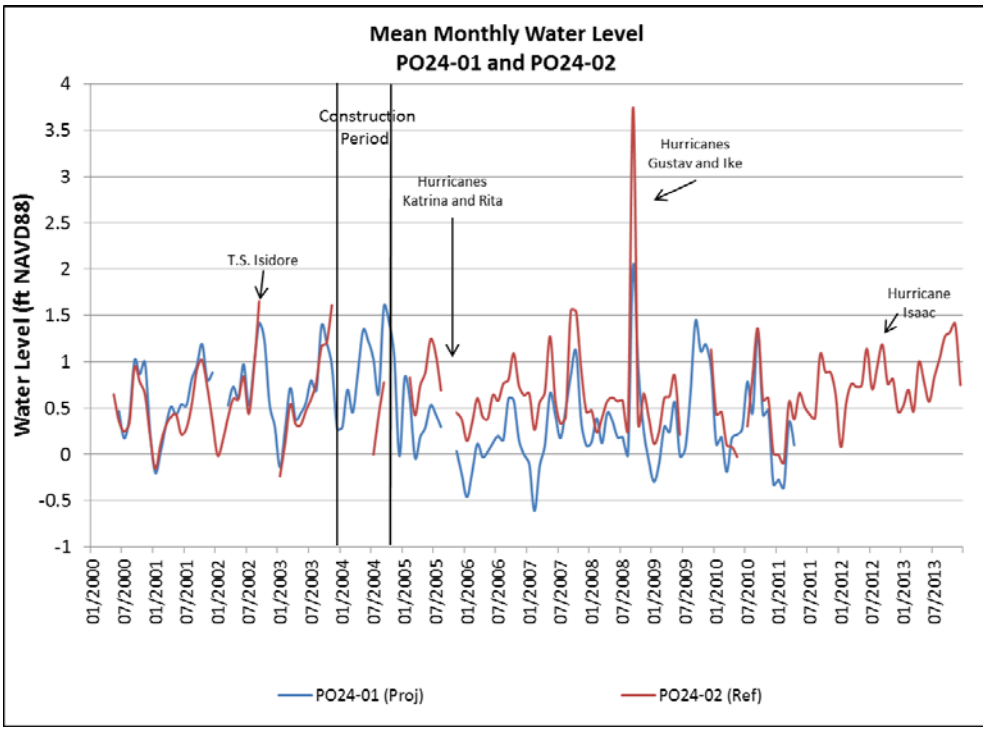

Figure 14: Mean monthly water level for project station PO24-01 and reference station PO24-02 for the Hopedale Hydrologic Restoration project.

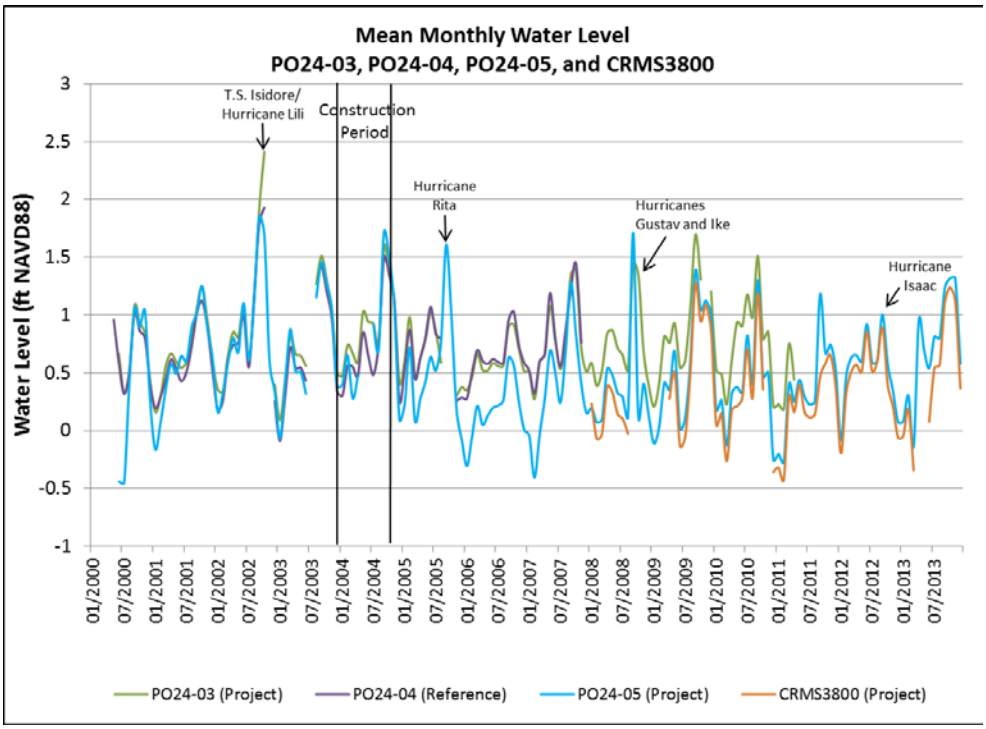

Figure 15: Mean monthly water level for project stations PO24-03, PO24-05, and CRMS3800, and reference station PO24-04 for the Hopedale Hydrologic Restoration project.

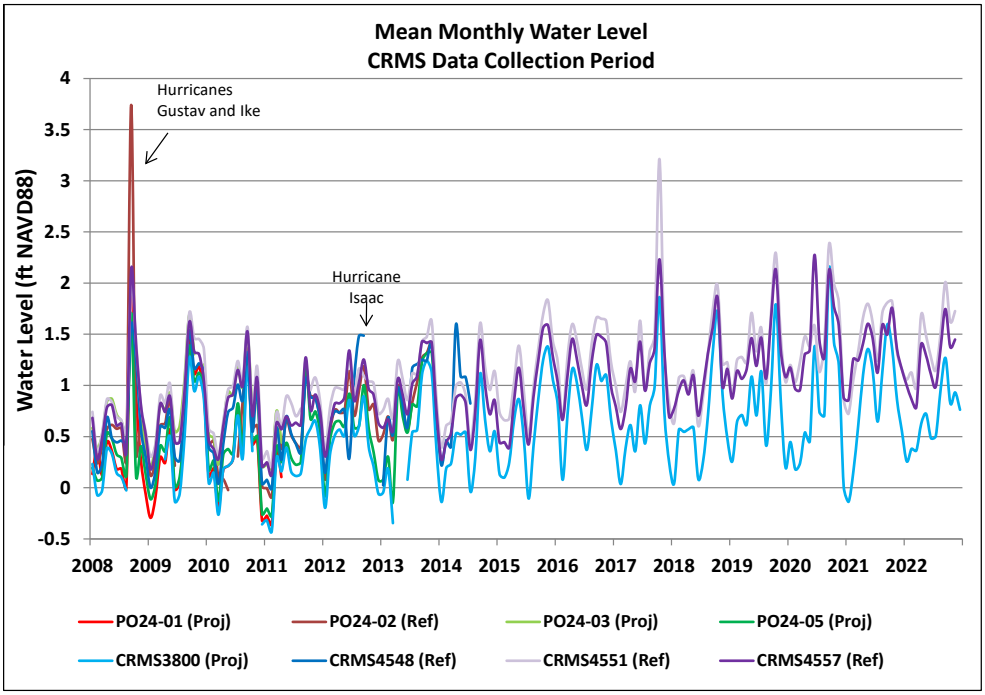

Figure 16: Mean monthly water level for the Hopedale Hydrologic Restoration project and reference stations during the CRMS data collection period.

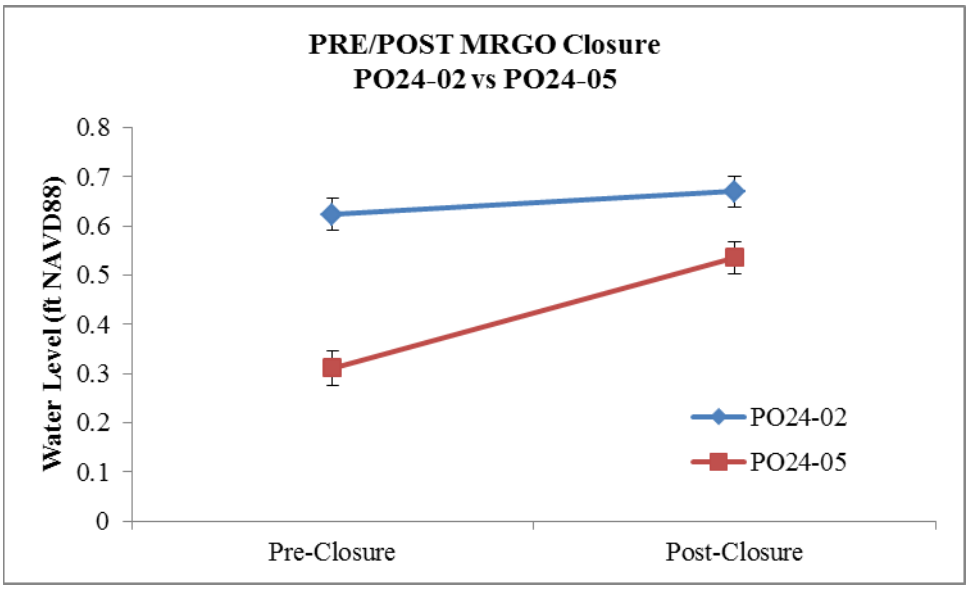

Figure 17: Change in water level at PO24-02 (reference) and PO24-05 (project) following the closure of the Mississippi River Gulf Outlet (MRGO) in 2009.

Figure 18 shows a significant decrease in mean weekly water levels of approximately 0.4 ft at project sites PO24-01 and PO24-05 (p<0.0001) during the post-construction period. Removing the drought period from the pre-construction period did not alter the results as was seen with the salinity data. Station PO24-03 showed a slight decrease in water level but this decrease was not significant. The reduced project effect on water level at station PO24-03 is reasonable considering its location within the project area. Station 03 is located in a small unnamed bayou on the south side of the Bayou La Loutre ridge, near the south central boundary of the project area. The connection of this small bayou with Bayou La Loutre is through three 36" non-gated culverts which run under Hwy 624. These open culverts allow water to flow in and out of the project area freely, as opposed to the structure near station PO24-01 which only allows water out. Reference stations PO24-02 and PO24-04 both showed increases in mean weekly water level following construction (Figure 18), however, only station 02 was significant (p=0.011). A comparison of CRMS reference stations (CRMS4548, CRMS4551, and CRMS4557) and project area stations (PO24-05 and CRMS3800) during the CRMS data collection period through 2013 indicate that water levels inside the project area were significantly lower than those outside of the project boundaries (Figure 19). Since all project specific gauges were removed in 2014, a comparison with CRMS data past 2013 was not possible.

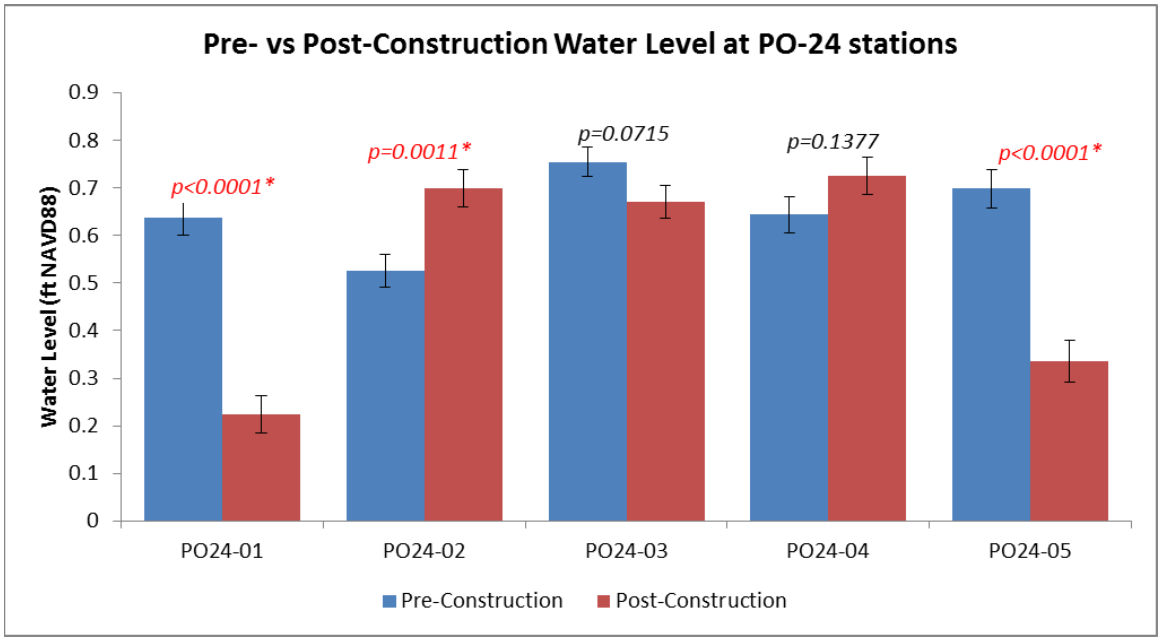

Figure 18: Average of mean weekly water level for the pre- and post-construction periods of the Hopedale Hydrologic Restoration project. Statistics computed using ANOVA.

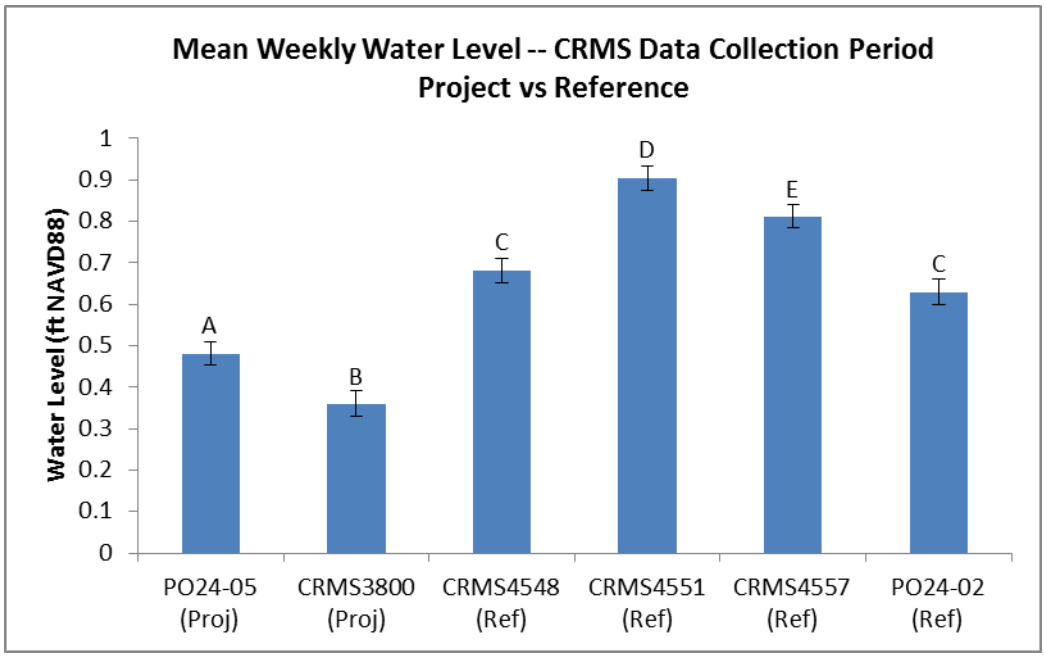

Figure 19: Average of mean weekly water level for project and reference stations during the CRMS data period, 1/1/08-12/31/13. Statistics computed using ANOVA. Different letters indicate significant difference.

To test the interaction between project and reference sites in pre-construction and post-construction time periods, mean weekly water level measurements were analyzed by the same method described for salinity data in the previous section. Results of the paired sites were significant for all comparisons (Figure 20) with water levels at PO24-01 and PO24-05 approximately 0.4 feet lower than what would be expected if the project had no impact. The project impact was reduced at PO24-03, yet still significant. When averaged, the project site water levels decreased from 0.70 ft to 0.41 ft, while reference site water levels increased from 0.58 ft to 0.71 ft between pre- and post-construction.

Frequency and duration of flooding in the pre-construction (2001-2003) and post-construction (2005-2007) periods were compared for the three project stations, PO24-01, PO24-03, and PO24-05. Inundation data for the reference stations, PO24-02 and PO24-04, cannot be calculated because an average marsh elevation is not available for these stations. At PO24-01 and PO24-05, the mean flood duration following construction was reduced by 5 and 8 days, respectively, and the % time flooded dropped by 26% (Table 5). Alternatively, there was no difference in mean flood duration (7 days) at PO24-03 between pre- and post-construction, and almost no difference in % time flooded (25.2 to 24.0%). The project goal of reducing the frequency and duration of flooding events was therefore

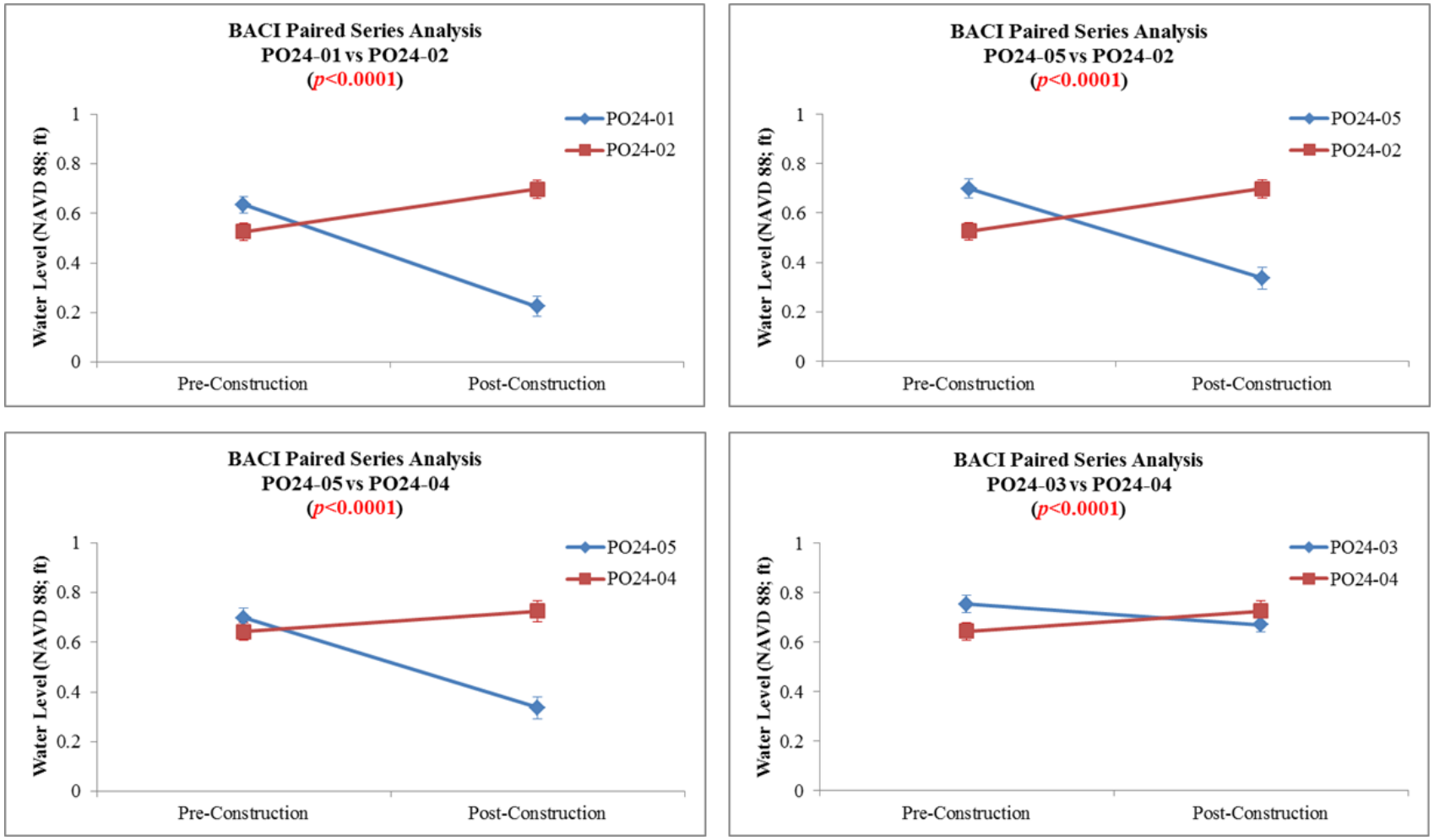

Figure 20: BACI paired series analysis graphs for water level.

Table 5: Frequency, depth, and duration of flooding for the Hopedale Hydrologic Restoration project and reference sites during the pre- and post-construction periods and the CRMS data collection period.

Station	PRE 2001-2003	POST 2005-2007	CRMS Period 2008-2013
PO24-01			
Mean Flood Duration (days)	11	6	
% Time Flooded	38.5	12.1	
Mean Flood Depth (ft)	0.36	0.41	
PO24-03			
Mean Flood Duration (days)	7	7	
% Time Flooded	25.2	24.0	
Mean Flood Depth (ft)	0.42	0.37	
PO24-05			
Mean Flood Duration (days)	13	5	14
% Time Flooded	44.9	18.3	22.9
Mean Flood Depth (ft)	0.43	0.47	0.49
CRMS3800			
Mean Flood Duration (days)			12
% Time Flooded			20.6
Mean Flood Depth (ft)			0.48
CRMS4548 (Ref)			
Mean Flood Duration (days)			9
% Time Flooded			15.4
Mean Flood Depth (ft)			0.50
CRMS4551 (Ref)			
Mean Flood Duration (days)			9
% Time Flooded			15.5
Mean Flood Depth (ft)			0.51

achieved at sites PO24-01 and PO24-05, but PO24-03 did not experience a similar reduction in flooding since it is located near an open culvert which allows water to flow freely. During the CRMS data collection period (2008-2013), the project sites, PO24-05 and CRMS3800, displayed a greater mean flood duration and % time flooded than CRMS4548 and CRMS4551. However, the average marsh elevation is much lower at the project sites (mean 0.37 ft NAVD88) than at the two CRMS sites (mean 0.76 ft NAVD88). Frequency and duration of flooding was not calculated at PO24-01 for the CRMS data period because the marsh elevation has not been

resurveyed since 2000, and subsequent surveys at stations PO24-03 and PO24-05 showed a decrease in marsh elevation at both sites.

Annual percent flooding was investigated by location using regression analysis. The project specific sites were significantly different over time only at PO24-03 ($p=0.029$, $F_{(1,8)}= 7.03$ $r^2=0.4$), which was the gauge that was not influenced by the project features due to nearby culverts. This site demonstrated a slight but steady increase in annual percent flooding (Figure 21). The other two project specific sites (PO24-01 and PO24-05) did not demonstrate any significant difference over time, most likely due to having higher flooding rates before the project, decreasing after project features were installed and then increasing again over time (Figure 21). While it appears that the project specific sites would increase in percent flooding on a trajectory similar to the CRMS sites, the data collection at these sites did not last long enough to conclusively determine this. Annual percent flooding did increase significantly over time at three of the four CRMS sites (CRMS 4548 with a short data collection window was not increase significantly). All of the CRMS sites seemed to increase at a similar rate (CRMS3800 = $p<0.001$, $F_{(1,13)} = 26.5$, $r^2 =0.65$; CRMS4551 = $p<0.001$, $F_{(1,13)} = 50.3$, $r^2 =0.78$; CRMS4557 = $p<0.001$, $F_{(1,13)} = 58.8$, $r^2 =0.80$). Percent annual flooding decreased at two of the project sites, as discussed above (PO24-01 and PO24-05), shortly after project construction. However, PO24-05, which had data available through 2014, and therefore overlapped with CRMS data for six years, demonstrated an increase in annual flooding over time, similar to the CRMS sites (Figure 21). The CRMS sites then continued to increase in percent annual flooding through 2022.

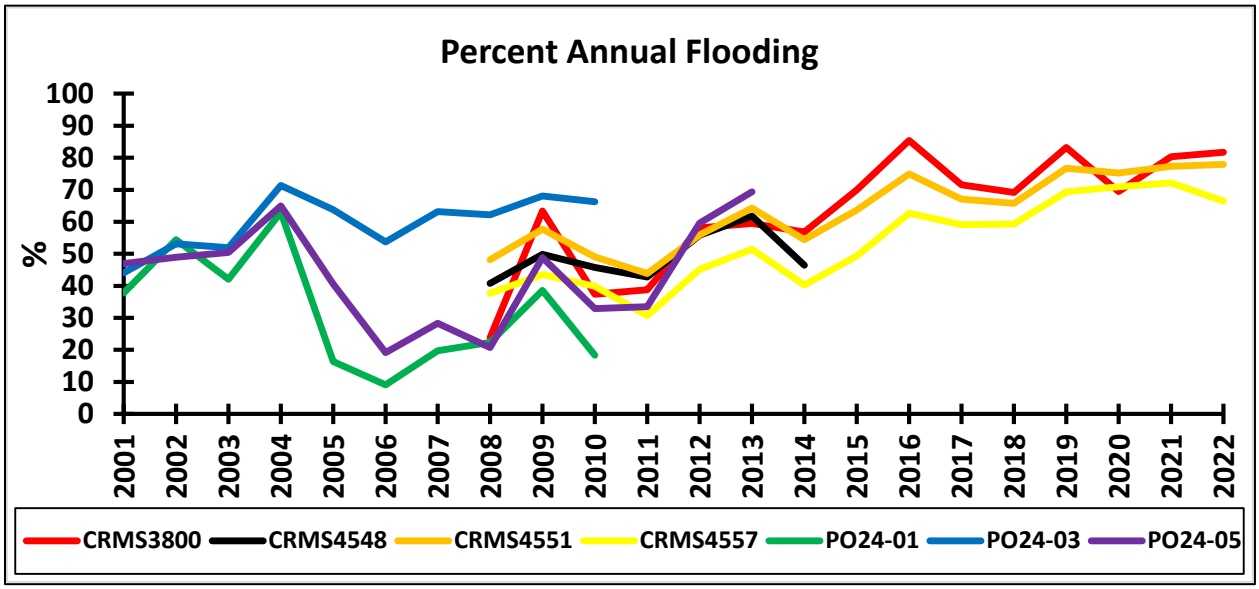

Figure 21: Percent annual flooding at project specific sites and nearby CRMS sites over time.

Although the project specific gauges were removed, further analysis of flooding at three of the CRMS stations through 2022 was possible (CRMS 4548 was eliminated with data only available through 2014). To investigate the regional trends discussed above, CRMS 3800, CRMS 4551, and CRMS4557 were analyzed for number average number of days of flooding in a year (i.e. how long did flood events last when flooded), average inundation depth, and total number of days flooded per year (which is a similar metric to percent annual flooding in Figure 21). Average number of days flooded was variable from year to year but did show a significant increase over time at all three sites (CRMS3800 = p= 0.38, $F_{(1,13)}$ = 5.3, r^2 =0.23; CRMS4551 = p<0.001, $F_{(1,13)}$ = 18.6, r^2 =0.56; CRMS4557 = p=0.009, $F_{(1,13)}$ = 9.3, r^2 =0.37). CRMS3800, which is in the project area (impoundment) was flooded the most average days throughout the time period (had the longest lasting flooding events), and CRMS4557, which is outside of the MRGO closure was flooded the least average days (had shorter flooding events) (Figure 22).

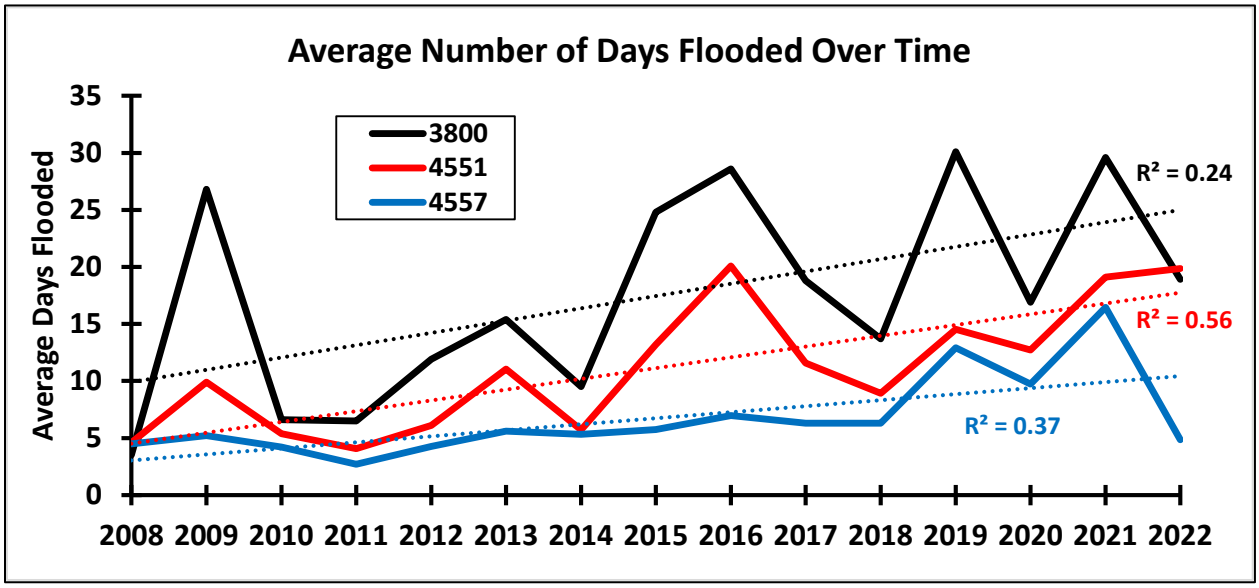

Figure 22: Average length of flood event over time at project (CRMS3800) and reference (CRMS4551 and 4557) CRMS sites.

Average annual inundation depth at the same three CRMS sites demonstrated a different pattern, with CRMS3800 and CRMS4551 showing a significant increase in average flooding depth over time (CRMS3800 = p= 0.007, $F_{(1,13)}$ = 10.0, r^2 =0.39; CRMS4551 = p=0.008, $F_{(1,13)}$ = 9.9, r^2 =0.39) and CRMS4557 showing no trend in flooding depth (Figure 23).

The total number of days flooded per year increased significantly over time at all three CRMS sites (Figure 24) (CRMS3800 = p<0.001, $F_{(1,13)}$ = 44.6, r^2 =0.76; CRMS4551 = p<0.001, $F_{(1,13)}$ = 42.9, r^2 =0.75; CRMS4557 = p<0.001, $F_{(1,13)}$ = 85.3, r^2 =0.86). CRMS4557 had lower annual days of flooding through 2019 than the other two sites, but by 2022, all three sites had similar number of days flooded.

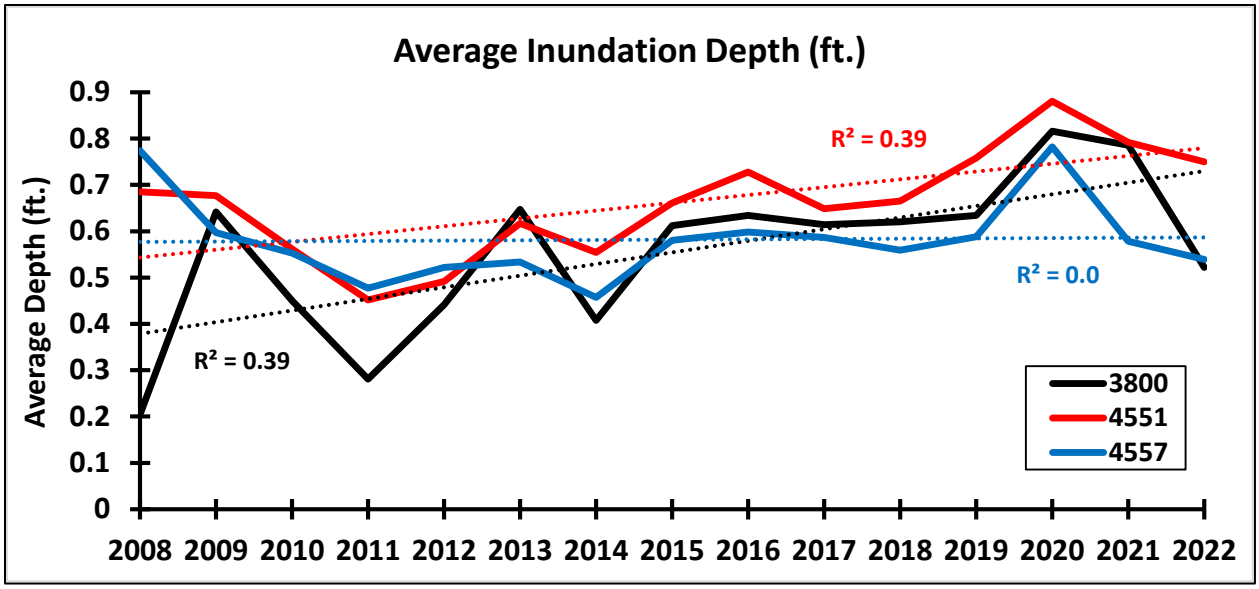

Figure 23: Average inundation depth over time at project (CRMS3800) and reference (CRMS4551 and 4557) CRMS sites.

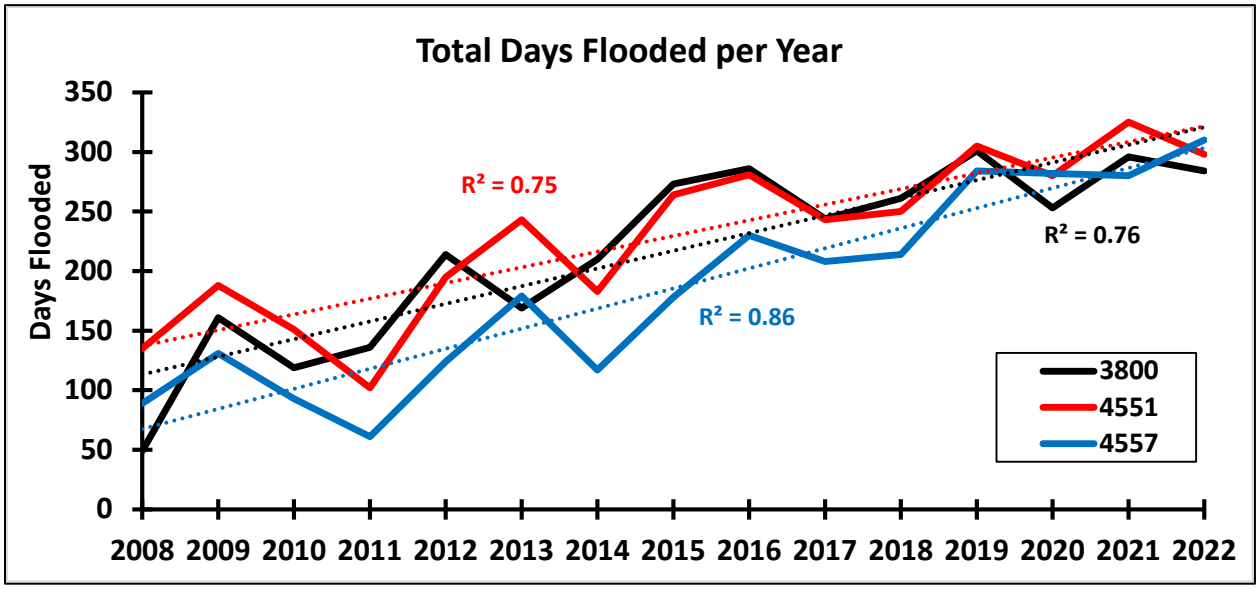

Figure 24: Annual total number of days flooded over time at project (CRMS3800) and reference (CRMS4551 and 4557) CRMS sites.

The analysis of water level and flooding indicate that water levels and flooding are increasing at stations both inside and outside of the project area. This increase was also observed at CRMS stations both inside and outside the MRGO closure. Therefore, the increase in water level and flooding seems to be a regional issue and not specific to any project features. The increase in water level and flooding is most likely due to a combination of subsidence and increasing sea-level. At sites where repeated elevation surveys were conducted, the marsh decreased in elevation over time. Any gains in decreased water level or annual flooding experienced because of project features were most likely overcome by regional changes over time. Therefore, project features seemed to elicit a temporary benefit. However, if the project features were not in place, there is a possibility that the regional increase in water level and flooding would be further exacerbated inside the project area which is impounded.

V. Conclusions

a. Project Effectiveness

One of the monitoring goals of this project was to maintain 99% of the pre-construction acreage of vegetated wetlands over the life of the project. Comparison of the 2000, 2012, and 2021 land-water analyses indicate that there has been no net loss in land acreage. It is important to note, however, that there is some land loss occurring within the project area shown in the loss of the acreage gained from dredge spoil between 2012 and 2021. Additionally, CRMS land-water analysis from within the project area support the conclusion that the project is meeting the goal of maintaining pre-construction acreage, although land area is recently decreasing both inside and outside the project area. The CRMS vegetation data from inside the project area indicates that some fragmenting of the interior marsh is occurring. However, the goal of maintaining land over the 20 year life of the project was met.

The goal of reducing the intensity and duration of flooding appears to have been achieved in the post-construction period for a short period of time (~6 years). A significant reduction in mean water level occurred between the pre- and post- construction period at project area stations north of the Bayou La Loutre Ridge, while both reference stations experienced an increase in water level. The project impact was reduced at the station south of the Bayou La Loutre Ridge. Based on paired analyses, water levels inside the project boundary decreased by approximately 0.4 ft after project construction was complete. In addition, mean flood duration following construction was reduced by 5-8 days and % time flooded dropped by 26%. This decrease in water level coupled with reduced salinity will likely reduced stress to the marsh vegetation within the project area for a period after construction. However, it appears that over time, the gains from the project features were overwhelmed by regional sea-level rise and subsidence indicated by increasing water levels and flooding duration at CRMS sites both within and outside of the project area. However, without the project features, there is a possibility the water levels and flooding would be even greater in the project area.

Reduction in salinity was not a specific goal of this project; however, there was a significantly greater decrease in surface water salinity in the project area following construction. While this change was statistically significant, the biological significance is likely minor. Salinity reductions resulting from the closure of the MRGO would be expected to have a comparatively greater impact on the project area. The salinity changes attributed to the closure of the MRGO seem to be long-lasting as evidence by the CRMS surface and soil salinity data which demonstrates maintained higher salinity outside of the closure and decreased salinity inside.

Finally, the third goal of the project was to maintain or improve fisheries ingress and egress. A study published in the *Journal of Experimental Marine Biology and Ecology* measured ingress and egress of fisheries through the PO-0024 water control structure and concluded the structure imposed no physical limitations (Kimball et al., 2010).

b. Recommended Improvements

The recommended improvements at this time are to:

1. Upgrade or replace the anodes at the structure with magnesium anodes.
2. Install an epoxy coating in order to treat and prevent surficial rust on the structure.
3. Install reflective tape on the structure's guardrails in order to improve visibility.

c. Lessons Learned

Bayou La Loutre is a high traffic area. The continuous recorders located within the bayou were constantly being struck by marine vessels causing occasional data gaps. PO24-02 was eventually moved to the bridge over the Back Dike Canal at its intersection with Bayou La Loutre and remained intact for the remainder of its deployment. PO24-04 had no such permanent structure to which it could be attached, and ultimately was removed.

d. Project Closeout

The Hopedale Hydrologic Restoration Project (PO-0024) will reach the end of its 20 year life in November of 2024. Through analysis of the Project using the **Decision Matrix for CWPPRA Projects at 20 Year Life** (Appendix D) it is determined that the Project is to be closed out without transfer or removal.

VI. References

Brown, Cunningham, and Gannuch, Inc. (BC&G) 2001. Report on Final Results of Hopedale Hydrologic Restoration Modeling. Hydrologic Investigations for National Marine Fisheries Service (NMFS Contract No. 50 WCMA806042). Baton Rouge, LA. June 2001. 10 pp, plus Appendices.

Carter, B., B. Richard, and P. Hopkins 2007. *2007 Operations, Maintenance, and Monitoring Report for Hopedale Hydrologic Restoration (PO-24),* Louisiana Department of Natural Resources, Coastal Restoration Division, New Orleans, Louisiana. 35 pp.

Carter, B., B. Richard., and Coastal Estuary Services. 2010. *2010 Operations, Maintenance, and Monitoring Report for HopedaleHydrologic Restoration (PO-24),* Office of Coastal Protection and Restoration, New Orleans, Louisiana. 35pp.

Folse, T.M., T. E. McGinnis, L. A. Sharp, J. L. West, M. K. Hymel, J. P. Troutman, D. Weifenbach, W. M. Boshart, L. B. Rodrigue, D. C. Richardi, W. B. Wood, C. M. Miller, E. M. Robinson, A. M. Freeman, C. L. Stagg, B. R. Couvillion, and H. J. Beck. 2023. A Standard Operating Procedures Manual for the Coastwide Reference Monitoring System-Wetlands and the System-Wide Assessment and Monitoring Program: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Baton Rouge, LA. 255 pp.

Gossman, B. P., M. K. Hymel, and B. J. Richard. 2014. *2014 Operations Maintenance and Monitoring Report for Hopedale Hydrologic Restoration (PO-24),* Coastal Protection and Restoration Authority of Louisiana, New Orleans, Louisiana. 33 pp. and Appendices.

Hartman, R., C. Baker, and D. Clark. 1998. Hopedale Hydrologic Restoration (PP0-38). Candidate Project for the Eighth Priority List of the Coastal Wetlands Planning, Protection, and Restoration Act. Candidate Project Information Sheet for Wetland Value Assessment. National Marine Fisheries Service, and Louisiana Department of Natural Resources.

Kimball, M.E., L.P. Rozas, K.M. Boswell, and J.C. Cowan. 2010. Evaluating the effect of slot size and environmental variables on the passage of estuarine nekton through a water control structure. Journal of Experimental Marine Biology and Ecology 395: 181-190.

LDNR. 2005. Operation, Maintenance, and Rehabilitation Plan for the Hopedale Hydrologic Restoration Project (PO-24). Louisiana Department of Natural Resources, Coastal Engineering Division, Baton Rouge, Louisiana. 7 pp. and Appendices.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller, and E. Swenson. 1995. Quality management plan for the Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-File Series No. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 108 pp.

Appendix A
(Inspection Photographs)

Photo 1. Structure viewed from project exterior (downstream) on northern bank depicting corrosion of the sheet pile structure.

Photo 2. Pipe barrier viewed from project exterior (downstream) on northern bank depicting corrosion.

Photo 3: Fish gate viewed from atop the structure. (Gearbox removed for repairs).

Appendix B
(Two Year O&M Budget Projection)

Hopedale Hydrologic Restoration
Federal Sponsor: NMFS
Construction Completed : January 6, 2005
PPL 8

Current Approved O&M Budget	Year 0	Year -1	Year -2	Year -3	Year -4	Year -5	Year -6	Year -7	Year -8	Year -9	Year -10	Year -11	Year -12	Year -13	Year -14	Year -15	Year -16	Year -17	Year -18	Year -19	Year-20	Project Life	Currently
	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	Budget	Funded
State O&M																						$449,209	$449,209
Corps Admin																							
Federal S&A																							
Total																						$449,209	$449,209

Projected O&M Expenditures																						Remaining Project Life	Current 2 year Request
Maintenance Inspection																				$960	$0	$960	$960
End of Life Admin																				$0	$15,533	$15,533	$15,533
Operations																				$7,920	$7,920	$15,840	$15,840
State S&A																				$316.80	$23,760.00	$24,077	$24,077
Maintenance																					$135,517	$135,517	$135,517
Total																				$9,197	$182,730	$191,927	$191,927

O&M Expenditures from COE Report	$251,693	Original O&M Budget	$449,209	Original Project Life Budget	$449,209
State O&M Expenditures not yet submitted for in-kind credit	$5,589	Remaining Available O&M Budget	$191,927	Total Projected Project Life Expenditures	$449,209
Federal Sponsor MIPRs (if applicable)	$0	**Incremental Funding Request Amount for Current 3 Years**	**$191,927**	**Project Life Budget Request Amount (Negative Equals Surplus)**	**$0**
Total Estimated O&M Expenditures (as of June 2022 LANA)	$257,282				

$ 15,533.20	End of Life Admin - 80 hrs at $158.76/hr (rate includes IDC) plus 20 hrs for GS-12 (federal) at $141.62 (rate includes IDC - from PPL 28)

Appendix C
(Field Inspection Notes)

FIELD INSPECTION CHECK SHEET

Project No. / Name: **Hopedale Hydrologic Restoration Project (PO-24)**

Date of Inspection: 04/19/2023 Time: 10:00 AM

Structure No. N/A

Inspector(s): Melissa Hymel (CPRA), Connor Hannan (CPRA), Brandon Howard (NMFS) and Louis Pomes (SBPG)

Structure Description: Gated Sheetpile Structure

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

Type of Inspection: Annual

Weater Conditions: Sunny, 74° F

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Swing Gates 84" D	Good	None visible over water surface	None visible over water surface	1	Aluminum gates are under water surface. No damage or corrosion visible.
Fish Gates 24" x 84"	Good (1 missing gearbox)	None visible over water surface	None visible over water surface	1 & 3	Gates were exercised and open during time of inspection except for one which remains closed due to broken gearbox.
Sheet pile Structure	Some corrosion noted	Some corrosion	Yes	1	Surficial corrosion observed, especially near the apparent mean water level at joints between sheet piles and pipe piles. Anodes are likely exhausted.
Handrails, Grating, Hardware etc.	Good	None	None	N/A	No remarks.
Galv. Pile Caps	Some corrosion noted	Some corrosion	Some	N/A	Some corrosion observed.
Signage/ Supports	Minor corrosion noted	Minor corrosion	Minor	N/A	Some corrosion observed. This does not impact the integrity or intended use of the structure.
Riprap	Good	None	N/A	1	
Silt/Fill	Good	None	N/A	1	

Are there any signs of vandalism? No
Conditions of existing levees? Good
Noticable breaches? None

Appendix D
(Decision Matrix for CWPPRA Projects at 20 Year Life)

Decision Matrix for CWPPRA Projects at 20 Year Life