APPENDIX R: MITIGATION & MONITORING AND ADAPTIVE MANAGEMENT PLANS

R1: Mitigation and Stewardship Plan

R2: Monitoring and Adaptive Management (MAM) Plan

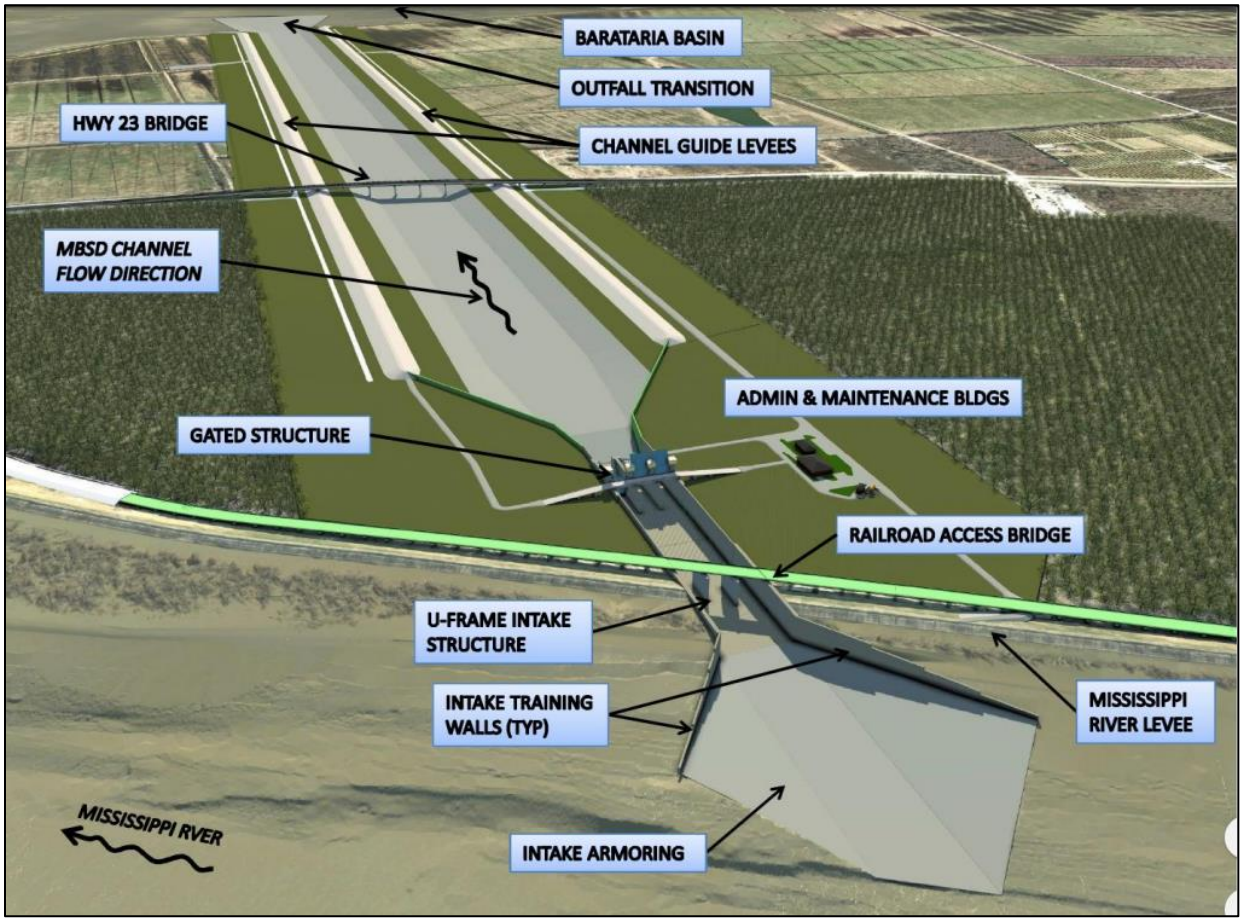
R3: Mitigation Summary Table

R4: Mitigation Measures Environmental Analysis

R5: Marine Mammal Intervention Plan

R1: Mitigation and Stewardship Plan

MITIGATION AND STEWARDSHIP PLAN
FOR THE
MID-BARATARIA SEDIMENT DIVERSION PROJECT
(CPRA PROJECT NUMBER BA-0153)



22 August 2022

TABLE OF CONTENTS

MID-BARATARIA SEDIMENT DIVERSION MITIGATION AND STEWARDSHIP PLAN

1. INTRODUCTION

The Coastal Protection and Restoration Authority of Louisiana (CPRA) is planning to construct, operate, and maintain the proposed Mid-Barataria Sediment Diversion Project (Project). The Project is intended to address injuries caused by the *Deepwater Horizon* (DWH) oil spill by implementing a large-scale sediment diversion in the Barataria Basin. The sediment diversion will reconnect and re-establish sustainable deltaic processes between the Mississippi River and the Barataria Basin through the delivery of sediment, fresh water, and nutrients to support the long-term viability of existing and planned coastal restoration efforts.

The Project has the potential to directly and indirectly impact—both beneficially or adversely—jurisdictional wetlands and other waters of the United States, U.S. Army Corps of Engineers (USACE) civil works projects, threatened and endangered species, marine mammals, essential fish habitat (EFH), and other elements of the environment, as identified in the National Environmental Policy Act (NEPA) environmental impact statement (EIS) for the Project.

The Purpose of this Mid-Barataria Sediment Diversion Mitigation and Stewardship Plan (Mitigation Plan) is to demonstrate how adverse impacts of the Project will be avoided, minimized, or mitigated to the extent required under applicable federal law. In particular, the objectives of the Mitigation Plan include identifying mitigation that will: (1) offset unavoidable adverse impacts to jurisdictional waters of the United States; and (2) ensure the Project is not contrary to the public interest, pursuant to section 404 of the Clean Water Act (CWA), and sections 9 and 10 of the Rivers and Harbors Act.

The Mitigation Plan also identifies: (1) conservation measures to avoid and minimize potential effects to species listed as threatened or endangered under the federal Endangered Species Act (ESA); (2) conservation recommendations provided by the National Marine Fisheries Service (NMFS) to conserve, avoid and/or minimize adverse effects to EFH; (3) recommendations provided by the U.S. Department of Interior's Fish and Wildlife Service (FWS) under the Fish and Wildlife Coordination Act (FWCA); and (4) stewardship measures to address project-related changes to the environment.

CPRA will implement the mitigation and stewardship measures set forth in this Plan provided the Project receives all necessary approvals and is funded for construction.

2. PROJECT OVERVIEW

The Project is a controlled intake diversion structure in Plaquemines Parish, Louisiana connecting the Mississippi River with the adjoining Barataria Basin. The structural features of the Project will be located on the west bank of the Mississippi River at River Mile (RM) 60.7. The Project is intended to convey sediment, fresh water, and nutrients from the Mississippi River

into an outfall area within the Barataria Basin in Plaquemines and Jefferson Parishes. After passing through a proposed intake structure complex at the confluence of the Mississippi River and the proposed intake channel, the sediment-laden water would be transported through a conveyance channel to an outfall area in the mid-Barataria Basin.

Flow in the diversion would be variable, with the gates opening when the Mississippi River gage in Belle Chasse reaches 450,000 cubic feet per second (cfs). The diversion would reach a peak flow of 75,000 cfs into the mid-Barataria Basin when the Mississippi River discharge is 1,000,000 cfs or more. When Mississippi River flows are below 450,000 cfs at Belle Chasse, the Project would maintain a background (base) flow of up to 5,000 cfs to protect, sustain, and maintain newly vegetated or recently converted fresh and intermediate habitats near the diversion outflow.

As more fully explained in Section 5 below, the Project is anticipated to have major, permanent benefits on wetlands and other U.S. jurisdictional waters in the Barataria Basin. The purpose of the diversion of fresh water, sediments, and nutrients into the Barataria Basin is to build, sustain, and maintain wetlands and riverine deltaic processes in an area that has been isolated from natural flooding inputs from the Mississippi River. A consistent and large magnitude input of sediment will lead to accumulation of diverted sediments and formation of new sub-areal features available for plant colonization. Direct deposition within existing wetlands contributes to surface accretion helping to offset the effects of sea level rise and subsidence.

3. PROJECT SITE

The Project Area is shown in Figures 1 and 2 below. A detailed description of the ecologic characteristics of the Project site is presented in Chapter 3 of the Final EIS.

Figure 1

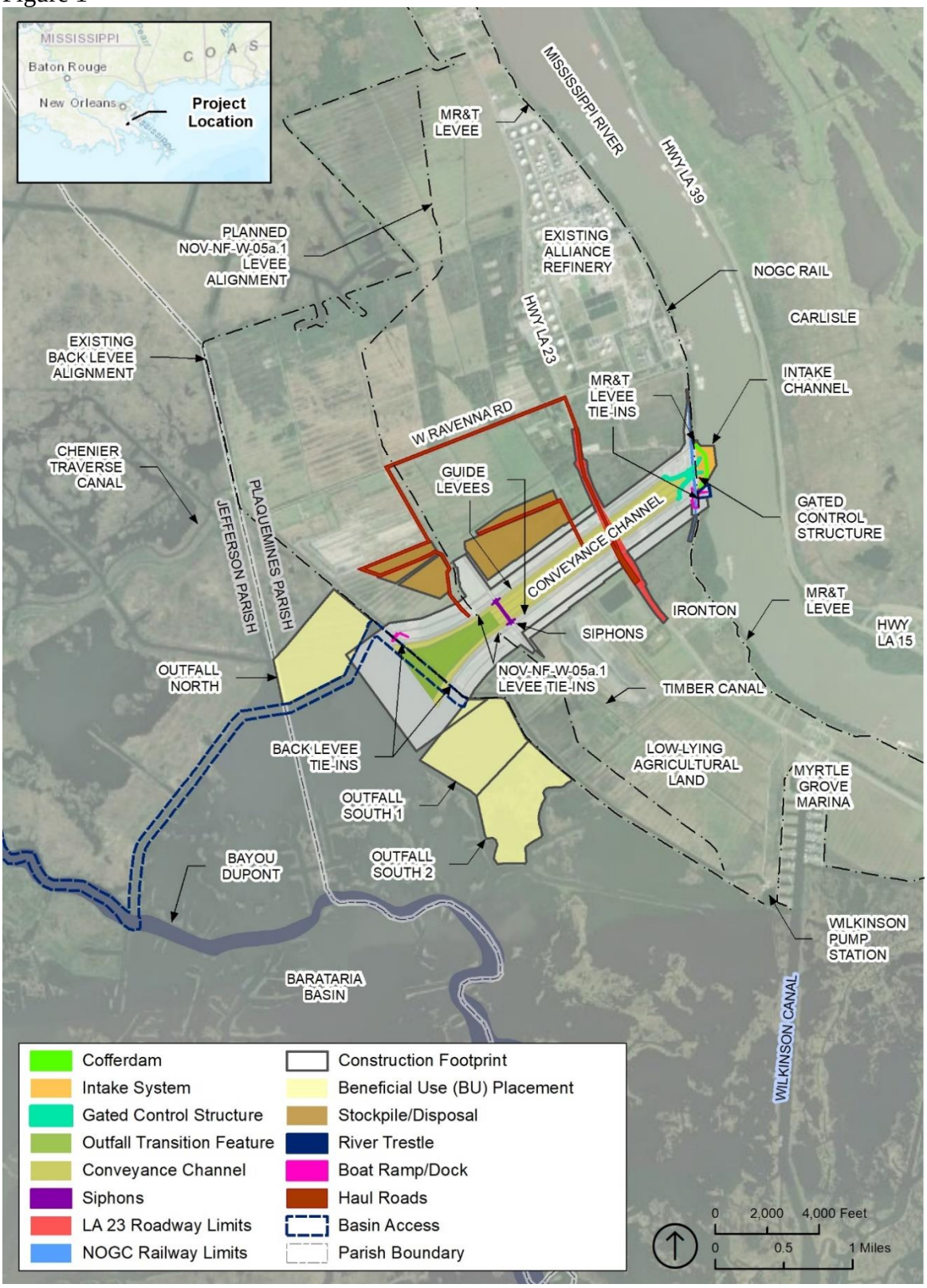
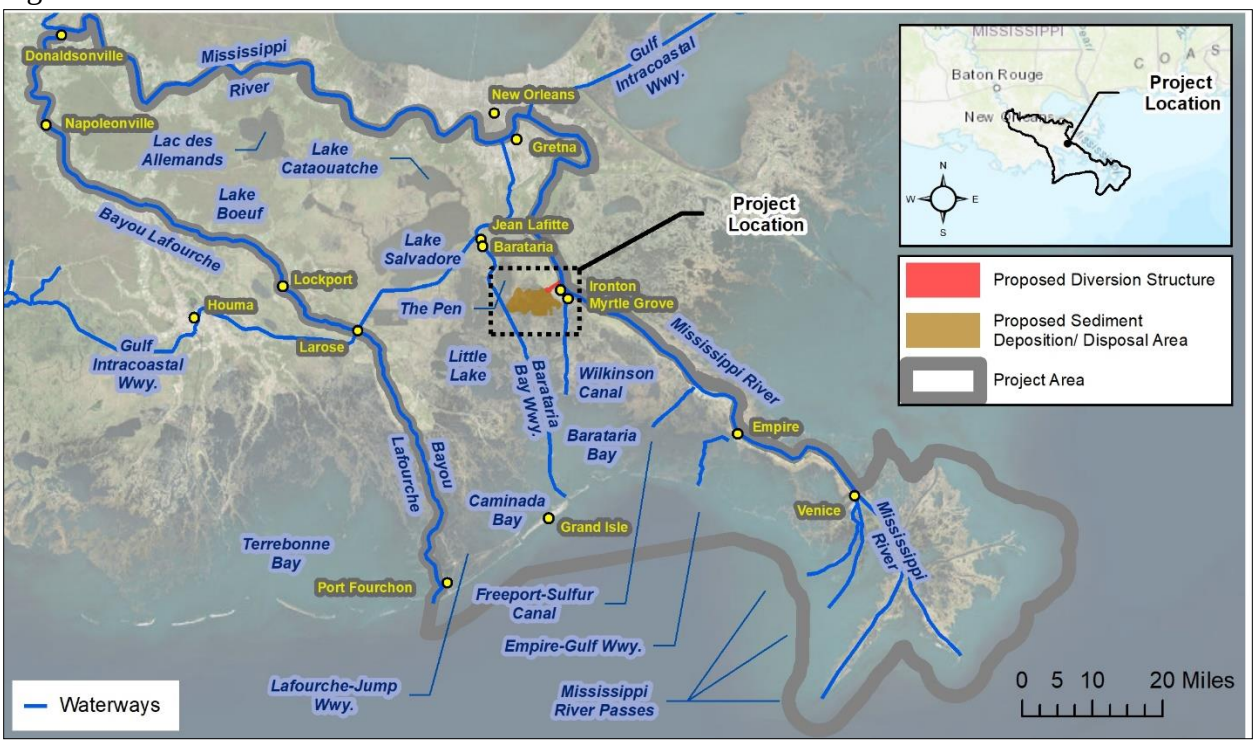

MISSISSIPPI
Baton Rouge
New Orleans
Project Location
MR&T LEVEE
MISSISSIPPI RIVER
HWY LA 39
PLANNED NOV-NF-W-05a.1 LEVEE ALIGNMENT
EXISTING ALLIANCE REFINERY
NOGC RAIL
CARLISLE
HWY LA 23
EXISTING BACK LEVEE ALIGNMENT
MR&T LEVEE TIE-INS
INTAKE CHANNEL
W RAVENNA RD
CHENIER TRAVERSE CANAL
GUIDE LEVEES
GATED CONTROL STRUCTURE
JEFFERSON PARISH
PLAQUEMINES PARISH
CONVEYANCE CHANNEL
IRONTON
MR&T LEVEE
HWY LA 15
SIPHONS
OUTFALL NORTH
NOV-NF-W-05a.1 LEVEE TIE-INS
TIMBER CANAL
BACK LEVEE TIE-INS
LOW-LYING AGRICULTURAL LAND
MYRTLE GROVE MARINA
OUTFALL SOUTH 1
BAYOU DUPONT
OUTFALL SOUTH 2
WILKINSON PUMP STATION
BARATARIA BASIN
WILKINSON CANAL
Cofferdam
Intake System
Gated Control Structure
Outfall Transition Feature
Conveyance Channel
Siphons
LA 23 Roadway Limits
NOGC Railway Limits
Construction Footprint
Beneficial Use (BU) Placement
Stockpile/Disposal
River Trestle
Boat Ramp/Dock
Haul Roads
Basin Access
Parish Boundary
0 2,000 4,000 Feet
0 0.5 1 Miles

Figure 2



The marshes of the mid-Barataria Basin are increasingly fragmented due to increased saltwater intrusion, subsidence, and erosional forces and are losing land area at a more rapid rate than other areas of the basin (Ayres 2012; Couvillion et al. 2016; CPRA 2012 and 2017). As a result, this portion of the Basin is viewed as an area of critical need within the Barataria Basin that may benefit most markedly from a sustained infusion of sediment, fresh water, and nutrients from a sediment diversion.

If no action were taken, the trend of increasing land loss in the Barataria Basin would continue, resulting in the projected conversion of up to nearly 274,000 acres of emergent wetlands and other subaerial (above the water surface) landforms to subaqueous (below the water surface) shallow water by the year 2070 (see Table 4.2-3 in Final EIS Section 4.2.3 Geology, Topography and Geomorphology).

The Barataria Basin was identified in the Louisiana Trustee Implementation Group's (LA TIG) Final Strategic Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats in the Barataria Basin, Louisiana (SRP/EA #3) as a focus area for restoration activities because within Louisiana, the Barataria Basin suffered the most severe and persistent oiling from the DWH oil spill (LA TIG 2017). It is also an "area of critical need" due to its significant and continuing land loss. In the SRP/EA #3, the LA TIG identified a combination of sediment diversions and marsh creation projects as the preferred restoration strategy for the Barataria Basin.

The proposed location for the Project is in the Middle Basin. As described in more detail in the Final EIS, a project in the Middle Basin allows for capture and redistribution of fine-grained and coarse-grained sediments, is buffered from excessive erosional forces, and is better protected from extreme changes in salinity.

4. PERMITTING HISTORY AND RELATED MITIGATION GUIDELINES AND REQUIREMENTS

4.1. Oil Pollution Act

On March 20, 2018, consistent with Oil Pollution Act (OPA), the LA TIG published the SRP/EA #3. In the SRP/EA #3, the LA TIG Trustees selected a large-scale sediment diversion for further planning as part of a suite of restoration projects that constitutes the Applicant's Preferred Alternative for restoring DWH oil spill injuries through restoration in the Barataria Basin. The Trustees further selected the Project, among others, for advancement and further evaluation under OPA and NEPA in a Phase II Restoration Plan and NEPA analysis.

4.2. Clean Water Act Section 404/Rivers and Harbors Act Section 10

Because the Project would involve the discharge of dredged and fill material into waters of the United States and requires construction to be performed in the Mississippi River and the Barataria Basin, a CWA Section 404 permit and a Rivers and Harbors Act (RHA) Section 10 permit are required for construction and operation of the Project. Permits for activities requiring approval under both Section 10 of the RHA and Section 404 of the CWA are processed simultaneously by the USACE.

CPRA submitted a Joint Permit Application on June 23, 2016, to the USACE, New Orleans District (CEMVN) for Section 404/10 permits. On March 26, 2018, CPRA submitted a revision to the permit application including a revised statement of Purpose and Need.

The USACE decision whether to issue Section 404/10 permits will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest.[i] Relevant factors in such evaluation include: "conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people."[ii] Compensatory mitigation may be required to ensure that an activity requiring authorization is not contrary to the public interest.[iii]

In addition, pursuant to CWA Section 404, compensatory mitigation is required to offset environmental losses from unavoidable impacts to waters of the United States.[iv] The U.S. Environmental Protection Agency (EPA) and the USACE have articulated the policy and procedures to be used in the determination of the type and level of compensatory mitigation necessary (Section 404(b)(1) Guidelines).[v] The Section 404(b)(1) Guidelines state that "the

district engineer will issue an individual Section 404 permit only upon a determination that the proposed discharge complies with applicable provisions of 40 CFR Part 230, including those which require the permit applicant to take all appropriate and practicable steps to avoid and minimize adverse impacts to waters of the United States."[vi] Practicable means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Under the Section 404(b)(1) Guidelines, impacts must first be avoided and minimized.[vii] Avoidance of impacts to aquatic resources involves the least-damaging project type, spatial location and extent compatible with achieving the purpose of the project. Avoidance is achieved through an analysis of appropriate and practicable alternatives and a consideration of the impact footprint. Minimization involves managing the severity of a project's impact on resources at the selected site. Minimization is achieved through the incorporation of appropriate and practicable design and risk avoidance measures. If impacts cannot be avoided or minimized, compensatory mitigation should be provided.[viii]

Compensatory mitigation involves replacing or providing substitute resources for impacts that remain after avoidance and minimization measures have been applied. The implementation of the compensatory mitigation should be in advance of or concurrent with the impacts.

4.3. Rivers and Harbors Act Section 408

Section 408 of the RHA provides that the USACE may grant permission for another party to alter a Civil Works project upon a determination that the alteration proposed will not be injurious to the public interest and will not impair the usefulness of the Civil Works project.[ix] As in the context of Section 404/10 permits, the USACE may require mitigation to ensure the proposed alteration is not injurious to the public interest.[x]

The Project has the potential to alter USACE civil works projects and requires Section 408 permission to proceed. The following USACE civil works projects are located within the Project area: the Mississippi River Ship Channel Gulf to Baton Rouge Project, Saltwater Sill Mitigation Project, Gulf Intracoastal Waterway, Barataria Bay Waterway, Bayou Lafourche and Lafourche-Jump Waterway, Mississippi River and Tributaries Project – Mississippi River Levee, Hurricane and Storm Damage Risk Reduction System Projects, Larose to Golden Meadow Project, and Davis Pond Freshwater Diversion Project.

CPRA submitted a Section 408 Permission Request Letter on January 13, 2017, to CEMVN for a Section 408 permission. CEMVN determined that Section 408 permission was required with respect to the Mississippi River Ship Channel, the Mississippi River & Tributaries Levees, and the New Orleans to Venice (NOV) Non-Federal Levee (NFL) USACE, New Orleans District projects.

4.4. National Environmental Policy Act

NEPA requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions. NEPA does not require federal agencies to prescribe mitigation for effects of their actions.

Because federal approvals, including Section 404 and 10 permits and Section 408 permission, are required for the Project, the Project is a federal action subject to NEPA. The USACE is the lead federal agency for compliance with NEPA. The USACE determined that the Project may significantly affect the quality of the human environment and therefore, decided to prepare an EIS. The USACE prepared a DEIS dated March 5, 2021, in accordance with NEPA and applicable NEPA implementation regulations (43 U.S.C. § 4321 *et. seq.*; 40 C.F.R. § 1500, as amended; 33 C.F.R. § 325, Appendices B and C). The USACE requested that six federal and state agencies with statutory authority or special expertise with an environmental issue participate in the EIS process as cooperating agencies, including the Environmental Protection Agency, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), the NOAA Damage Assessment, Remediation, and Restoration Program (DARRP), the U.S. Department of Interior's FWS, the Louisiana State Historic Preservation Office (LA SHPO), and the Louisiana Department of Transportation and Development (LDOTD). The USACE also invited several federal, state, and local agencies to participate in the EIS process as commenting agencies, including the U.S. Geological Survey (USGS), the Natural Resources Conservation Service (NRCS), the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), the Louisiana Department of Wildlife and Fisheries (LDWF), the Louisiana Department of Natural Resources (LDNR), the Louisiana Office of State Lands (OSL), the Louisiana Department of Environmental Quality (LDEQ), the Plaquemines Parish Government (PPG), and the Jefferson Parish Government (JPG).

Impacts identified in the Draft and Final EIS and associated technical analyses (as well as in other analyses outside of the NEPA process) were used as the basis for mitigation in the Mitigation Plan. The Final EIS is expected to be published in 2022. The Final EIS will also inform decisions made by the LA TIG regarding restoration planning and related funding decisions relevant to the Deepwater Horizon natural resource damage settlement. The Final EIS evaluates any environmental consequences associated with implementation of the mitigation and stewardship measures presented here. That evaluation is included in Appendix R-3 and Appendix R-4 of the Final EIS.

4.5. Endangered Species Act

Section 7(a)(2) of the ESA requires federal agencies to consult with NMFS and/or the FWS (collectively the Services) to ensure that effects of actions that the federal agencies authorize, fund, or carry out are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat. During this consultation, the federal action agency prepares an initial assessment of the potential impacts of the proposed action on listed species and critical habitat. If the action agency determines that an action is not likely to adversely affect

listed species or critical habitat, and the Services agree with that assessment, the ESA consultation is concluded informally.

If the action agency determines that an action is likely to adversely affect listed species or designated critical habitat, the action agency prepares an assessment of those potential impacts and provides it to the Services. The Services then evaluate the impacts to listed species and their designated critical habitat, including impacts resulting from any indirect and cumulative effects.[xi] Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur.[xii] Cumulative effects are effects of future State, tribal, local, or private actions (not Federal actions) that are reasonably certain to occur in the action area.

The evaluation of the impact of the proposed action may take into account the actions to benefit or promote the recovery of listed species that are included by the federal agency as an integral part of the proposed action. If the applicable Service determines that the action is not likely to jeopardize the continued existence of the listed species and not likely to destroy or adversely modify its designated critical habitat, it will issue a "no jeopardy" biological opinion and an incidental take statement (ITS), detailing the amount and extent of anticipated incidental take.[xiii] The ITS will include reasonable and prudent measures—actions the Director believes necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take. The ITS will also include additional terms and conditions that the federal agency and any applicant must implement to minimize the impact of such incidental take. If the applicable Service determines that the action is likely to jeopardize the listed species or to destroy or adversely modify its designated critical habitat, it will issue a "jeopardy" biological opinion and identify a reasonable and prudent alternative to the proposed action.

The USACE submitted a biological assessment to NMFS and initiated Section 7 consultation for the Project in February 2021. The USACE submitted a biological assessment to FWS and initiated Section 7 consultation for the Project on July 2, 2021. These consultations resulted in a biological opinion from each Service in December 2021. This documentation is provided in Appendix O of the FEIS.

4.6. Fish and Wildlife Coordination Act

The FWCA requires federal agencies to consult with FWS and the head of the agency exercising administration over the wildlife resources of the particular State regarding activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat.[xiv] FWS and the state agency may make recommendations for consideration by the federal agency; the agency may consider the recommendations but is not required to follow them.[xv]

Pursuant to FWS guidance,[xvi] mitigation is accomplished through the use of a five-step process for reducing or eliminating losses from a project: avoidance, minimization, rectification, rectification over time, and compensation. Compensation is used to mitigate for unavoidable losses after the first four components of mitigation have been applied. Compensation means full

replacement—substitution of fish and wildlife resource losses with resources considered to be of equivalent biological value—of project-induced losses to fish and wildlife resources.

Under the policy, the mitigation goal depends on the category of resource to be impacted by the action, as follows:

- Resource category 1: Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.
    - Mitigation goal: no loss of existing habitat value.
- Resource category 2: Habitat to be impacted is of high value for evaluation species and is relatively scarce.
    - Mitigation goal: no net loss of in-kind habitat value.
- Resource category 3: Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant.
    - Mitigation goal: no net loss of habitat value while minimizing loss of in-kind habitat value.
- Resource category 4: Habitat to be impacted is of medium to low value for evaluation species.
    - Mitigation goal: minimize loss of habitat value.

The USACE initiated consultation with the FWS and the state under the FWCA on January 19, 2021. FWS made the following recommendations:

1. The Service recommends the construction of crevasse projects that may include terracing to offset the indirect loss of 926 acres on the Delta NWR [National Wildlife Reserve] and 37 acres on the Pass-A-Loutre (PAL) WMA [Wildlife Management Area]. Funding for these crevasse projects is potentially available from a variety of sources, including the Coastal Wetland Planning, Protection and Restoration Act (CWPPRA), but should funding not be available through those sources to implement the crevasse projects, funding should be secured through Operations and Maintenance costs associated with the project or set aside in the Monitoring and Adaptive Management Plan to ensure wetland losses in Delta NWR and PAL WMA will be addressed. Any CWPPRA funding for these crevasse projects should be in addition to, and should not displace, CWPPRA funding that would otherwise be used to implement crevasse projects in Delta NWR and PAL WMA. The Service recognizes that the Birdfoot Delta Hydrologic Restoration Project, the Engineering and design of which were funded pursuant to Deepwater Horizon Oil Spill, Louisiana Trustee Implementation Group Final Restoration Plan and Environmental Assessment #7: Wetlands, Coastal and Nearshore Habitats and Birds (November 2020), will, if funded for implementation, provide further benefits to the Delta NWR and PAL WMA and offset the indirect losses on those resources from the MBSD. For additional information on possible projects, associated permits, and for all activities occurring on the Delta NWR, please coordinate with this office and the Southeast Louisiana Refuges by contacting Barret Fortier (985.882.2011, barret_fortier@fs.gov), and for similar information on any activities planned for Pass a

Loutre WVA contact LDWF, Mr. Vaughn McDonald 225-765-2708, atvmcdonald@wlf.la.gov).
Applicant Response: Within 5 years of the commencement of Project operations, CPRA or the LA TIG will provide $10,000,000 of additional funding for wetland preservation and restoration work in the Delta NWR and the PAL WMA to offset modeled acres of indirect wetland losses in those areas. That funding may be accomplished through additional funding through the CWPPRA program, through additional restoration work sponsored by the LA TIG (for example, construction of the E&D work discussed in the DWH LA TIG's Restoration Plan and Environmental Assessment #7), or through a direct contribution for additional work. The funding will be proportioned between the Delta NWR and the PAL WMA based on the magnitude of the predicted wetland loss in each area. FWS concurs with this implementation strategy for Conservation Recommendation Number 1.

2. The impacts to Essential Fish Habitat should be discussed with the NMFS to determine if the project complies with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), Magnuson-Stevens Act; P.L. 104-297, as amended, and its implementing regulations.
Applicant Response: CPRA agrees to Conservation Recommendation 2 and is actively coordinating with NMFS regarding potential impacts to Essential Fish Habitat.

3. In order to better coordinate and consider the overall health of the Barataria Basin, the Service recommends that a basin-wide operations and basin monitoring data repository be developed. The data and conclusions should be readily available to help in the general coordination among diversion operators, within their authorizations, and to understand both adverse and beneficial impacts to the overall basin. The Service and other natural resource agencies should be involved in reviewing and commenting on this data repository.
Applicant Response: CPRA agrees to Conservation Recommendation 3 and has developed a data repository consistent with this Recommendation. CPRA looks forward to discussing that repository with the Service and other natural resource agencies.

4. Monitoring of the Davis Pond and Caernarvon Diversions indicated that some contaminants were being introduced into the receiving areas from the Mississippi River. To address potential impacts of future contaminants on fish and wildlife resources, the Service recommends that pre and post sampling of fish and shellfish from the outfall area and the Mississippi River be undertaken. The Service recommends that CPRA, in coordination with the Service, develop a list of contaminants to be analyzed. The Service and CPRA should refer to the most recent EPA Priority Pollutant list in developing the list of contaminants to be analyzed. Periodic post-operational sampling should start after sufficient time for potential contaminants to accumulate (i.e., 3 to 5 years) and the frequency of subsequent periodic sampling (e.g., 3 to 5 years) would be predicated upon levels of contaminants detected. Expansion of sampling to local nesting bald eagles (e.g., fecal and blood samples analyzed for the same contaminant) would also be predicated

upon the type and level of contaminants detected. If high levels of contaminants are found, the Service and other resource agencies should be consulted. This adaptive sampling plan should be developed in cooperation with the Service and other natural resource agencies and implemented prior to operation.
Applicant Response: CPRA agrees to Conservation Recommendation 4.

5. The Service recommends that consideration be given to operating the diversion in a manner that would prevent or minimize adverse impacts to wetlands due to prolonged inundation and focus on the overall enhancement of the entire project area to the greatest extent possible.
Applicant Response: CPRA agrees to Conservation Recommendation 5.

6. The Service recommends development of a detailed Monitoring and Adaptive Management (MAM) Plan to inform operational decisions in order to minimize adverse impacts where possible. The MAM Plan should be developed through coordination with the Service, NMFS, and other resource agencies. At a minimum, the MAM Plan should address the following issues:
    a. Receiving area water levels should be monitored to minimize any potential adverse impacts such as inundation impacts (refer to Services' recommendation 5, which should be included as part of the MAM plan).
    b. The operational plan should include provisions for water level triggers to mitigate effects from coastal flood advisories during operation.
    c. Implementation of water quality sampling for concentrations of nutrients and dissolved oxygen prior to and during operation to help determine impacts from diverted water on nutrient concentrations and resulting water quality effects.
    d. Concentrations of EPA Priority Pollutants and Contaminants of Concern (COC) should be sampled in fish and shellfish from the outfall area and Mississippi River prior to and following operation to determine potential adverse effects to fish and wildlife. The frequency, intensity, and potential expansion of the sampling should be predicated upon containment levels detected (refer to the Services' Recommendation 4 which should be included in the MAM plan).
    e. There should be monitoring of below- and above- ground biomass to understand inundation and salinity effects on wetland health.
    f. Measurement of sediment accretion (water bottom and on the marsh surface) and bulk density should be conducted throughout the receiving area to provide the data needed to optimize sediment delivery and distribution to receiving area wetlands.
    g. MAM plan results (i.e., sedimentation, fishery, water quality monitoring, etc.) should be used to refine and improve future operations (refer to the Services' Recommendation 3).

    Applicant Response: CPRA agrees to Conservation Recommendation 6 and has worked closely with the Service, NMFS, and other resource agencies to develop a MAM plan that satisfies the components of this Recommendation.

7. The Service recommends adaptively managing the diversion outfall area to minimize stage increases and to maximize distribution and capture of suspended sediments within the immediate outfall area. This is needed to prevent the loss of diversion efficiency should diverted water attempt to circumvent the wetlands and flow directly into Wilkinson Canal or the Barataria Bay Waterway rather than flow over marsh where it will do the most good and ensure achieving project goals. Dredged material associated with achieving this recommendation should be beneficially used to create, restore, or enhance marsh within the basin or surrounding areas.
   Applicant Response: CPRA agrees to Conservation Recommendation 7.

8. A report documenting the status of implementation, operation, maintenance and adaptive management measures should be prepared every three years by the managing agency and provided to the USACE, the Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Louisiana Department of Natural Resources, Louisiana Coastal Protection and Restoration Authority, and the Louisiana Department of Wildlife and Fisheries. That report should also describe future management activities and identify any proposed changes to the existing management plan.
   Applicant Response: CPRA agrees to Conservation Recommendation 8.

9. Further detailed planning of project features and any adaptive management and monitoring plans should be developed in coordination with the Service and other State and Federal natural resource agencies so that those agencies have an opportunity to review and submit recommendations on work addressed in those reports and plans.
   Applicant Response: CPRA agrees to Conservation Recommendation 9 and the MAM plan referenced in Conservation Recommendation 6 includes provisions on governance that establish the suggested inter-agency coordination.

10. The pallid sturgeon is found in the Mississippi River and is adapted to large, free-flowing turbid rivers with a diverse assemblage of physical characteristics that are in a constant state of change. Entrainment associated with the diversion of river water to coastal estuaries is a potential effect that should be addressed in coordination with the Service. The Service recommends consultation under the Endangered Species Act (ESA) with this office for pallid sturgeon.
    Applicant Response: CPRA agrees to Conservation Recommendation 10.

11. West Indian manatees occasionally enter Louisiana coastal waters and streams during the warmer months (i.e., June through September). During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and state law. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with manatees, although passively taking pictures or video

would be acceptable. For more detail on avoiding contact with manatees refer to the Endangered and Threatened Species section of this document and contact this office. Should a proposed action directly or indirectly affect the West Indian manatee, further consultation with this office will be necessary.
Applicant Response: CPRA agrees to Conservation Recommendation 11.

12. If implementation of the proposed action has the potential to directly or indirectly affect the red knot, piping plover, and eastern black rail or their habitat, further consultation with this office will be necessary.
Applicant Response: CPRA agrees to Conservation Recommendation 12.

13. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. During project construction, a qualified biologist should inspect the proposed construction site for the presence of documented and undocumented wading bird colonies and bald eagles.
    a. All construction activity during the wading bird nesting season (February through October 31 for wading bird nesting colonies, exact dates may vary) should be restricted within 1,000 feet of a wading bird colony. If restricting construction activity within 1,000 feet of a wading bird colony is not feasible, CPRA should coordinate with FWS to identify and implement alternative best management practices to protect wading bird nesting colonies.
    b. During construction activities, if a bald eagle nest is within or adjacent to the proposed project area, then follow the bald and golden eagle guidelines found on-line at https://www.fws.gov/library/collections/bald-and-golden-eagle-management to determine whether disturbance will occur and/or an incidental take permit is needed.
    Applicant Response: CPRA agrees to Conservation Recommendation 13.

14. The Service recommends that CPRA and the USACE contact the Service and LDWF for additional consultation if: 1) the scope of location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat, 3) the action is modified in a manner that causes effects to listed species or designated critical habitat, or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made or finalized.
    Applicant Response: CPRA agrees to Conservation Recommendation 14.

If, after further consultation with CPRA, USACE, and LDWF, the FWS modifies these recommendations in the future, the modified recommendations shall automatically supersede the recommendations set forth herein without the need to update this Mitigation Plan.

4.7. Magnuson–Stevens Fishery Conservation and Management Act

Under the Magnuson–Stevens Fishery Conservation and Management Act **(**MSA), NMFS approves, implements, and enforces fishery management plans (FMPs) that are developed and prepared by regional fishery management councils.[xvii] FMPs must identify EFH for each life stage of the managed fish species based on certain guidelines, minimize adverse fishing effects on EFH, and identify other actions to encourage the conservation and enhancement of EFH.[xviii] EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."[xix] Once designated, the MSA requires that federal agencies consult with NMFS regarding actions that may adversely affect EFH.[xx]

The MSA consultation obligation is triggered when a federal action "may adversely affect" identified EFH.[xxi] EFH consultations evaluate potential adverse effects of actions separately from any proposed compensatory mitigation, even though the net effect of a particular project could be considered neutral or even positive for EFH if sufficient compensatory mitigation is attached to the action.[xxii] Where consultation is required, NMFS must provide EFH conservation recommendations (which may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH), and the federal agency must respond to the recommendations, but is not required to follow them or to ensure that its action will not adversely affect EFH.[xxiii]

The USACE contacted NMFS regarding EFH consultation in December 2019 to notify NMFS that the Project may impact EFH. The USACE provided an EFH assessment and requested EFH consultation with NOAA in February 2021. NMFS issued a response to the EFH consultation in June 2021, in which NMFS concurred with USACE's findings regarding EFH and provided conservation recommendations. This documentation, including the conservation recommendations, are provided in Appendix N of the FEIS. If, after further consultation with CPRA and USACE, NMFS modifies these recommendations in the future, the modified recommendations shall automatically supersede the recommendations attached in Appendix N of the FEIS.

4.8. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) prohibits the taking and importation of marine mammals and marine mammal products unless the taking or importation is authorized or exempt. Under certain circumstances, NMFS and FWS may waive the requirements of the MMPA for species under their jurisdictions so as to allow the taking, or importing of any marine mammal, or any marine mammal product.

Congress passed the Bipartisan Budget Act of 2018, Public Law 115-123 (BBA-18), which recognized the consistency of the Project, among other CPRA projects, with the findings and policy declarations in Section 2(6) of the MMPA. The BBA-18 included a requirement that the Secretary of Commerce, as delegated to the Assistant Administrator of the NMFS, issue a waiver of the MMPA moratorium and prohibitions for the Project. As directed by Congress, on March 15, 2018, NMFS issued the waver pursuant to BBA-18 and Section 101(a)(3)(A) of the MMPA: "National Marine Fisheries Service hereby issues this waiver pursuant to title II, section 20201

of the Bipartisan Budget Act of 2018 and section 101(a)(3)(A) of the MMPA for the three named projects, as selected by the 2017 Louisiana Comprehensive Master Plan for a Sustainable Coast. The requirements of sections 101(a) and 102(a) of the MMPA do not apply to any take of marine mammals caused by and for the duration of the construction, operation, or maintenance of the three named projects."

BBA-18 also required the State of Louisiana, in consultation with the Secretary of Commerce (delegated to NMFS), to the extent practicable and consistent with the purpose of the Project, to minimize impacts on marine mammal species and population stocks and monitor and evaluate the impacts of the Project on such species and population stocks. The specific measures to be implemented as part of the Project are set forth in Section 6.3.6 below.

4.9. National Historic Preservation Act

The National Historic Preservation Act (NHPA) and its implementing regulations[xxiv] set out the requirements and process to identify and evaluate historical resources, determine effects on these resources, and resolve adverse effects on properties eligible for the National Register of Historic Places (NRHP) that occur as a result of the federal agency's permitted undertaking. Where adverse effects are found, consultation among the federal agency, applicant, and consulting parties, including the Advisory Council on Historic Preservation (ACHP) in some cases, is pursued to develop avoidance alternatives or mitigation measures to resolve adverse effects.[xxv]

The USACE sent a letter of introduction and invitation to informally begin the NHPA consultation process on October 21, 2016. The USACE also made participating requests to the following Tribal Nations: Alabama Coushatta, Caddo Nation of Oklahoma, Chitimacha, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw, Mississippi Band of Choctaw, Muscogee Nation, Seminole Nation of Oklahoma, Seminole Tribe of Florida, Tunica-Biloxi Tribe of Louisiana. The Alabama Coushatta, the Caddo Nation of Oklahoma, and the Choctaw Nation of Oklahoma are participating. In 2017, the USACE initiated formal consultation between the ACHP, SHPO, and participating Tribal Nations.

The USACE consulted with the SHPO and Federally-recognized Tribal Nations to identify concerns and determine survey requirements for Section 106 compliance. All consulting parties agreed to a Construction Impacts Area of Potential Effect (APE) of approximately 3,095 acres that encompasses the footprint of all Project features and an Operational Impacts APE of approximately 70,630 acres within the Barataria Basin.

A Phase I cultural resources survey was conducted from August to November 2019 in both the Construction Impacts and Operational Impacts APEs. Phase II National Register of Historic Places eligibility testing was conducted at one site (16PL107) in the Construction Impacts APE from January to March 2022. The cultural resources surveys found:

1) The majority of the 31 previously recorded archaeological sites within the Operational Impacts APE are submerged due to forces including subsidence and erosion, and the

identifiable portions do not contain qualities of significance or integrity and therefore, these sites are considered not NRHP-eligible; and

2) Four (4) previously-recorded archaeological sites within the Operational Impacts APE retain integrity and have been determined to be historic properties eligible for listing in the NRHP (Sites 16JE2, 16JE3, 16JE11, 16JE147); and
3) Two (2) new archaeological sites were identified in the Operational Impacts APE, but only one (Site 16JE237) retains integrity and is being treated as NRHP eligible; and
4) Numerous archaeological and architectural features within 16PL107 Locus 1 in the Project construction limits which contribute to Site 16PL107's significance. The portion of 16PL107 in the Project construction limits of the Construction Impacts APE has been determined eligible for listing in the NRHP; and
5) One (1) previously identified archaeological site within the Construction Impacts APE (Site 16PL269) was determined not eligible for listing in the NRHP.

The USACE determined that the Project would have an adverse effect on NRHP-eligible and NRHP-potentially eligible resources. The Section 106 Consultation concluded with execution of a Programmatic Agreement. The Programmatic Agreement is provided in Appendix K of the FEIS and attached as Appendix A to this Final Mitigation and Stewardship Plan.

5. PROJECT OPERATIONS, OBJECTIVES, AND BENEFITS

The purpose of Project is to restore for injuries caused by the DWH oil spill by implementing a large-scale sediment diversion in the Barataria Basin that will reconnect and re-establish sustainable deltaic processes between the Mississippi River and the Barataria Basin through the delivery of sediment, fresh water, and nutrients to support the long-term viability of existing and planned coastal restoration efforts. The intent of sediment diversions, such as the Project, is to maximize development of new wetlands and increase the health of or sustain existing wetlands. Sediment diversions will best meet the objectives of capturing sediment and building wetlands when located and designed to maximize capture and distribution of coarse-grained sediment. Sediment diversions are designed at a discharge capacity (specific to the location) sufficient to mobilize and entrain (via turbulence in the water column) the appropriate range of sediment sizes, as well as draw material from the more sediment-rich portions of the riverbed (CPRA 2011; Allison et al. 2014).

The Project is designed to provide large-scale wetland restoration benefits while promoting and maintaining an estuarine characteristic within the Basin. The Project's operations plan as analyzed triggers the opening of the gates when the Mississippi River gage in Belle Chasse reaches 450,000 cfs and reduces the flow to a maximum base flow of up to 5,000 cfs when the gage falls below 450,000 cfs. This operation plan allows for diversion operations that capture the high sediment loads associated with rapidly rising river discharges and thus (1) more effectively allows for distribution of fine-grained and coarse-grained sediments, which in turn promotes the long-term sustainability of existing coastal resources that are currently degraded, (2) effectively addresses relative sea-level rise, and (3) effectively promotes the infilling of shallow open water areas. Following initiation of operations, CPRA will adaptively manage the Project consistent

with the Monitoring and Adaptive Management Plan (MAM Plan or MAMP), which is Appendix R-2 to the Final EIS. See Section 7.1 for additional details.

The Project would maintain a background (base) flow of up to 5,000 cfs to protect, sustain, and maintain newly vegetated or recently converted fresh and intermediate habitats near the diversion outflow. The base flow maximizes wetland benefits, relative to a future without sediment diversion or an operation plan with no base flow after 50 years. The base flow effectively promotes the long-term sustainability of existing marshes and sustainability of newly created wetland habitats.

At the end of 40-years of operation, the Project is projected to create and sustain approximately 17,100 acres of wetland habitat in the Barataria Basin when compared to the No Action Alternative. However, these wetland benefits are happening against a backdrop of significant land loss in the basin and across the region due to subsidence and sea-level rise, so that even as diversion operations are supporting wetland sustenance and creation, some acreage would be lost over time due to these ongoing processes. At the end of the 50-year analysis period, the Project is projected to create and sustain approximately 12,700 acres of wetland habitat in the Barataria Basin when compared to the No Action Alternative.

In addition to these wetland benefits, the Project will also result in the following habitat/aquatic species benefits: increase submerged aquatic vegetation coverage and biomass, increased shallow bottom habitat, net increase in structured essential fish habitat, moderate benefits to largemouth bass, moderate benefits to red drum, moderate benefits to gulf menhaden, minor benefits to bay anchovy, negligible to minor benefits to white shrimp and negligible to minor benefits to blue crab.

6. AVOIDANCE, MINIMIZATION, MITIGATION AND STEWARDSHIP MEASURES

6.1. Avoidance and Minimization Measures

The Project was designed and selected among other alternatives to minimize incidental environmental impacts, while achieving wetland benefits described above. The alternatives evaluated in detail under the NEPA environmental review include structural alternatives, including sediment diversions with different variable flow rates (50,000 and 150,000 cfs), and alternatives that include marsh terracing outfall features.

CPRA has committed to implement Best Management Practices (BMPs) to minimize the impacts associated with the construction and operation of the Project on each element of the environment (i.e., protection of land, water, fish and wildlife, and cultural resources). These BMPs are described in Appendix B to this Mitigation Plan.

6.2. Clean Water Act Section 404 Compensatory Mitigation

This section of the Mitigation Plan identifies compensatory mitigation to offset unavoidable adverse impacts to jurisdictional waters of the United States, including wetlands and special aquatic sites.

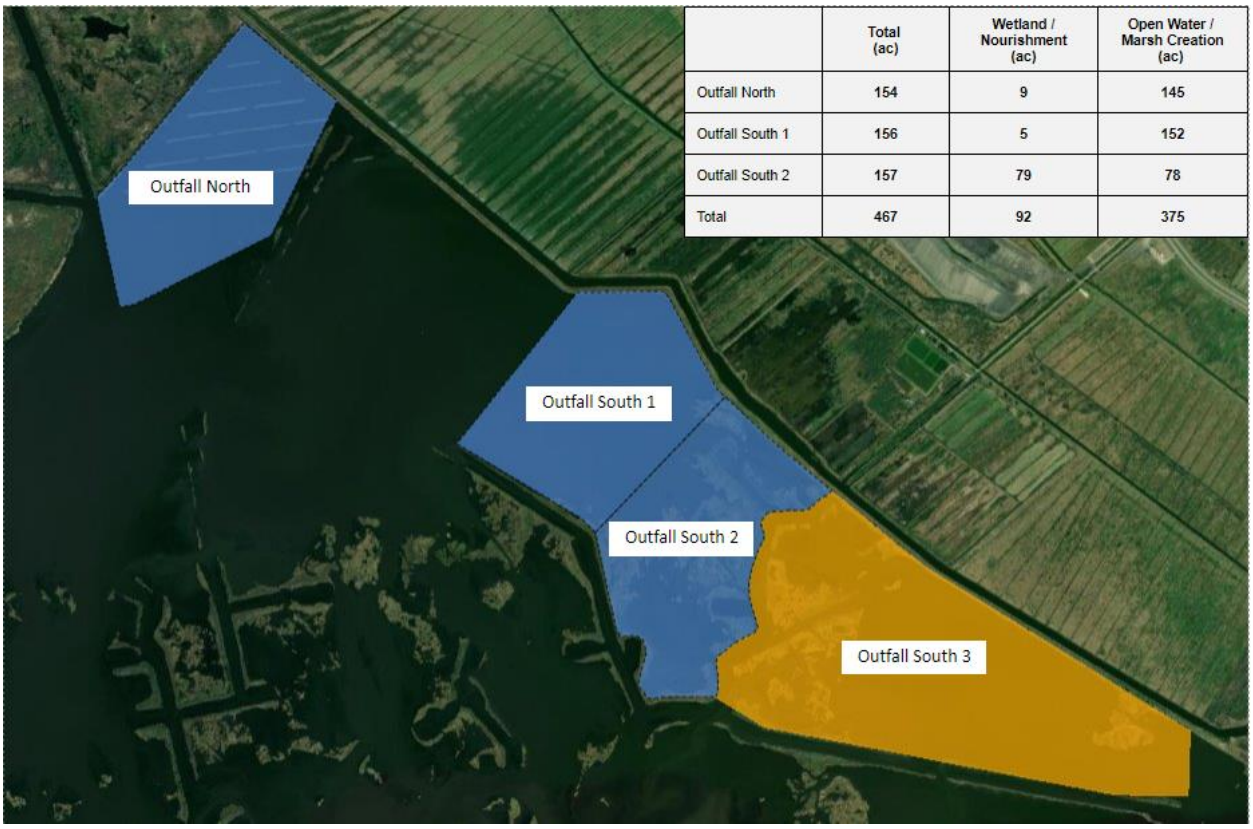
6.2.1. Wetlands and Jurisdictional Waters

Impacts. The Project would directly impact 182.9 acres of jurisdictional wetlands and 305.6 acres of waters of the U.S, however, wetlands created or sustained by the Project will be significantly greater than wetlands negatively impacted. Any permanent losses will be offset by wetland creation associated with the Project. Other wetland impacts are discussed in Chapter 4.6 of the Final EIS.

Mitigation. As discussed above, the Project itself is projected to create and sustain approximately 17,100 acres of tidal wetland habitat in Barataria Basin through operation of the diversion over a forty year operation period, which would thereafter decline due to the impacts of sea-level rise and subsidence. In addition to the wetland benefits built into the Project, CPRA will mitigate direct impacts (construction excavation and placement) to wetland soils through beneficial use placement, which will occur concurrent with construction impacts.

The construction footprint by design is constrained to minimize excavation and fill activities in the Mississippi riparian wetland area. It is anticipated that the limited quantity of wetland soil requiring excavation would result in dredge material displacement, processing, and use in upland construction. Excavation of the conveyance channel could result in excess upland and wetland soils that would need disposal. Nearby disposal areas include abandoned borrow pits that were excavated for Post-Katrina HSDRRS levee construction. See Figure 1. These abandoned borrow pits will be filled to address pre-existing impacts to the landscape and congruent with landowner and Parish interests. Also, in the area of the outfall transition feature, CPRA has designated three beneficial use placement areas, totaling approximately 770 acres, currently occupied by open water in the basin. These areas will be used for placement of suitable upland or wetland soils that will become available during construction and subsequent maintenance dredging. CPRA plans to place approximately two million cubic yards of suitable material in these areas to create 375 acres and nourish 92 acres of emergent marsh habitat concurrent with Project construction (Figure 3); this would be equivalent to a projected 402 net acres of direct benefits (or, 158 average annual habitat units) over 50 years.

In the Basin, the selected construction access routes—to allow access channels for vessels, equipment, and material transport—have been designed to avoid or minimize wetland impacts to the greatest extent practicable, along with minimizing the excavation footprint and subsequent volume of material displaced. The placement of soils in areas adjacent to channel excavation will be done in a manner to minimize the disruption of water circulation. Prior to construction completion, the material would be left in place as habitat enhancement or backfilled into the impacted, temporary access channel.



	Total (ac)	Wetland / Nourishment (ac)	Open Water / Marsh Creation (ac)
Outfall North	154	9	145
Outfall South 1	156	5	152
Outfall South 2	157	79	78
Total	467	92	375

Figure 3. Locations of the beneficial use areas proposed for marsh creation and nourishment (Outfall North, Outfall South 1, Outfall South 2). The Outfall South 3 is reserved as a future beneficial use area for outfall maintenance dredged material placement for habitat creation.

6.3. Other Mitigation and Stewardship Measures

The purpose of the mitigation set forth in this section of the Mitigation Plan is to ensure that the Project is not contrary to the public interest, pursuant to Section 404 of the CWA and Sections 10 and 14 of the Rivers and Harbors Act. Mitigation measures have been developed to address certain impacts identified in the NEPA DEIS and in the public interest review. These are measures that CEMVN could consider including as conditions to any Section 404/10 permit or Section 408 authorization for the Project, but they are not required as compensatory mitigation to address the impacts of the Project on wetlands or other waters of the U.S.

6.3.1. Impacts to Navigation

Impacts. Based on basin-wide modeling, the accumulation of sediment may affect navigation channel depths over time. Project impacts to navigation are projected to be primarily limited to changes in bed elevation (aggradation) that may occur in the Barataria Bay Waterway federal navigation channel and other frequently used privately-owned canals, such as Wilkinson Canal. Other non-federal channels and facilities (oil and gas facilities, oil and gas canals, privately owned water bottoms, marinas) near these channels can be assumed to also experience increased

sedimentation. It should be recognized that maintenance of navigation in the outfall area will be subject to private property rights, as the preponderance of existing canals, other waterways, and water bottoms are under private ownership. Further, as the delta channels evolve, new channels could support vessel access, but access would be subject to individual user and property owner's rights.

Mitigation. CPRA will undertake the following actions to mitigate impacts to navigation within the Project area.

- CPRA will undertake project specific Adaptive Management (AM) for the operation of the Mid-Barataria Sediment Diversion in regard to data collection, monitoring, and implementation of AM decisions. Monitoring will assess the Project's effect on bathymetry, consider required or authorized elevations, and operations and maintenance of the navigation channel. Details regarding this monitoring are set forth in Section 3.7.1.1.7 of the MAM Plan.
- To the extent the Barataria Waterway aggrades to a degree that inhibits navigation as a result of Project operations, CPRA will take one or more of the following actions to mitigate the identified Project impact:
    - adjust operations of the Project,
    - conduct maintenance dredging of the Waterway to provide sufficient depths for the safe transit of watercraft or to maintain authorized depths for navigation, or
    - implement outfall management measures to limit the loss of sediments to the waterway.
- To the extent that Project operations lead to aggradation within Wilkinson Canal[1] to a degree that inhibits navigation, and as long as Wilkinson Canal is being used for that purpose, CPRA will take one or more of the following actions to mitigate the identified Project impact:
    - adjust operations of the Project,
    - with approval from the underlying landowner, conduct maintenance dredging of the canal to provide sufficient depths for the safe transit of watercraft or to maintain authorized depths for navigation, or
    - provide alternative boat access to Myrtle Grove and Woodpark communities (e.g., as shown in Figure 4.13-2 in EIS Section 4.13 Socioeconomics).

CPRA does not intend to dredge any of the other privately-owned canals, waterways, or water bottoms in the Basin that may be impacted by the Project. The purpose of the Project is to create and maintain marshes in the Basin, and the continued dredging of private canals or private property (e.g., water bottoms) contributes to the loss of marshes the Project is seeking to

[1] Wilkinson Canal is a privately owned canal, and CPRA has recognized that the canal is used by the public as well. Given its current use and activity, CPRA recognizes its importance to local users, but CPRA cannot presume future use patterns or private intentions. Given the uncertainty of where and when impacts could occur with sedimentation and the nature of private property rights, CPRA must adopt an Adaptive Management approach regarding decisions to maintain navigability of the Canal; thus, improving and maintaining an alternate access route is proposed as a mitigation option depending on the time and location of impacts.

maintain. See EIS Sections 3.6.2.2, 4.2.3.2, 4.2.4.2, 4.6.5.1, and 4.25. Further, the majority of private canals where sedimentation is projected to occur comprise inactive abandoned oil and gas facilities and wells that have been plugged and abandoned.

In addition, CPRA has proposed the following measures to address concerns about navigation impacts in the Mississippi River during Project construction. These measures have been forwarded to the U.S. Coast Guard for their review and input.

- CPRA will coordinate the location of Mississippi River Aids to Navigation (ATONS) associated with the MBSD structure with the USCG. The ATONs will be visually inspected each day and the operability recorded in the Daily Report and would be maintained for the duration of the Project.
- Whenever flow through the structure is started or stopped, on-site personnel shall notify the USCG via a Navigation Bulletin so that traffic is informed of the Project's operating condition.
- Before raising or lowering any gate at the entrance to the diversion channel, the operator should check the vicinity of the inflow, conveyance and outflow channels for boats, fishermen and swimmers and alert them to clear the area. Methods for these alerts may include horns, lights and/or audio messages.

The final mitigation and stewardship measures related to navigational impacts in the Mississippi River will be included in the USACE permit/authorization, if one is issued. CPRA will update the Mitigation Plan to reflect any changes to these conditions included in that permit/authorization, if one is issued.

6.3.2. Property Impacts

Impacts. Property related impacts from the Project are described in detail in Chapter 4 Sections 4.13 and 4.20 of the Final EIS. The following subsections provide a brief overview of the affected communities and the properties within those communities, the anticipated impacts of the Project on tidal flooding[2] in these communities, the outreach efforts undertaken to develop mitigation strategies, and the resulting mitigation and stewardship measures.

Overview of Communities in the Project Area. The properties in the tidal floodplain are subject to high rates of land subsidence and sea level rise, which has resulted in an increased frequency and overall duration of tidal flooding. With the implementation of the Project, low-lying properties of the communities outside flood protection will be subject to an increased annual

[2] For purposes of this analysis, "tidal flooding" is comparable to "nuisance flooding" as defined by NOAA. Nuisance flooding refers to low levels of water that do not pose significant threats to public safety or cause major property damage, but can disrupt routine day-to-day activities, put added strain on infrastructure systems such as roadways and sewers and cause minor property damage. Nuisance flooding is also synonymous with high tide or minor flooding and is increasingly common due to years of relative sea level increases (Sweet et al., 2018; https://repository.library.noaa.gov/view/noaa/17403).

frequency and duration of nuisance flooding events as compared to the No Action Alternative. The impact area is projected to encompass the lower portion of Bayou Barataria to Happy Jack (see Figure 4), which includes the communities of Myrtle Grove, Woodpark, Suzie Bayou, Deer Range, Lake Hermitage, Grand Bayou, and Happy Jack, and to a lesser extent communities in the vicinity of Lafitte (i.e., Lower Lafitte, Goose Bayou polders).

The properties in this area occur in a *Coastal High Hazard Area*[3] and are subject to high rates of land subsidence and sea level rise. Since the properties occur outside of levee protection, they are exposed to at least 8 or more of the 11 identified flood hazards[4] (Figure 5). Not including tropical systems, the low-lying properties of each of the communities currently experience multiple annual flood events from combined astronomical and meteorological tides. Most parcels in this area have low-lying land at grade that is approximately 1 foot above the mean high tide (land elevation = 2 ft NAVD88[5]). See Figures 11 through 16 in the Coastal Water Surface Elevation Report for information regarding projected tidal flooding impacts without the Project (Final EIS, Appendix P. Part P2).

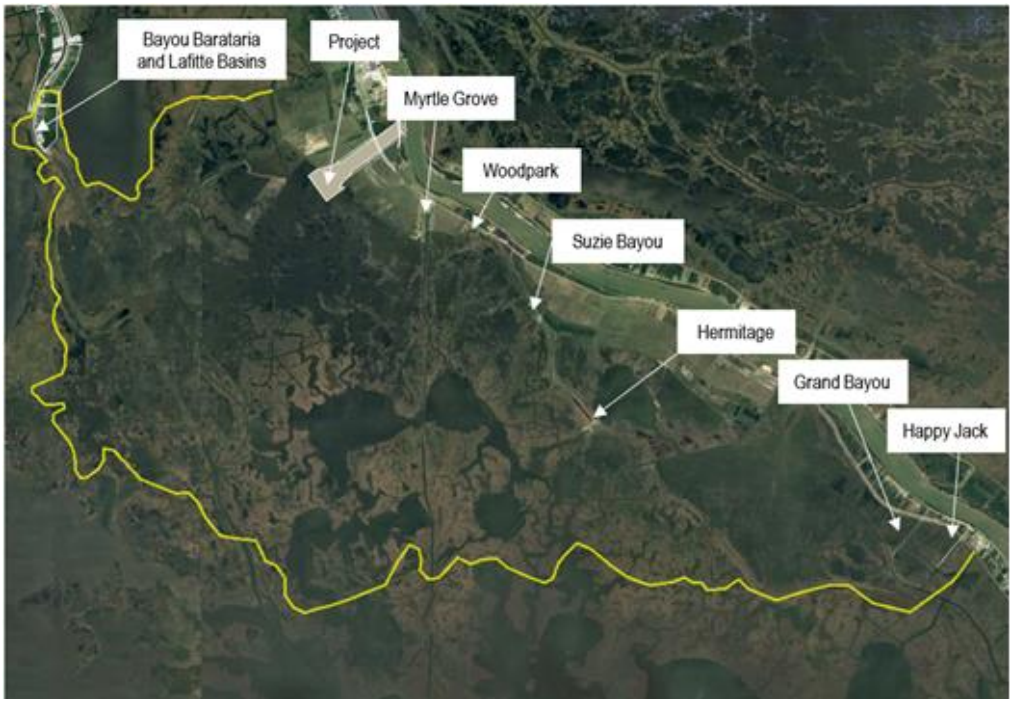


Figure 4. Communities and subdivisions subject to potential inundation with the Project and the maximum extent of inundation impacts (yellow line).

[3] Coastal High Hazard Area – an area of special flood hazard along an open coast and any other area subject to high velocity wave action from storms or seismic sources (https: //repository.library.noaa.gov/view/noaa/17403).
[4] See definition of Coastal Flood Hazard Composite (https://coast.noaa.gov/data/digitalcoast/pdf/flood-exposure-faq.pdf).
[5] Source: All South Consulting Engineers elevation survey, 2019; USGS LiDAR Digital Elevation Model, 2013.

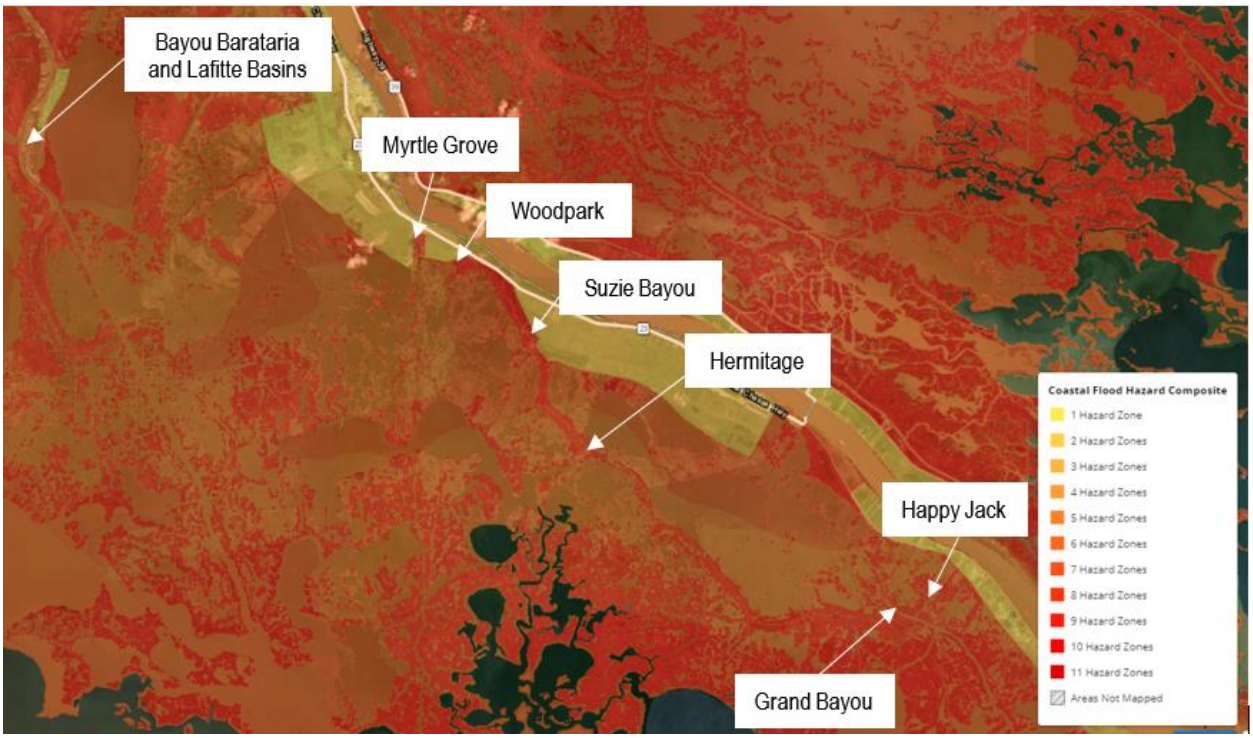


Figure 5. The communities and subdivisions subject to potential inundation with the Project are largely designated as Coastal High Hazard Areas. Image and data from the NOAA Coastal Flood Exposure Mapper (https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html).

Types of Properties and Improvements. These communities are road accessible private subdivisions[6] supplied with municipal water, electricity, and other utilities. Most of the communities were originally developed without municipal water and sewerage. Newer developments such as the Myrtle Grove Marina Estates Subdivision and Happy Jack have municipal wastewater treatment, whereas the other communities rely on individual septic units. The communities are generally subdivided into private lots improved with residences and campsites. In some cases, residences occupy leased land. Some of the existing or newer construction may comply with Plaquemines Parish Floodplain Management Regulations[7] (or other state or local regulations that prescribe standards for the purpose of flood damage prevention and reduction); improvements on some properties may pre-date or be inconsistent with those regulations. For all properties in these communities, vehicular access to the properties is between approximately 10-11 feet below the FEMA Base Flood Elevation (BFE), and thus is at high risk in any given year for flooding from tidal or tropical cyclone events. Public property

[6] Except for Grand Bayou, which is a water-based village near the end of Grand Bayou Way.
[7] The floodplain management regulations include zoning ordinances, subdivision regulations, building codes, health regulations, and special purposes ordinances.

in the area is generally comprised of roads, lanes, and drainage canal rights-of-way that are maintained by Plaquemines Parish.

Impacts to Properties. As explained in the Final EIS (Section 4.20.4.2) and supporting technical appendices, the low-lying properties in these communities outside flood protection will be subject to an increase in water levels, which would increase the annual duration (i.e., number of days per year[8]) of tidal flooding with the operation of the Project. These flooding impacts consist of inundation to roads, driveways, parking areas, non-habitable structures at grade, and potential strain on support services (e.g., drainage and/or septic systems). For more information about these impacts, see Table 4.20-2 and Figure 4.20-3 to Figure 4.20-6 in the Final EIS (Section 4.20.4.2), and Appendix P, Part P2.

Process for Developing Mitigation and Stewardship Measures. Based on the impact projected from the Project reported in the EIS, CPRA undertook a multi-step process to solicit public input and to identify and refine the mitigation and stewardship measures. These steps included:

- Solicited public input (benefits, impacts, mitigation measures) through CPRA's Coastal Connections (2016 – ongoing);
- Reviewed impact projections based on technical analysis reported in the EIS (see Appendix P to the Final EIS);
- Developed preliminary mitigation measures to address, offset, or minimize the impacts projected from Project operations (reported in the Draft Mitigation and Stewardship Plan published as Appendix R1 in the Draft EIS);
- Solicited additional detailed input from affected communities on the proposed mitigation and stewardship measures (see further description below); and
- Completed a technical evaluation of mitigation and stewardship measures, which led to the community-specific mitigation measures presented herein.

Public Input on Mitigation Measures. CPRA held twenty-three (23) meetings in the communities south of the diversion outfall outside of levee protection (from Myrtle Grove to Happy Jack and Grand Bayou) between February and August 2021 to solicit feedback regarding its proposed mitigation and stewardship measures. In addition to meetings held in the communities to have direct interaction with residents, several of these meetings were held with smaller groups of stakeholders or elected officials who represent these communities and constituencies to solicit feedback.

In addition to soliciting feedback through meetings, CPRA solicited feedback regarding its proposed mitigation and stewardship measures through a survey (available in person, online, and mailed via U.S. Mail). The survey was completed by 302 total respondents as of November 2021. The largest number of respondents live in Myrtle Grove (62 respondents), followed by Happy Jack (56 respondents), Hermitage (41 respondents), Woodpark (24 respondents), Grand Bayou (22 respondents), Suzie Bayou (20 respondents), and Deer Range (18 respondents). Thirty

[8] The annual duration of flooding is estimated comparing the number of days (With Project – No Action) above the specific flood threshold for the community.

respondents indicated they live elsewhere in places such as Buras, Belle Chasse, Gretna, and Port Sulphur. The highlights of the feedback from respondents include the following:

- 134 respondents (44.4 percent) have made changes to their homes to mitigate flood risks.
- 32.5 percent of total respondents (98) say they will stay in their homes even if the flooding gets worse because of the Project.
- Respondents are most interested in CPRA paying property owners for losses in property values from flooding (178), elevating roadways or utilities (155), followed by elevating homes and structures (142), and to a lesser degree, reducing flooding of their septic/sewer systems and other utilities (124).

Surveys also solicited other ideas and solutions to address flooding impacts of the Project from each community. The mitigation ideas provided to CPRA consisted of buyouts, financial support, raising bulkheads, elevating lots, floodgates, levees, closing pipeline canals, and barrier island restoration (or, other wetland restoration projects).

Flood Impact Mitigation and Stewardship Measures. Definitions. To help in understanding the flooding impacts and proposed mitigation and stewardship measures, the following terms are used in this Plan:

Flood Threshold Elevation – The elevation within the community where tidal waters begin to exceed the ground elevation resulting in flooding. These threshold elevations are based on measurements taken within each community and reflect existing local conditions. See Appendix P, Part P2 of the EIS.

Project Impact and Project Impact Water Surface Elevation (PIWSE) - This is the difference in the maximum water surface elevation (WSE) between the No Action Alternative and with Project scenario; this difference in WSE is leads to increased frequency and duration of inundation. From the Final EIS analysis, a sustained, high discharge operation scenario[9] provided the basis for projecting the inundation impacts with Project operation. This difference is the maximum impact within the analyzed hydrograph year. In addition, CPRA selected near term values (i.e., WSEs for earlier decades within the period of analysis), which is the period projected to experience the largest difference between the No Action Alternative and with Project scenario. As identified in the Final EIS, Appendix P2, the Project Impact decreases with time due to Relative Sea Level Rise. For example, in the Myrtle Grove area, the PIWSE is the Flood Threshold Elevation + the Project Impact (e.g., in Myrtle Grove: 1.7 ft + 1.3 ft = 3.0 ft NAVD88). The PIWSE is the minimum elevation to which improvements would need to be made to offset the impacts of water inundation resulting from Project operations.

[9] The Mississippi River 2011 flood year scenario resulted in a long duration and high discharge diversion operation to evaluate maximum impacts to WSE.

Mitigation Standard Elevation (MSE) – The standard elevation to which CPRA will provide mitigation/stewardship measures in each community. The MSE exceeds the PIWSE, i.e., additional benefit above the Project Impact is provided.

Community	Existing Conditions Flood Threshold Elevation (NAVD88)	Project Impact (FWP – FWOP WSE Difference) (ft)	Project Impact Water Surface Elevation (PIWSE) (NAVD88)	Mitigation Standard Elevation (NAVD88)
Myrtle Grove, Woodpark	1.7 ft	1.3 ft	3.0 ft	4.0 ft or greater
Suzie Bayou, Deer Range, Lake Hermitage	1.5 to 2.0 ft	≤ 1.0 ft	2.5 to 3.0 ft	
Grand Bayou, Happy Jack	1.5 ft	0.5 ft	2.0 ft	

Determination of Mitigation Standards and Criteria. The PIWSE provided a starting point for determining the elevation necessary for structural improvements, such as elevating a road, dock, or residence to offset Project Impacts. From there, CPRA developed the Mitigation Standard Elevation (MSE) of 4.0 ft NAVD88 or greater considering the Project Impact, the communities, and feasibility. The rationale for selecting this MSE included:

- It provides a single, robust elevation that can be applied to each of the communities that mitigates against flooding impacts due to the Project as well as non-Project related flood risk reduction, e.g., low level tropical storm surge;
- It exceeds the PIWSE and thus provides an additional flood risk reduction benefit above the projected Project Impact (mitigation/stewardship measure constructed to elevation 4.0 feet while the Project Impact is limited to elevation 2.0 to 3.0 feet); and,
- It extends the time available to property owners to further adapt to an anticipated future of increased flooding from sea level rise and land subsidence.

Property owners within these communities will be eligible for mitigation and stewardship measures based on the Project Impact on the community and/or individual property owner. For example, septic tank systems effluent pipes or fields below the PIWSE would be eligible for replacement/rehabilitation.

Table 1
Number of days per year that mean Water Levels are projected to Exceed the local Flood Threshold (FT)
Under No Action, Applicant's Preferred Alternative and Applicant's Preferred Alternative with Mitigations

Community	2020's (short-term)			2040's (medium-term)			2060's (long-term)		
	Existing (No Action)	With Project (Applicant's Preferred)	With Project (Applicant's Preferred) + mitigation	Existing/ Future without the Project (No Action)	With Project (Applicant's Preferred)	With Project (Applicant's Preferred) + mitigation	Existing/ Future without the Project (No Action)	With Project (Applicant's Preferred)	With Project (Applicant's Preferred) + mitigation
Myrtle Grove FT +1.75	24	143	0	127	247	1	315	364	10
Woodpark FT +2.0	10	75	0	66	176	1	294	364	10
Suzie Bayou FT +2.0	10	75	0	66	176	1	325	339	10
Hermitage FT +1.5	33	123	0	198	285	0	333	352	6
Grand Bayou Happy Jack FT +1.5	17	64	0	199	248	0	333	339	1

All elevations are in ft, NAVD88. Mitigation standard elevation (all communities) = +4.0 ft, NAVD88
Source: Analysis of Delft 3D Water Surface Elevation data, 2011 Mississippi River Hydrograph, Water Institute (2019), CPRA (2020)

Table 1 explains the projected number of days that the mean water levels are projected to exceed the Flood Threshold in the communities south of the Project outfall to Grand Bayou and Happy Jack under three scenarios: (i) existing conditions and future conditions without the Project: (ii) future conditions with the Project in operations, but no additional mitigation; and (3) future conditions with the Project in operation and the mitigation measures set forth below in place.

This table demonstrates that the mitigation measures provide benefit that exceeds the projected Project Impact. In Myrtle Grove, the construction of the project and CPRA's construction of mitigation measures are anticipated to reduce flood risk below what is anticipated under the No Action Alternative. In the other communities, the construction of the Project and CPRA's construction of the mitigation measures are anticipated to allow better access to properties than what is anticipated under the No Action Alternative. In terms of impacts to particular properties in those communities, CPRA's compensation payments will allow property owners, at their discretion, to implement measures on their property to reduce flood risk below what is anticipated under the No Action Alternative.

Mitigations by community. The proposed mitigation and stewardship measures for the affected communities (Myrtle Grove, Woodpark, Suzie Bayou, Deer Range, Lake Hermitage, Happy Jack, and Grand Bayou) reflect the measures that best address: 1) the unique circumstances and variability of affected properties (e.g., their varied layouts and improvements); 2) projected impacts based on data analysis (see Table 1); and 3) the design and feasibility assessments that have been completed at this stage in the process.

Based on the EIS impact determinations and public input, CPRA has identified the following mitigation and stewardship measures:

- Road and lane improvements: CPRA will elevate publicly maintained roads or lanes that are currently below the PIWSE to the Mitigation Standard Elevation, and make corresponding road drainage improvements.
- Boat dock/boat house improvements: CPRA will provide property owners with funds sufficient to elevate boat docks and boat houses that are currently located below the PIWSE to the Mitigation Standard Elevation.
- Septic or sewerage treatment system improvements: In communities that rely on septic systems, CPRA will improve on-site septic systems impacted by Project operations that are located below or discharge below the PIWSE so that they are located at or above the MSE. In communities with community sewer systems, CPRA will improve and/or flood proof central sewerage elements (e.g. lift stations). Both measures are intended to ensure system function and treatment performance with increased water levels from the Project.
- Project Servitude Agreements (compensation): In exchange for monetary compensation, CPRA will acquire from affected property owners a permanent right known as a Project Servitude. That Project Servitude will allow CPRA to flow water over the property owner's property at heights and durations that are greater than would be in the case in the future without the Project. The Project Servitude will be recorded against title to the property and will run with the land. CPRA will attempt to negotiate with the affected

landowner to acquire the Project Servitude. If the CPRA and the landowner were unable to reach a negotiated agreement, CPRA would exercise its eminent domain authority to purchase the servitudes. CPRA will compensate those landowners for the value of the Project servitude. A property owner would be able to use the funds received in exchange for the servitude to implement flood mitigation measures, for example, raising the lot elevation or improving a bulkhead.

- Bulkhead improvements: In limited communities (Myrtle Grove), CPRA will improve the existing bulkhead along a property's edge abutting the Basin to the Mitigation Standard Elevation (in some cases, higher). This bulkhead will reduce the number of days that protected properties will experience tidal flooding.
- Elevating residences: Where the lowest floor of the living area of a residence is at or below the PIWSE, CPRA will provide the property owner funds sufficient to elevate the residence to, at a minimum, the Mitigation Standard Elevation.
- Voluntary individual buyouts: CPRA may consider purchasing an impacted property outright (i.e., in fee) if requested by the owner. Decisions about whether to purchase a property would be made on a case-by-case basis depending on the particular circumstances.

These measures will be further refined during mitigation implementation following Project approval and funding; implementation will include:

- Mitigation planning, design, and permitting;
- Engagement of property owners eligible for one or more of the mitigation and stewardship measures;
- Refine eligibility criteria for structures for improvement;
- Detailed design of improvements (roads, drainage, septic, bulkheads);
- Project Servitude details;
- Property appraisal standards and Uniform Relocation Act compliance; and,
- Clarify where CPRA would implement versus property owner.

Combinations of the mitigation and stewardship measures will be implemented in each of the affected communities as explained below. CPRA has taken a different approach to the mitigation and stewardship measures in Myrtle Grove than in the other affected communities. This is due to several factors. First, the drainage and road systems are principally different in Myrtle Grove than the other communities, such that drainage and road systems in Myrtle Grove are the low points (below mean water level) where water is collected and then drained via a pump station. In general, road systems of the other communities are the high points and designed to drain by gravity directly toward the closest receiving body (e.g., ditch, bayou, canal, or marshland). Second, Myrtle Grove is closest to the diversion outfall and is projected to experience the greatest change in water levels due to Project operations. Third, the existing layout of a continuous bulkhead/berm system around the Myrtle Grove Marina Estates Subdivision forms the primary barrier against flooding of the public access roads, property, road and utilities serving the community. Thus, improving the elevation of the existing bulkhead in Myrtle Grove will provide benefits to the entire community. Other communities have unique

layouts and variable construction and topographic differences that arise at the individual parcel scale. As such, comprehensive road improvements and offering compensation through Project Servitudes best allows individuals to make their own, necessary flood adaption improvements.

Also, CPRA is not proposing any tidal flooding mitigation in Lafitte as part of this Mitigation Plan. In the vicinity of Lafitte, there are two polders (Lower Lafitte and Goose Bayou) that are projected to experience an increase in water level with the Project (less than or equal to 0.5 ft). Impacts to properties in these areas are not projected to occur during the early years of the Project, but impacts are projected to occur in later years if no flood protection improvements were implemented. See Figures 18, 21 and 24 in Appendix P, Part P2 of the EIS. To prevent flood impacts due to the Project, CPRA is facilitating the funding and providing technical support to the Lafitte Independent Levee District to advance the construction (advertisement for construction bids are scheduled for late 2022) of tidal flood protection (elevation ~ 7.5 ft) for both polders.[10] These Projects would be completed prior to the operation of the Project.

- *Myrtle Grove*.

  CPRA will implement the following mitigation and stewardship measures (as explained above) in the Myrtle Grove Marina Estates Subdivision prior to initiating operation of the Project:

  - Improving/replacing boat docks, and boat houses;
  - Improving/replacing bulkheads; and
  - Voluntary individual buyouts.

  By raising the bulkhead around the Myrtle Grove Marina Estates Subdivision, CPRA will reduce the number of days that properties in Myrtle Grove Marina Estates Subdivision experience tidal flooding compared to the No Action Alternative. Boat docks and boat houses will be improved or replaced to maintain functionality with the increases in water surface elevation.

  For any improvements constructed by CPRA, CPRA will obtain the necessary permits prior to initiating construction. For purposes of Section 404 of the CWA (33 USC 1344), CPRA expects that it will be able to permit these measures using one or more regional general permits or nationwide permits. These permits may require additional consultation(s) (e.g., NHPA Section 106, ESA, EFH) if triggered by their conditions. They may also trigger additional mitigation, which CPRA will complete as part of implementing the measure. CPRA will complete construction or other implementation (for measures not requiring construction) of these measures prior to initiating operation of the Project.

[10] Goose Bayou (Penn Levee, BA-0223) is currently identified in the Draft Fiscal Year 2023 Annual Plan (https://coastal.la.gov/wp-content/uploads/2022/01/AP-FY-23.pdf). Funding allocation for the Lower Lafitte polder is under coordination as of Jan 2022.

- *Woodpark, Suzie Bayou, Deer Range, Lake Hermitage, Happy Jack, and Grand Bayou.*

  CPRA will implement the following mitigation and stewardship measures in Woodpark, Suzie Bayou, Deer Range, Lake Hermitage, Happy Jack, and Grand Bayou prior to initiating operation of the Project:

  - Providing funds to property owners to improve/replace their boat docks and boat houses;
  - Improving/raising access roads;
  - Improving/replacing septic/sewerage systems;
  - Providing Project servitudes;
  - Providing funds to property owners to elevate their residences; and
  - Voluntary individual buyouts.

  By raising the access roads into each of these communities, CPRA will reduce the number of days that properties in these communities would not have access compared to the No Action Alternative conditions and improve access for emergency services (e.g., police and fire). Also, by funding the elevation of homes whose living areas is currently below the PIWSE, CPRA will reduce the incidence of damages to residences within these communities compared to the No Action conditions. Similarly, by improving/replacing the sewerage systems to address increases in water surface elevation, CPRA will improve water quality in the Basin compared to No Action conditions. CPRA would not elevate the lots or bulkheads within these communities, and instead would compensate landowners through a Project Servitude. Compensation paid to property owners may be used for flood adaptation improvements to their properties.

  For any improvements constructed by CPRA, CPRA will obtain the necessary permits prior to initiating construction. For purposes of Section 404 of the CWA (33 USC 1344), CPRA expects that it will be able to permit these measures using one or more regional general permits or nationwide permits. These permits may require additional consultation(s) (e.g., NHPA Section 106, ESA, EFH) if triggered by their conditions. They may also trigger additional mitigation, which CPRA will complete as part of implementing the measure. CPRA will complete construction or other implementation (for measures not requiring construction) of these measures prior to initiating operation of the Project. In the case of home elevations, the property owner will be expected to obtain any necessary permits and complete the improvements.

- *Additional Measures for Grand Bayou.*

  CPRA engaged in direct outreach with leaders of the community of Grand Bayou to identify additional specific mitigation and stewardship measures that support the community. Based on the results of that outreach, CPRA added additional mitigation and stewardship measures for Grand Bayou, including:

- Floating gardens;
- Community connecting sidewalks; and
- Backfilling and ridge restoration project (project funded for E&D through NFWF and CPRA; CPRA has received funding for construction).

More details regarding these mitigation and stewardship measures are set forth in Section 6.3.8 below.

6.3.3. Aquatic/Fisheries Impacts

Impacts to Oysters and Oyster Fisheries. The oyster resources within the Basin are projected to see declines in both the No Action Alternative and the Project related to loss of habitat primarily driven by changes in the estuary's salinity structure. The oyster fishery is expected to experience major, permanent, adverse impacts sooner under the Project relative to the No Action Alternative, primarily driven by Project-related reductions in salinity within the Basin. This determination considers expected impacts on oyster abundance as well as the anticipated response from commercial fishers. The potential impacts of fecal coliform contamination from introduced Mississippi River water could also have a major, adverse impact on beneficial uses related to oyster harvest. However, Project-related changes in the salinity structure within the lower Basin may also allow for re-habilitation of historic oyster growing areas that are currently non-supportive and may help mitigate impacts to other areas. Because these areas would be located further away from the Project outfall area than current oyster seed grounds, they would also be less susceptible to fecal coliform impacts.

Mitigation. CPRA will implement measures to both mitigate for the loss of oyster habitat within the Basin as well as the potential impacts to the oyster fishery within the Basin, including potential water quality impacts that could restrict oyster harvest. Any potential mitigation to the oyster resource is of benefit to the oyster industry and is expected to mitigate for the potential effects of the Project. Furthermore, given the dynamic conditions of any estuarine system, and the uncertainty around future conditions, some of the mitigation measures will rely on data from the MAM Plan to appropriately site and scale the measure based on post-operational conditions.

CPRA will implement the stewardship measures listed below for impacts to oysters. As the EIS identified the potential for the Project to result in disproportionate impacts to some low income and minority commercial oyster fishers, CPRA is developing options to tailor these measures to ensure they reach those populations. This is further discussed in Section 6.3.8 below.

- *Establish New Public Seed Ground in Lower Barataria Basin*
  Currently there are three public oyster areas within the Barataria Basin, the Hackberry Bay Seed Reservation and the Little Lake and Barataria Bay Seed Grounds. Given the current salinity regime, only the Hackberry area experiences oyster recruitment and growth on a recurring basis with some years showing no production due to suppressed salinities. The Little Lake Seed Ground salinities are too low except during significant periods of drought, and the Barataria Bay Seed Ground salinities are elevated to a degree

that promotes deleterious impacts from disease and predation. Predictive modeling indicates that conditions within the Hackberry seed ground may be impacted such that the POSR may not consistently support commercially viable populations of oysters in the future with Project operations. Conversely, modifications to the salinity regime of the lower Basin may allow for reestablishment of oyster recruitment and growth within the historically fished areas of the lower Basin. This mitigation measure would address the loss of a public oyster area with the potential establishment of a new area in the lower Basin if future conditions allowed. While modeling indicated that this new area will likely be in the Southwest quadrant of the Basin, post-operational monitoring is necessary to determine the best location. Therefore, the MAM Plan will include that after evaluation of the Hackberry area post initial Project operation, and with a favorable evaluation of lower Basin salinities and fecal coliform contamination, a new Public Seed Ground (or reservation) will be established on the state-owned water-bottoms within the Barataria Basin. This will include either the relocation of native cultch materials or the provision of new cultch material to establish the oyster beds.

This public seed ground will be established after operations have occurred for a sufficient length of time, considering initiation of operations, river flows in initial years of operations and other factors necessary to collect sufficient monitoring data to establish a reasonable baseline for the revised salinity regime in the basin. If no suitable conditions are found in lower Barataria Basin, this public seed ground would be sited in the nearest suitable area, with input from oyster fishers and oyster industry representatives.

The Louisiana Department of Wildlife and Fisheries will be the lead agency for siting and construction of this seed ground and will include oyster fishers in the construction, if possible. Oyster shell or other native materials will be used for establishing the seed grounds, if available. Total cost for this mitigation action is estimated at $4,000,000.

- *Enhance Public and Private Oyster Grounds*. This program will have three primary components:

    - Cultch or spat/shell will be used to enhance public areas adjacent to Barataria Basin (Terrebonne, Pontchartrain and/or Breton Sound basins) prior to and after commencement of diversion operations.
    - For 10 years after Project operations commence, or until funds are expended, affected state leaseholders will be reimbursed for cultch or spat/shell used to rehabilitate leases in the lower Barataria Basin both prior to and after the commencement of diversion operations.
    - Affected state leaseholders will be reimbursed for cultch or spat/shell placed on new leases within Barataria Basin or in other suitable areas prior to and after the commencement of diversion operations.

Oyster fishers will be used to support bedding and transplanting efforts on public grounds. Eligibility in this program will be based on trip tickets from Barataria Basin,

other supporting documentation, state issued lease ownership and considerations of equity based on level of impact. A portion of the funding from this program will initially be reserved for oyster fishers who are part of an identified community with environmental justice concerns that may be disproportionately impacted by the Project (see discussion under Section 6.3.8 below). This program will commence prior to the commencement of diversion operations and continue after operations commence. Total cost for this mitigation action is estimated at $15,000,000.

- *Create or Enhance Broodstock Reefs*
  Historically, Louisiana estuaries have had an adequate supply of oyster larvae to replenish reefs that were impacted by natural and anthropogenic events. However, modification to the estuaries altered hydrology in ways that have isolated oyster subpopulations. To mitigate for potential future adverse changes in hydrology, circulation, and overall habitat from the MBSD Project, broodstock reefs will be used to provide a larval supply to areas either separated hydrologically, or located in a salinity regime that does not result in an annual recruitment event. Through monitoring under the MAM Plan, hydrologic data will be assessed to understand the salinity regime within the Basin after Project operations commence, and density and abundance estimates of the Basin oyster resource will be used to determine the need for and potential location of these broodstock reefs. Broodstock reefs will be established after operations have occurred for a sufficient length of time, river flows in initial years of operations and other factors necessary to collect sufficient monitoring data to establish a reasonable baseline for the revised salinity regime in the basin. These reefs will be located, where possible, in shallow or intertidal areas to enhance that resource as well as protect new reefs from predators. The Louisiana Department of Wildlife and Fisheries will lead this effort and will utilize Barataria Basin oyster fishers for placement of reefs, using trip-tickets and other evidence for eligibility. Cost of this program is estimated at $4,000,000.

- *Alternative Oyster Aquaculture*
  To adjust to changing coastal conditions new techniques will be initiated or expanded to assist the oyster industry in remaining sustainable into the future. One such technique is the use of alternative oyster culture (AOC) opportunities. This technique allows for the cultivation of oysters while taking into account the possibility of natural and anthropogenic changes to an estuary. In Louisiana, the technique most often associated as alternative culture is that of "off-bottom" culture.

  Off-bottom culture of oysters is done within floating or suspended containers that provide protection from predation and siltation as well as the give the operator ability to move to different growing areas in response to episodic events or longer-term changes in salinity.

  The State of Louisiana recognizes AOC as an area of the oyster industry that can help diversify the oyster industry and add a level of sustainability as the industry adjusts to a changing coast. Specifically, to best mitigate the potential effects of the MBSD Project

on the oyster fishery within the Barataria Basin, specific components of an AOC Program will include some or all of the following:

1. *Introduction and Training*
   Establish a training program and information exchange for oyster industry members interested in transitioning/entering AOC activities. This program would introduce industry members to the tools, techniques, laws, and other necessary information necessary to participate in the AOC sector.
2. *Startup Assistance*
   Small grants would be made available to procure equipment necessary to enter the AOC alternative oyster aquaculture industry, including seed oyster production.
3. *Hatchery establishment/enhancement*
   Grants would be provided for establishing or enhancing hatcheries to provide a consistent seed supply for establishing and maintaining a robust AOC growing community.
4. *Designated Use Areas*
   The State recognizes that siting and permitting may be a barrier to entry in alternative oyster culture. Under this strategy, areas on state-water bottoms would be designated specifically for use by oyster growers engaged in AOC and permitted as such by the State. While it would be the intent to locate these areas within the impacted Basin, future conditions will dictate the availability and location. Site selection may also include locations in adjacent Basins with suitable conditions.

Funds under this program would be available prior to the diversion commencing operations. A portion of the funding from this program will initially be reserved for fishers who are part of an identified community with environmental justice concerns that may be disproportionately impacted by the Project. See discussion in Section 6.3.8 below for details on this reservation program. The cost of this program is estimated at $8,000,000.

- *Marketing*
  The State, through the Louisiana Department of Wildlife and Fisheries, working with guidance from the Louisiana Oyster Task Force, will assist in the marketing needs of oyster fishers in the Barataria Basin. Funds for this marketing program will be available prior to the diversion commencing operations. The total cost for this program is $1,000,000.

Impacts to Finfish Fisheries. Impacts assessed as a result of the Project vary between species. However, with the exception of flounder and spotted seatrout, the Project is predicted to have negligible impacts on the vast majority of commercially important fishes and in many cases trend to positive impacts. While the overall Project impact to the saltwater commercial finfish industry is anticipated to be small, the State will nevertheless enhance marketing efforts intended to

address any impacts. This enhanced marketing effort will also help to mitigate effects in other fisheries as fishermen may choose to switch to saltwater and freshwater finfish after operation of the Project.

Mitigation.

- *Marketing*
  The finfish industry has long realized that effective marketing is invaluable to the adaptability and sustainability of the industry. Historically, the finfish industry has utilized marketing to aid in the exploitation of new resources adjusting to changes along Louisiana's coast. The State, through the Louisiana Department of Wildlife and Fisheries, working with guidance from the Louisiana Finfish Task Force, will assist in the marketing needs of fisheries impacted in the Barataria Basin as well as to help transition to other species if abundance patterns change. Funds for this marketing program will be available prior to the diversion commencing operations. The cost of this program is $1,000,000.

Impacts to Crab Fishery. The Project is not anticipated to negatively impact Louisiana's crab fishery. Project operations are projected to benefit blue crab resources. Nevertheless, the State will offer two forms of stewardship to support the crab fishery.

Stewardship Measures.

- *Marketing*
  The State, through the Louisiana Department of Wildlife and Fisheries, working with guidance from the Louisiana Crab Task Force, will assist in the marketing needs of blue crab fishers in the Barataria Basin. Funds for this marketing program will be available prior to the diversion commencing operations.

- *Gear Funding*
  The State will make funds available for improvements to crab fishing gear through a grant program to be administered by the Louisiana Department of Wildlife and Fisheries, the Louisiana's Seafood Future Program, and industry partners. Eligibility requirements for this program will require use within the project area and may include information from trip tickets and vessel licenses.

  The total cost for both elements of this program is $1,000,000.

Impacts to Shrimp Fishery. The Project is projected to have a major, adverse permanent impact on the brown shrimp resource and a negligible to minor beneficial permanent impact on the white shrimp resource. Together these two species account for almost all of the shrimp landed from the Project Area. Given the resultant impacts to the individual species, and the reliance of fishermen on both species, the EIS concludes that the overall Project effect determination is a moderate to major permanent adverse impact to the commercial shrimp fishery. This is largely

driven by the predicted reduction in brown shrimp abundance and uncertainty around the offset of increased white shrimp production.

Mitigation. Proposed mitigation strategies for shrimp are directed at the fishery rather than the resource. As the EIS identified the potential for the Project to result in disproportionate impacts to some low income and minority shrimp fishers, CPRA will implement measures to ensure they reach communities with environmental justice concerns that may be disproportionately impacted by the Project. This is further discussed in Section 6.3.8 below.

- *Vessel/Facility Improvements*
  The analysis in the Final EIS projects that the brown shrimp distribution pattern will likely shift down basin, and overall abundance may be reduced. When discussing how the industry might best adjust to coastal change and restoration projects (LSF 2019) vessel and gear modifications were repeatedly mentioned as strategy to help mitigate those changes. Equipping a vessel with new assets such as refrigeration can both extend the time the vessel can transit to and remain on the fishing grounds (or fish new areas) or allow for a better-quality product that results in a higher price. In addition, changing gear types on existing vessels (for example, from skimmer to trawl), or using substitute gears that increase efficiency and lower overall operating costs (for example, from nylon trawl to spectra trawl), would help mitigate impacts of the Project to shrimpers. Several commenters on the Draft EIS also noted that updates and improvements to dock facilities would provide significant benefits to the overall shrimp industry.

  The State will make funds available for these types of improvements through a grant program to be administered by the Louisiana Department of Wildlife and Fisheries, the Louisiana's Seafood Future Program, and industry partners. The grant program will be available for vessel improvements (such as refrigeration or gear improvements), to help fund acquisition of new vessels, or to update and improve dockside facilities. Eligibility requirements for this program will require use within the project area and may include information from trip tickets and vessel licenses, with a goal of equitably apportioning grants to address potential impacts. A portion of this funding will be initially reserved for fishers who are part of an identified community with environmental justice concerns that may be disproportionately impacted by the Project. (See Section 6.3.8 below.) Additionally, to help address access issues to the mitigation programs, a portion of the funding will be reserved to assist fishers and dock owners with the application process. Funds for this initiative will be available before and after diversion operations commence for up to 10 years or until the funds are expended. The cost of this program is anticipated to be $15,000,000.

- *Marketing*
  The Louisiana Shrimp Industry routinely describes marketing as the one of the primary needs for the industry. Competition from imports suppresses domestic shrimp demand and price and places an overwhelming stress on the industry. To mitigate for additional stresses potential changes in brown shrimp abundance may have, marketing would be

used to help increase market-share of domestic shrimp. Specific targets could include marketing of the Barataria white shrimp resource similar to the success had in other estuaries of Louisiana (see Vermilion Bay). This program will be administered by the Louisiana Department of Wildlife and Fisheries with guidance from the Shrimp Task Force. The cost of this program is anticipated to be $2,000,000.

- *Assistance with Federal Considerations*
  Several Draft EIS commenters noted that some of the restrictions imposed by NOAA/NMFS, for example, the Federal Shrimp Permit Moratorium, and the shrimp trade imbalance, negatively impact Louisiana shrimpers' ability to compete in the marketplace. The State will work with NOAA/NMFS on the upcoming review of the Federal Shrimp Permit Moratorium, as well as in other ongoing efforts, to ensure Louisiana shrimpers' perspectives are factored into the decision-making process.

Overall Fisheries Mitigation.

- *Workforce and Business Training*
  A common mitigation strategy mentioned within various sectors of the commercial fishing industry is workforce training. Under several survey activities workforce training and business training are listed as ways to either transition into new employment or enhance revenue within current employment, respectively. The State, working through the Louisiana Economic Development, the Louisiana Workforce Commission, local colleges, trade schools and other partners, will develop a workforce and business training program to provide business training to enhance current business operations and provide training in new skills for individuals that want to transition to new employment opportunities. This training would be made available to qualified participants[11] within the commercial fishing industry. A portion of this program would be reserved for fishers who are part of an identified community with environmental justice concerns that may be disproportionately impacted by the Project. The funds under this program would be available before diversion operations commence. The total cost of this program is anticipated at $2,000,000.

- *Subsistence Fishing Access*
  There are a number of subsistence fishers that access the Project Area. While impacts on subsistence fishing resources are not anticipated to be significant, the State will provide funding to enhance subsistence fishing opportunities. Funds in this program will be used to increase shore-based subsistence fishing in both Barataria Basin and along the Mississippi River prior to initiation of Project operations. Funds in this program may also be used to improve boat launch access. These funds will be used in Plaquemines Parish, and the program will be administered jointly by Plaquemines Parish and the state prior to the initiation of Project operation. The total cost of this program is anticipated at

[11] For purposes of this program, qualified participants would include fishers who are able to demonstrate a recent history of fishing in Barataria Basin through trip ticket data.

$1,000,000. Details regarding implementation of this measure are set forth in Section 6.3.8 below.

- *Project Operational Considerations*
  Initial operations of the project will be closely monitored to assess changes within the Barataria Basin system. Data from these initial operations, along with consultations with experts and fishers, will allow the State to refine and optimize project operations to achieve project success while minimizing impacts where practical.

- *Enhanced Resource Sampling*
  The State will continue the enhanced sampling effort put into place to characterize the baseline condition of the Barataria Basin as well as enhance monitoring to assess project-related changes. Information from this enhanced sampling effort will then be used to inform Project operational strategies that will meet project success objectives while minimizing impacts where practical.

Implementation of Aquatic Stewardship Measures. Table 2 below summarizes the various fisheries mitigation and stewardship measures that will be implemented as part of the Project. Where available, information is included as to timing, duration, potential linkages to existing programs, anticipated amounts and the entity(ies) associated with the day-to-day implementation of the activity. CPRA is also outreaching to the fishing community through a survey (similar to the survey used for to solicit feedback on the mitigation proposed for tidal flooding impacts, see discussion in Section 6.3.2 (Public Input on Mitigation Measures)) to request their input on the details and implementation of these fisheries measures. The results of those surveys may lead to refinements to these measures, but the general categories of measures and total funding allocation will remain as set forth herein. CPRA will continue to advance the implementation details for each measure.

Table 2.

Measure	*Location*	*Implemen-tation Period*	*Program Status*	*Project Associated Funding*	*Implementing Entity*
Establishment of Reefs within Public Seed Grounds	Barataria Basin or adjacent areas identified by industry	Operation	New	$4,000,000	LDWF
Enhance Public and Private Oyster Grounds	Barataria/ Outside	Construction/ Pre-operation	New program adapted from previous programs	$15,000,000	LDWF

Create or Enhance Broodstock Reefs	Barataria	Operation	New program but companion to NRDA program	$4,000,000	LDWF
Alternative Oyster Culture (AOC) *Introduction and Training*	Barataria/ Outside	Pre-operation and Operations	New program building off existing statewide effort	$8,000,000	Louisiana Seafood Future
Alternative Oyster Culture (AOC) *Startup Assistance,*	Barataria/ Outside	Pre-operation and Operations	New program building off existing statewide effort		Louisiana Seafood Future
Alternative Oyster Culture (AOC) *Designated Use Areas*	Barataria/ Outside	Pre-operation and Operation	New program building off existing statewide effort		Louisiana Seafood Future
Marketing to Support the Oyster Industry	Industry	Pre-operation and Operation	New Program informed by industry	$1,000,000	Louisiana Seafood Future
Marketing to Support the Finfish Industry	Industry	Pre-operation and Operation	New Program informed by industry	$1,000,000	Louisiana Seafood Future
Marketing and Gear Improvements to Support the Crab Industry	Industry	Pre-operation and Operation		$1,000,000	Louisiana Seafood Future; LDWF
Grant Program for Shrimp Vessel/Facility Improvements	Basin/ Industry	Pre-operation and Operation	New, based on previous successful programs	$15,000,000	Louisiana Seafood Future
Marketing to Support the Louisiana Shrimp Industry	Industry	Pre-operation and Operation	New Program informed by industry	$2,000,000	Louisiana Seafood Future

Subsistence Fishing	Basin and River	Pre-Operation	New Program with stakeholder input	$1,000,000	CPRA
Workforce and Business Training for Commercial Fishers	Basin/ Industry	Pre-operation	New	$2,000,000	TBD

The funds identified above will be fully committed for these measures to address Project related impacts. To the extent the dollars identified for a particular measure are not used by that measure, they will be reassigned to another measure.

To extent these measures will be implemented by an agency other than CPRA, CPRA will enter into a contract with the implementing agency specifying the implementation plan, including the schedule, duration and funding for the measure. CPRA has an established history of such arrangements for other programs (e.g., agreement with LDWF for implementation of Oyster Strategic Restoration and Rehabilitation Plan (OSRRP)).

6.3.4. ESA-Listed Species

Impacts. Impacts to ESA-listed species from construction and operations of the Project are described in detail in the Biological Assessment and in the Draft EIS Chapter 4 Section 4.12. Formal consultation with FWS and NMFS resulted in issuance of two separate Biological Opinions, one from each agency.

Effects determination for six of the ten listed species and designated critical habitat are *Not Likely to Adversely Affect* or *No Effect.* Effect determinations for the remaining four species (pallid sturgeon, green sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle) are *Likely to Adversely Affect* and include:

(1) Minor adverse impacts to pallid sturgeon from underwater noise associated with pile driving in the river during construction.
(2) Minor to moderate impacts to pallid sturgeon due to loss of individuals through entrainment by the diversion structure during operations.
(3) Minor adverse impacts to green, Kemp's ridley, and loggerhead sea turtles due to reductions in certain prey species and increased negative interactions with commercial shrimp fishing due to the spatial shift in shrimp fishing effort due to the Project.

Conditions and Recommendations. The Biological Opinions include Reasonable and Prudent Measures (RPMs) and Terms and Conditions (T&Cs) to avoid and minimize effects to listed species and designated critical habitat. CPRA anticipates that those RPMs and T&Cs will be conditions of any Corps permit or LA TIG funding decision and will undertake the RPMs and

implement the T&Cs identified in the Services' Biological Opinions for the Project. If those Biological Opinions are modified in the future through re-initiation of consultation, any modified RPMs and T&Cs shall automatically supersede those RPMs and T&Cs included in the Biological Opinions referenced herein.

6.3.5. Non-ESA Listed Fish and Wildlife

Impacts. The MBSD Project anticipates benefiting the Barataria Basin with a basin wide net increase of 12,684 marsh acres and near field (e.g., close proximity to the outfall) increase of 13,151 marsh acres (3,848 Average Annual Habitat Units (AAHUs)) over the 50-year period of analysis. The near field area (13,151 acres) focuses on a smaller lower-salinity portion of the basin (primarily an area of wetland gain) near the diversion outfall. The larger basin benefits (12,684 net acres) include the lower basin brackish and saline marsh losses, which offsets some of the fresh/intermediate gains seen in the diversion outfall area resulting in an overall smaller net wetland gain across the basin than when compared to the near field area alone.

The Project would directly impact 193.1 acres of jurisdictional wetlands and 225 acres of vegetated shallows (SAV) and other waters of the U.S. Of the 193.1 acres (-102 AAHUs) of total permanent direct wetland impacts, 26.1 acres (-14.9 AAHUs) are of bottomland hardwood forest, 163.4 acres (-66.9 AAHUs) are of wet pasture, and 3.6 acres (-20.3 AAHUs) are of scrub/shrub. The Project is expected to benefit (nourish and restore) 13,151 acres (3,848 AAHUs) of marsh in the Barataria Basin. Project benefits of wetland creation and nourishment offset the permanent loss in existing wetland function from Project construction.

Because sediments, freshwater, and nutrients transported by the Mississippi River would be diverted up river from the Birdfoot Delta of the Mississippi River, the Birdfoot Delta would experience an additional projected indirect loss of 2,891 acres of wetlands by 2070 when compared to the No Action Alternative. Changes in land area in the Birdfoot Delta between the Applicant's Preferred Alternative and the No Action Alternative would be relatively minor (3 to 6 percent in operational years 2030 to 2060). The expected total project benefits would far outweigh the indirect negative impacts to the Birdfoot Delta. However, of the loss to the Birdfoot Delta, 926 acres of marsh is projected to be lost in the Delta NWR and 37 acres on the PAL WMA because of the reduced sediment being delivered to the area.

See also the Fish and Wildlife Coordination Act recommendations set forth in Section 4.6 above, which are fully incorporated here.

6.3.6. Marine Mammals

Impacts to Bottlenose Dolphins. Impacts on the Barataria Bay Estuarine System (BBES) stock under the Project action alternatives include: (1) immediate and permanent, major, adverse impacts on survival from low salinity throughout the BBES stock area; (2) adverse effects on health and reproduction from multiple stressors including low salinity exposure, wetland loss in the BBES stock area (also occurring under the No Action Alternative), lower temperatures, an increased risk of HABs, and the residual effects from the DWH oil spill; and (3) based on the

estimated decreases in survival rates, there may be a substantial reduction in population numbers. Thus, the Project is projected to have permanent, major, adverse impacts on BBES dolphins. The measures noted below will be implemented by NOAA and partners on behalf of CPRA in recognition of the anticipated impacts to bottlenose dolphins.

Operational Minimization Measures. CPRA will examine operational strategies to minimize, to the extent practicable and consistent with the purposes of the Project, the Project's impacts on bottlenose dolphins. Given the dynamic conditions of any estuarine system, and the uncertainty around future conditions, the minimization measures will rely on the MBSD MAM Plan to inform future implementation.

State-wide Stewardship Measures. CPRA will also support non-operational stewardship measures to reduce existing and future threats to Bay/Sound Estuary (BSE) and coastal dolphin stocks throughout and adjacent to Louisiana coastal waters. While these measures may not minimize impacts from the Project on BBES dolphins, they could enhance individual dolphin survival from other anthropogenic stressors. These measures will also improve understanding and management of Louisiana dolphins.

- *Statewide Stranding Program*
  A statewide stranding program for a 20-year period to begin immediately following current funding expiration in 2026 will be provided. Stranding response in Louisiana would improve the survival and health outcomes of marine mammal populations injured by the DWH spill, especially coastal and estuarine stocks of bottlenose dolphins. Enabling a more rapid response to a live stranded cetacean will increase that animal's chance of survival by reducing the time spent on the beach, reducing stress on the animal, providing rapid treatment and, if appropriate, transport to an authorized rehabilitation facility for additional treatment and care. In addition, this program will increase the quality and quantity of data that can be collected from dead stranded cetaceans, by decreasing decomposition time on the beach and ensuring that fresher carcasses are recovered for necropsy. This will improve the ability to diagnose causes of illness and death in cetaceans to better understand natural and anthropogenic threats, which will inform restoration planning, monitoring and adaptive management.

- *Human Interaction/Anthropogenic Stressor Reduction*
  CPRA will reduce existing and future stressors to bottlenose dolphins statewide, including within Barataria Bay, in several ways:
  - Reduce bottlenose dolphin mortalities from rod and reel fishing gear,
  - Reduce intentional injury and mortality (e.g., shooting) to bottlenose dolphins,
  - Reduce illegal feeding of bottlenose dolphins, and
  - Evaluate the potential impacts of noise, vessels, and other direct threats to identify and implement stewardship measures designed to address these threats.

- *Contingency Fund for Stranding Surge, Unusual Mortality Events (UME), or Episodic Mortality Event Response*

  As described in the FEIS, survival rates of BBES dolphins are likely to be greatly reduced upon operation of the Project. To respond to the expected increase in dolphin strandings, CPRA will establish funds for stranding surge capacity in Barataria Basin. The national UME Contingency Fund is extremely limited and is used to respond and investigate UMEs nationally. Additional funds for a Barataria Basin Stranding Surge, UME, or Episodic Mortality Event Response will be made available upon onset of operations for immediate use in or be reimbursable to the stranding network.

6.3.7. Essential Fish Habitat

Impacts. Impacts to EFH as managed under the Magnuson-Stevens Act from construction and operations of the Project are described in detail in the Essential Fish Habitat Assessment and in the Final EIS Chapter 4 Section 4.10.3.3 and Section 4.10.4.3. Impact to EFH and managed species include:

(1) Temporary to permanent, negligible to minor impacts from construction due to structure placement, dredging, and turbidity and sedimentation.
(2) Major beneficial changes from conversion of more ubiquitous soft bottom habitats to higher value submerged aquatic vegetation and marsh habitats within Barataria Basin.
(3) Moderate adverse impacts in the birdfoot delta from loss of marsh habitat.
(4) Minor adverse impacts on reef fish from changes in prey species (gray snapper) and salinity and nursery habitat (lane snapper).
(5) Major adverse impacts to brown shrimp and oysters from decreased salinities.

Conservation Recommendations. Formal consultation on EFH with NMFS resulted in the identification of the following EFH Conservation Recommendations:

(1) The MAMP should clearly identify variables and conditions to be monitored and describe the monitoring protocols. The MAMP should also identify specific management alternatives including, but not limited to alternate flow rate, frequency, timing and duration, and an effective decision making regime to modify project management if monitoring and subsequent analyses indicate diversion operations are not providing the desired outputs, or are causing unexpected or unwanted effects to resources of concern.
(2) CPRA should continue investment in ecosystem and individual species models development and refinement for their use in comparing alternatives in the MAMP.

These measures have been included in the MAMP for the Project, Appendix R2 to the Final EIS.

6.3.8. Environmental Justice

Impacts. Impacts to Environmental Justice populations from the Project are described in detail in Chapter 4 Section 4.15 of the Final EIS, and briefly summarized below.

Construction Impacts

The Project is projected to have minor to moderate adverse construction-based impacts during the approximately 5-year construction period on properties in the immediate vicinity (about 0.5 mile) of the construction footprint, including portions of the community of Ironton, which is predominantly (97%) African American. This includes impacts to air (construction dust), noise (pile driving), and land-based transportation (traffic congestion from construction trucks/vehicles and construction worker vehicles).

Operations Impacts

The Project is projected to have minor to major impacts on populations near the Project immediate outfall area (within 10 miles to the north and 20 miles to the south) outside of levee protection due to increases in tidal flooding and storm hazards. These impacts may be disproportionately high and adverse for some communities with environmental justice concerns, including low income and minority populations, to the extent these populations are uniquely vulnerable to tidal flooding and storm hazards. The effects would be most pronounced within the first two decades of operation, after which time, impacts would be more minor as compared to the No Action Alternative. All tidal flooding impacts would be reduced to minor by 2070, when the dominant driver of tidal flooding would be relative sea-level rise.

The Project is also projected to adversely impact communities with environmental justice concerns, including low-income and minority populations engaged in commercial and subsistence fishing and dependent on adversely impacted fisheries in the Barataria Basin. These impacts may be disproportionately high and adverse depending on the degree of engagement and dependence by these populations on these fisheries.

Mitigation.

Consistent with CEQ's guidance regarding outreach and engagement to communities with environmental justice concerns[12], CPRA engaged in additional outreach to populations potentially impacted by the Project to seek their input on mitigation and stewardship measures. A summary of that outreach is included in Chapter 7 of the Final EIS. Based on CPRA's evaluation of the projected impacts of the Project, combined with the input received on the draft mitigation measures, CPRA has developed the following mitigation and stewardship measures to assist community members potentially affected by the Project.

[12] For purposes of the Mitigation Plan, the term "communities with environmental justice concerns" refers to communities overburdened by pollution as identified in Executive Order 12898 of February 11, 1994 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*). Those communities include communities of color, low-income communities, and Indigenous communities. The term also includes communities identified as "disadvantaged" from the Office of Management and Budget's interim implementation guidance for the Justice40 Initiative (July 20, 2021), available at https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf.

Construction Impacts

CPRA will implement a number of BMPs to minimize the construction based impacts, including:

A. ROAD CROSSINGS AND ACCESS POINTS
   i. Maintain safe and accessible conditions at all road crossings and access points during construction. Details regarding implementation of this measure will be coordinated with and approved by the Louisiana Department of Transportation. A copy of that plan will be appended to this Mitigation Plan when available.
   ii. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions.

B. DUST MANAGEMENT
   i. Water or chemical dust suppressants will be used to control dust released during land clearing and grading and on dirt roads and material stockpiles to minimize the release of dust.

In addition, recognizing the unique vulnerability of the Ironton community, CPRA will, prior to the start of construction, engage a community liaison whose position will include receiving and responding to concerns from Ironton community members regarding Project construction impacts. This will include access to CPRA, via means such as a telephone hotline, email address, etc., where Ironton community members will be able to directly contact CPRA's community liaison.

In addition, prior to the start of construction, CPRA will develop a Community Communications Plan to assist with communications with community members. It will include a plan for periodic meetings with representatives from the Ironton community, as well as a plan for disclosure of the upcoming construction schedule and anticipated construction activities during that period. A copy of that Plan will be appended to this Mitigation Plan when available prior to commencement of construction, and may be revised as appropriate throughout the construction process.

Operations Impacts

Subsistence and recreational fishing. To address identified potential for disproportionately high and adverse impacts to subsistence oyster and brown shrimp fishing, CPRA will provide public access opportunities within the Barataria Basin and Mississippi River Basin. This is intended to address effects on proximity of resources for both consumptive and non-consumptive use. These effects will be primarily addressed through the provision of public shoreline access and watercraft launching around the project area to assist recreational and subsistence fishing. No later than 24 months prior to the anticipated commencement of operations of the Project, CPRA will convene a community working group to identify preferred locations for these new access points. CPRA will invite community representatives to participate in this working group, and

will provide special outreach to individuals and communities that rely on fishing in the Basin for subsistence aimed at ensuring their participation. Based on the input received from this community working group, CPRA will identify and develop one or more additional public shoreline access points for fishing and/or boat launching.

Commercial fishing impacts. CPRA recognizes that certain individuals and communities with environmental justice concerns, including low income and minority populations, may experience unique vulnerabilities that may include difficulty switching to other industries due to economic challenges, age, educational or training background, and cultural or language barriers. These populations may also be less likely or able to relocate to other geographic areas for alternative employment opportunities due to economic or cultural reasons. Species substitution may require traveling long distances or investing in expensive new equipment, which adds costs that may be challenging for low-income and minority fishers.

In an effort to respond to these unique vulnerabilities, CPRA will reserve a portion of each of the following mitigation and stewardship programs for individuals from identified communities with environmental justice concerns that may be disproportionately impacted by the Project: shrimping vessel and gear improvement grants, enhancing public and private oyster seed grounds, Alternative Oyster Culture, and overall fisheries workforce and business training. CPRA will engage representatives from community-based non-profit organizations to assist in providing information to community members regarding available programs, to assist in developing eligibility criteria to utilize in approving program recipients, and to assist potential applicants in completing any application processes.

Following Project approval and funding and prior to Project operations, CPRA will implement an outreach plan targeting fishers from identified communities with environmental justice concerns to ensure they learn about and are able to access these programs. This plan will include:

1) coordination with local community organizations to advertise these programs and to assist fishers from identified communities with environmental justice concerns with completing the applications needed to participate in these programs; and
2) engaging an outreach coordinator to assist in implementation of the plan, including:
    a) targeted advertising,
    b) working with individual applicants to complete the application materials,
    c) follow-up with individuals to ensure they receive the benefits of the program,
    d) monitoring and reporting of the numbers of fishers identified from identified communities with environmental justice concerns who utilize the program, and
    e) the percentage of program resources that are utilized by fishers from identified communities with environmental justice concerns each year.

Water Level/Inundation Impacts. CPRA will provide mitigation for projected increases in water level and corresponding increases in tidal flooding as explained in Section 6.3.2 above. CPRA recognizes that low income and minority community members may experience unique vulnerabilities that make it more difficult to respond or adapt to Project impacts, such as residing in sub-standard housing, having limited access to information about emergencies and hazard

responses, as well as economic and social obstacles to relocating, finding housing, commuting to employment opportunities, or responding to environmental damage to homes and businesses.

In an effort to ensure that identified communities with environmental justice concerns affected by the projected water level increases are informed about and have an equal opportunity to access the benefits of the mitigation and stewardship programs, CPRA will engage an outreach coordinator to:

a) develop and implement targeted outreach,
b) inform impacted community members of available programs and resources,
c) work with individuals to assist them in pursuing benefits and completing the necessary materials,
d) follow-up with individuals who are selected for benefits to ensure that they receive the benefits of the programs,
e) monitor and report the number of community members who utilize the programs, and
f) the amount and percentage of program resources utilized annually.

CPRA intends to follow the Uniform Relocation Act when engaging with any property owner or tenant who requests to relocate due to concerns about the impacts of Project operations on water levels prior to Project operations.

In addition, CPRA recognizes that Grand Bayou is a unique tribal community with deep connections to the natural environment. It is the ancestral village of the Atakapas-Ishak/Chawasha Tribe, and most of the residents are members of the Tribe. CPRA engaged in direct outreach with leaders of the community of Grand Bayou Indian Village to identify specific mitigation and stewardship measures that support the community. Based on the results of that outreach, CPRA added additional mitigation and stewardship measures for Grand Bayou, including:

- Floating gardens (funded through NRDA)
    - Large, waterproof boxes designed to serve as a raised garden bed in close proximity to resident's home. Provides suitable planting ground for vegetables, plants, etc. that will float during flood season and prevent plant inundation.

- Community connecting sidewalks (funded through NRDA)
    - Raised boardwalks connecting residents' elevated homes, community center, boat launches, etc. that will serve similar function to sidewalks and provide improve pedestrian connectivity for residents of the Grand Bayou community. These raised pathways for walking will allow continued access and increase community walkability during flood season.

- Grand Bayou Canal backfilling and ridge restoration project (project funded for E&D and construction)
    - The project would restore wetlands and ridge habitat adjacent to the Grand Bayou Community through canal backfilling and ridge restoration. Plans include restoring wetland hydrology through canal backfilling and restoring approximately 50,000-linear feet of coastal upland habitat to provide wave and storm surge attenuation along Grand Bayou and Bayou Grand Cheniere, including for the Grand Bayou community. The ridge restoration component of this project is adjacent to the DWH Trustee funded Bayou Grand Cheniere Ridge and Marsh Restoration Project. See figure depicting the project features in Appendix C.

With regard to the backfilling and ridge restoration project (third bullet above), CPRA pursued and received grant funding from the National Fish and Wildlife Foundation (NFWF) through their National Coastal Resilience Fund to conduct preliminary design for this project. NWFW granted this funding request in November 2021. Numerous canals have been constructed over the years through the marsh around the Grand Bayou community. Canal backfilling has successfully been used in coastal Louisiana to return canal spoil banks into canals to mitigate damage caused by construction of the canals. This project would create or restore approximately 1,500 acres of wetlands and roughly 50,000 linear feet of habitat, restore natural hydrology, and provide wave and storm attenuation along Grand Bayou and Bayou Grand Cheniere. The CPRA will collaborate with representatives from the community of Grand Bayou in the planning and development of the project including site investigations (bathymetric, topographic, geotechnical, pipeline, and cultural resources surveys), preliminary design, and robust outreach. CPRA requested and received funding for construction of this project as part of its 2022/2023 Annual Plan.

Ironton is located behind the USACE NOV-NFL levee and, therefore, would not be impacted by changes in tidal flooding resulting from the Project. The Final EIS, however, states that negligible to minor increases in levee overtopping could affect the community of Ironton inside the NOV-NFL system. CPRA is not proposing specific mitigation to address or offset this negligible to minor increased risk because this potential increased risk does not accrue until Project operations have resulted in the development of a delta (wetlands and marsh) in the area outside the NOV-NFL levee adjacent to Ironton (circa 2040), and because this risk was identified for only one of the 100-year storm scenarios modeled. However, to help Ironton prepare for and mitigate flood risk from storms generally, CPRA will designate a liaison to work with residents in Ironton prior to commencing operations of the Project on community preparedness for storm-based flooding and damage.

Communications. As part of the above measures, CPRA will provide, at no cost to the requester, language services to ensure that individuals with limited English proficiency can meaningfully participate in CPRA's programs and activities, including those described above.

6.3.9. Cultural Resources

Impacts. Impacts to Cultural Resources from the Project are described in detail in Chapter 4 Section 4.23 of the Final EIS, and are briefly summarized below.

USACE determined, and consulting parties concurred, the Project will have an adverse effect on one (1) historic property in the Construction Impacts APE (Locus 1 within Site 16PL107), four (4) historic properties (archeological sites) eligible for the NRHP located within the Operational Impacts APE (Sites 16JE2, 16JE3, 16JE11, 16JE147), and one (1) additional archeological site in the Operational Impacts APE the eligibility of which has not been determined but which is being treated as NRHP eligible (Site 16JE237).

Examples of potential direct impacts on these historic properties during Project operations would include burial from sediment deposition and erosion resulting from changes in flow velocity. Given the large size and submerged nature of much of the Operational Impacts APE, as well as the multiple other processes affecting these submerged areas (such as subsidence, erosion, and channel dredging), it is not possible to fully separate the Project-caused impacts on historic properties from those impacts caused by subsidence, erosion and other processes unrelated to the Project, particularly over the 50-year analysis period in the EIS.

Mitigation. CPRA, USACE, federal agency members of the LA TIG, SHPO, federally-recognized Tribal Nations, and the ACHP consulted pursuant to Section 106 of the NHPA regarding the effects of the Project on historic properties in the APE. The consulting parties developed a Programmatic Agreement (PA) for the Project. With regard to Locus 1 of 16PL107 in the Project construction limits within the Construction Impacts APE, the consulting parties agreed that a treatment plan will be developed and appended to the PA.

For the Operational Impacts APE, the PA includes an alternative mitigation plan, agreed to by CPRA, to resolve adverse effects. That alternative mitigation plan includes a regional ethnohistory of Native American settlement in the southeastern coastal Louisiana region (Barataria Basin, Breton Sound Basin, and Pontchartrain Basin). The analysis conducted as part of the Alternative Mitigation Plan would include an examination of the archaeological record at the regional level as well as oral and archival sources. The plan would: (1) mitigate for the lack of cohesion among the archaeological record, scholarly literature on Native American history, and the available vital/archival records; (2) produce a series of documents and/or maps for participating Tribes to improve consultation with federal agencies in specific areas of Tribal interest within the alternative mitigation plan study area; and (3) make Tribal history available to the public online and in the classroom.

The PA also includes the agreed upon plan for monitoring Project impacts on cultural resources within the Operational Impacts APE which are included in the MAM Plan, as well as an unanticipated discoveries plan. The PA was executed by [*TBD*] concurrent with the Final EIS or Record of Decision (ROD) and is attached as Appendix A.

7. PLAN IMPLEMENTATION

7.1. Performance, Monitoring, Maintenance, and Adaptive Management

Evaluation metrics and implementation guidance and goals are identified in the MAM Plan, developed by the LA TIG. Performance evaluation metrics and parameters are also adopted for the Project to ensure that the Project is achieving its intended restoration benefits.

Such performance metrics and parameters will help determine if the Project and the related mitigation are achieving the overall objectives of the Project and this Plan. These standards are based on attributes that are objective and verifiable by field measurements and analysis. Data collection and analysis will be based on methods established and/or approved by CPRA using established best-practices.

The MAM Plan also identifies monitoring, maintenance, and adaptive management requirements to ensure that mitigation components and the Project restoration objectives are achieving the performance standards. Certain mitigation measures contained in the Mitigation Plan will be specifically contained within the MAMP. Once construction is underway, CPRA will be responsible for monitoring per the MAMP and implementation of any required mitigation.

If monitoring reports comparing progress on mitigation and stewardship measures to performance standards indicate progress for any USACE required mitigation is falling short of the identified performance standards, consultation with the USACE would be initiated regarding the need for adaptive management.

A table summarizing the mitigation and stewardship measures set forth herein is in Section 4.27 of the Final EIS.

8. FINANCIAL ASSURANCES

If the *Deepwater Horizon* Louisiana Trustee Implementation Group decides to fund the Project, each component of this Mitigation and Stewardship Plan will be funded as part of the LA TIG's funding decision unless otherwise specified.

APPENDIX A

NHPA Section 106 Programmatic Agreement

Placeholder pending final agreement

APPENDIX B

MBSD Construction Best Management Practices

CPRA Mississippi River Mid-Basin
Sediment Diversion Program

ENVIRONMENTAL PROTECTION PLANNING DOCUMENT FOR THE CONSTRUCTION OF MID-BARATARIA SEDIMENT DIVERSION

PREPARED BY: CPRA
PROJECT: Mid Barataria Sediment Diversion
DATE: February 4, 2022

PURPOSE AND SCOPE

This document provides a preliminary list of Best Management Practices (BMPs) that would be implemented during construction of the Mid Barataria Sediment Diversion. CPRA (or its Contractor's; hereafter referred to as CPRA) will implement each of these BMPs to the maximum extent practicable.

CPRA will develop an Environmental Protection Plan (EPP) that includes each of these BMPs and details, for each component of the environment, the procedures and measures for environmental protection during the construction of the project. Environmental protection is the prevention/control of pollution and habitat disruption that may occur during construction. The control of environmental pollution and damage requires consideration of air, water, land, biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive materials; and other pollutants.

CPRA shall provide as part of the EPP a list of all Federal, State and local environmental laws and regulations which apply to the construction operations. The Plan shall detail the action which the contractor shall take to comply with all applicable Federal, State and local laws and regulation concerning environmental protection and pollution control and abatement, as well as any additional specific requirements. The EPP would also delineate the required environmental monitoring plan for compliance of various environmental regulations.

The EPP will include an approved Spill Control Plan, Waste Management Plan, Contaminant Prevention Plan, and Environmental Inspection Plan. Other plans that will be developed and are related to environmental protection include: Site Safety and Health, Accident Prevention, Organization and Authority, and Personnel Training.

BMPs here are presented in the following sections: 1) Protection of Land Resources; 2) Protection of Wetlands and Water-based Resources; 3) Protection of Fish and Wildlife Resources, and 4) Protection of Cultural Resources.

SECTION 1: PROTECTION OF LAND RESOURCES

I. GEOGRAPHIC APPLICABILITY

The Protection of Land Resources applies to upland areas of the Project, which predominantly occur between the Mississippi River Levee (MRL) and existing NOV back levee(s). Wetland and waterbody features of the Mississippi River and Barataria Basin are addressed in the Wetland and Water Resources section.

II. ENVIRONMENTAL INSPECTION

A. CPRA will ensure that the number and experience of inspectors assigned to the Project shall be appropriate for the size of the construction area, the level of activity, and the number/significance of resources affected.

Inspectors are responsible for:

B. Inspecting construction activities for compliance with the requirements of the Environmental Protection specifications and plans, other environmental permits and approvals, and environmental requirements in landowner easement agreements;
C. Identifying, documenting, and overseeing corrective actions as necessary to bring an activity back into compliance;
D. Verifying that the limits of authorized construction work areas and locations of access roads are visibly marked before clearing, and maintained throughout construction;
E. Verifying the location of signs and highly visible flagging marking the boundary of sensitive resource areas (e.g., cultural resource sites);
F. Identifying erosion/sediment control and soil stabilization needs in all areas;
G. Ensuring that erosion control devices are properly installed and determining the need for additional erosion control devices;
H. Inspecting and ensuring the maintenance of temporary erosion control measures;
I. Ensuring the repair of ineffective temporary erosion control measures;
J. Verifying that dewatering activities are conducted according to the Storm Water Pollution Prevention Plan (SWPPP);
K. Ensure that temporary construction areas are returned to surrounding conditions;
L. Keeping records of on-site compliance with environmental protection specifications;
M. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase; and
N. Verifying accepted material disposal locations and practices.

III. PRECONSTRUCTION PLANNING

A. CONSTRUCTION WORK AREAS

i. All construction work areas will be identified (e.g., project construction boundary, temporary construction right-of-way, work space areas, material storage, contractor yards, borrow and disposal areas, and access roads) that would be needed for safe construction.
ii. The development of a Stormwater Pollution Prevention Plan (LAR100000 Storm Water Discharges from Construction Activities of 5 Acres or More; NPDES, LDEQ) will be developed during the preconstruction planning phase.

B. INTERIOR DRAINAGE SYSTEMS

i. CPRA will develop a *Maintenance of Drainage Plan* that will ensure that the existing level of drainage be maintained during Project construction in areas bounded by the MRL and existing NOV back levee(s).

C. ROAD CROSSINGS AND ACCESS POINTS

i. Plans will be developed for safe and accessible conditions at all roadway crossings and access points during construction and restoration.
ii. Project access points with ingress and egress to state highways will be approved by Louisiana Department of Transportation and Development (LDOTD).

D. DISPOSAL AND HAZARDOUS SUBSTANCES PLANNING

i. The methods and locations for the regular collection, containment, and disposal of excess construction materials and debris (e.g., timber, mats, garbage) throughout the construction process will be specified in a Waste Management Plan.
ii. For work activities (such as painting, metal finishing, etc.) that will involve bringing hazardous chemicals, hazardous substances or hazardous materials onto the project site, the Contaminant Prevention Plan will specify practices for hazard communication, safe storage, waste identification and disposal. Licensed contractors will be responsible for removing and disposing hazardous materials.

iii. For work activities that pose a risk of an oil or hazardous substance spill, a Spill Control Plan will include the procedures, instructions, and reports to be used in the event of an unforeseen spill, including:
    1. Party responsible for implementing and supervising the containment and cleanup;
    2. Training requirements of personnel and methods of accomplishing the training;
    3. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified;
    4. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency;
    5. The materials, methods, and procedures to be used for expeditious contaminant cleanup; and
    6. The reporting process of any spills or hazardous substance releases and who will follow up with complete documentation.

IV. CONSTRUCTION

A. APPROVED AREAS OF DISTURBANCE

i. Project-related ground disturbance shall be limited to the construction footprint. In the event temporary rights of way need to be established for construction (e.g., additional area or route), these will be subject to all applicable survey and permit requirements, and landowner easement agreements.

B. TOPSOIL

i. Topsoil will be stockpiled and re-incorporated into the levee or work areas to enhance vegetation establishment.

C. INTERIOR DRAINAGE SYSTEMS

i. The Maintenance of Drainage Plan will specify how flow collected from the existing drainage system affected by the construction of the project shall be collected and diverted into the existing or new operational downstream drainage system.
ii. The installation, maintenance, and operation of drainage will be designed to: 1) collect and dispose of all storm water entering

directly into the construction area, and 2) prevent flow in the downstream portion of the drainage system from backing into the work area.

iii. Monitoring of rain events and water levels in drainage ditches will be implemented.

D. ROAD CROSSINGS AND ACCESS POINTS

i. Maintain safe and accessible conditions at all road crossings and access points during construction.
ii. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions.

E. DUST MANAGEMENT

i. Water or chemical dust suppressants will be used to control dust released during land clearing and grading and on dirt roads and material stockpiles to minimize the release of dust

F. TEMPORARY EROSION CONTROL

CPRA will implement and pursue all measures required in the SWPPP to control soil erosion, and the resulting sediment, to the extent necessary, to prevent sediment from leaving the construction servitude and prevent pollution of any water body caused by the runoff from the areas of construction activities.

i. Erosion and Sediment Controls

1. The construction-phase erosion and sediment controls should be designed to retain sediment on-site to the maximum extent practicable.
2. The best practicable technology currently available will be designed, installed and maintained such that erosion and sediment controls minimize the discharge of pollutants, which requires: 1) control of storm water volume and velocity to minimize soil erosion in order to minimize pollutant discharges; and, 2) control storm water discharges, including both peak flow rates and total storm water volume to minimize channel and stream bank erosion and scour in the immediate vicinity of discharge points.
3. Structural measures to divert flows from exposed soils, retain flows or otherwise limit runoff and the discharge of pollutants from exposed areas to the degree attainable may

include but are not limited to: silt fences, earth dikes, drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins.

4. All control measures must be properly selected, installed, and maintained in accordance with the manufacturer's specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately, or incorrectly, the permittee must replace or modify the control for site situations.
5. If sediments escape the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize off-site impacts (e.g., fugitive sediment).
6. Sediment must be removed from sediment traps or sedimentation ponds as required by design.
7. Trapped sediment must be removed from a silt fence as required by the design in accordance with the manufacturer's specifications.
8. Material storage areas (also including overburden and stockpiles of dirt, borrow areas, etc.) used solely for the project are considered a part of the project and shall be addressed in the storm water pollution prevention plan.
9. Provide and maintain natural buffers around waters of the state, direct storm water to the vegetated areas and maximize storm water infiltration to reduce pollutant discharges, unless infeasible.

ii. Seeding and Mulching

1. Temporary erosion control including ground cover establishment will be described in a Sodding, Seeding, and Mulching specification, which will require that seed and sod sources are free of noxious species.
2. Mulch may be applied on levee slopes concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion.
3. Mulch can consist of weed-free straw or hay, wood fiber hydro-mulch, erosion control fabric, or some functional equivalent.
4. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch

binders within 100 feet of wetlands or waterbodies, except where the product is certified environmentally non-toxic by the appropriate state or federal agency or independent standards-setting organization.

5. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

V. CONSTRUCTION CLOSE-OUT

A. CLEANUP

i. Commence cleanup of construction debris and temporary erosion control measures in areas where work activities have been completed.
ii. Complete final grading, topsoil replacement, and installation of permanent erosion control structures. When access is no longer required, travel lanes must be removed, and the temporary construction right-of-way restored.
iii. Grade the construction right-of-way to provide positive drainage.
iv. Remove construction debris from all construction work areas.
v. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. FINAL STABILIZATION AND REVEGETATION

i. Final stabilization practices may include but are not limited to: establishment of permanent self-sustaining perennial vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, and other appropriate measures.
    1. Vegetation establishment will follow the guidelines and project specific criteria as established by CPRA and USACE-MVN Agency Technical Review teams.
    2. CPRA will consult with USACE and other specialists regarding the selection and establishment of grass species along the conveyance channel levees.

ii. Soil Additives
    1. Fertilize and or use pH modifiers in accordance with project specifications.

iii. Seeding or Sodding Requirements

1. Perform seeding of permanent vegetation within the recommended seeding dates.
2. Seed all disturbed soils within the construction footprint but outside of the Project facilities permanent footprint as soon as practical.
3. Use seeding methods (broadcast, drill, or hydro) that best apply to the existing conditions to achieve the target establishment coverage.

C. SOIL COMPACTION MITIGATION

i. Minimizing soil compaction is not required where the intended function of a specific area of the site dictates that it be compacted.
ii. Severely compacted soils associated with temporary construction right-of-way outside of the construction boundary may include deep tillage or aeration to relieve compaction.

VI. POST-CONSTRUCTION ACTIVITIES AND DOCUMENTATION

A. MONITORING AND MAINTENANCE

i. Conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation.
ii. Continue revegetation efforts until revegetation is successful.
iii. Monitor and correct problems with drainage systems resulting from construction in agricultural areas until restoration is successful.

B. DOCUMENTATION

Records shall be maintained that identify:

i. Method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;
ii. Acreage treated;
iii. Dates of backfilling and seeding;
iv. Names of landowners requesting special seeding treatment and a description of the follow-up actions;
v. The location of any subsurface drainage repairs or improvements made during restoration; and
vi. Any problem areas and how they were addressed.

SECTION 2: PROTECTION OF WETLAND AND WATER-BASED RESOURCES

I. GEOGRAPHIC APPLICABILITY

The Protection of Wetland and Water Resources applies to in-water construction activities in wetlands and waters of the United States influenced by the Mississippi River (MR) and the Gulf of Mexico in the Barataria Basin (Basin).

II. ENVIRONMENTAL INSPECTION

A. CPRA will ensure that the number and experience of inspectors assigned to the Project shall be appropriate for the size of the construction area, the level of activity, and the number/significance of resources affected.

Inspectors are responsible for:

B. Inspecting construction activities for compliance with the requirements of Environmental Protection construction specifications and plans, other environmental permits and approvals, and environmental requirements in landowner easement agreement;
C. Identifying, documenting, and overseeing corrective actions as necessary to bring an activity back into compliance;
D. Verifying that the limits of authorized construction work areas and locations of access are known and are acknowledged throughout construction;
E. Verifying the location of signs and highly visible flagging mark vessel construction work area and vessel access routes;
F. Identifying erosion/sediment control needs in all areas;
G. Ensuring sediment containment, temporary or permanent soil stabilization devices are properly installed, maintained, and repaired to the design specifications;
H. Keeping records of on-site compliance with environmental protection specifications; and
I. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase.

III. PRECONSTRUCTION PLANNING

A. A Waste Disposal Plan will be developed that identifies the methods and locations of disposal of materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., and ensures that harmful debris will not enter

ditches, rivers, bayous, canals, groundwater, and thus prevent the use of the area for recreation or present a hazard to wildlife.

B. A Spill Control Plan for in-water vessels and personnel will be developed that meets state and federal requirements and identifies the responsibilities for structuring operations in a manner that reduces the risk of spills and accidental exposure of fuels or hazardous materials to waterbodies and wetlands. The Plan will specify procedures for:
    i. Party responsible for implementing and supervising the containment and cleanup;
    ii. Training requirements of personnel and methods of accomplishing the training;
    iii. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified;
    iv. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency;
    v. The materials, methods, and procedures to be used for expeditious contaminant cleanup;
    vi. The reporting process of any spills or hazardous substance releases and who will follow up with complete documentation.

C. Disposal of Excavated Materials for Beneficial Use
    i. CPRA and Contractor responsibility for dredge material evaluation of possible contaminants of soil excavated from the conveyance channel and Outfall Transaction Feature (OTF) to be used for beneficial placement:
    ii. CPRA is responsible for the reasonable identification and evaluation of all Hazardous, Toxic and Radioactive Waste (HTRW) contamination within the vicinity of the Project (the conveyance channel and the OTF).
    iii. CPRA will provide a Phase I Environmental Site Assessment report prior to the Draft Environmental Impact Statement (DEIS) that will evaluate whether there is reason to believe the proposed dredge or fill material is or is not a carrier of contaminants (or material meets the testing exclusion criteria).
    iv. The construction Contractor will also comply with the applicable permits or regulations and will be obligated to obtain a Phase I Environmental Site Assessment (ESA) report within at least 6 months prior to construction.
    v. Regulations apply to cease construction if suspected HTRW materials encountered.

D. Vessel Access
   i. The route for construction vessels and work boats will be identified with temporary channel markers during construction.
   ii. Water bottom assessment surveys will be conducted to identify oyster beds.
   iii. Minimum depths of water above the bottom will be determined so that bottom resources are not impacted.
   iv. Vessel operators will operate along approved routes.

IV. IN-WATER CONSTRUCTION (MISSISSIPPI RIVER AND BARATARIA BASIN)

A. NOTIFICATIONS
   i. CPRA will notify the navigation sector of the United States Coast Guard providing the type and location of construction activities in the Mississippi River, so that a Local Notice to Mariners (LNM) can be issued.

B. CONSTRUCTION IN THE RIVER
   i. Aboveground and submerged construction of structures will require excavation and fill activities.
   ii. River bed or batture soils may be used for land- or water-based construction purposes. Excavation of bar sands may be used for land- or water-based project construction (e.g., fill material for cofferdam cells). During construction or de-construction the native fill will be resuspended to the river.
   iii. Removal of existing revetment will be reused or disposed of in an approved site.
   iv. Deep soil mixing (using bentonite/cement slurries/other) will be stabilized within the earth and any excess material or runoff will be collected, dewatered, and disposed.
   v. In cases of an imminent tropical cyclone, the cofferdam enclosure area will be filled with water from the river for safety purposes. Following storm passage, the enclosure will be de-watered to the river.

C. CONSTRUCTION IN THE BASIN
   i. General

   Beneficial Use Areas (BU Areas) have been located for excess soil placement. The route for vessel access and the excavation/placement areas have been located.

ii. Excavation and Fill—Vessel Access
    1. Vessel Access: Excavation of waterbottoms may occur in navigable waters, private canals, sediment infilled natural bayous, and emergent wetlands to allow shallow draft vessel access, which could include tugs, scows, and barges with mounted equipment and/or materials.
    2. Where vessel access dredging of waterbottom sediments is required, the excavation and disposal methods will be designed to minimize hydrologic disruption, and when feasible, restore intertidal habitat.
    3. Excavation and subsequent disposal of soils excavated for access channel could include:
        a. temporary disposal (side cast, temporary containment cells);
        b. backfilling of artificial canals;
        c. shallow water or wetland nourishment (thin spray, hydraulic dredge); or
        d. wetland creation.

iii. Excavation and Fill— BU Areas
    1. The excavation of the conveyance channel and the OTF will result in excess sediments that may be placed in the basin waterbottoms in the BU Areas.
    2. Existing natural or artificial features (e.g., canal spoil banks, marsh edge) may be used to retain pumped sediments. The construction of containment dikes may be necessary to limit sediment loss. Upon completion of filling, dikes may be gapped to maintain tidal exchange.
    3. The placement of fill material will avoid high elevation stacking and instead result in settled elevations that are conducive to shallow water or emergent wetland habitat.

SECTION 3: PROTECTION OF FISH AND WILDLIFE RESOURCES

I. GEOGRAPHIC APPLICABILITY

The Protection of Fish and Wildlife Resources applies to in-water and land-based construction activities, which would occur in the Mississippi River, Barataria Basin, Project construction limits and buffer areas adjacent to the construction limits as required.

II. ENVIRONMENTAL INSPECTION

A. CPRA will ensure that the number and experience of inspectors assigned to the Project shall be appropriate for the size of the construction area, the level of activity, and the number/significance of resources affected.

Inspectors are responsible for:

B. Inspecting construction activities for compliance with the requirements of Environmental Protection construction specifications and plans, other environmental permits and approvals as described herein;
C. Verifying and maintaining limits of authorized construction work areas and access routes (e.g., appropriate signage, or markers/flagging) throughout construction;
D. Executing the proper protocols for reporting or notifications to resource agency personnel;
E. Keeping records of on-site compliance with environmental protection specifications;

III. PRECONSTRUCTION PLANNING

A. CPRA will verify that Environmental Specifications and Special Provisions issued to the Contractor are current, accurate, and complete prior to construction.
B. CPRA will ensure that required fish or wildlife field surveys are executed prior to construction.
C. CPRA will consult with USFWS prior to land-based vegetation clearing to identify beneficial practices to minimize impacts to migratory birds.

IV. IN-WATER OR LAND-BASED CONSTRUCTION MEASURES/REQUIREMENTS

A. LOCATION CHANGES: Regarding location changes, modifications to construction areas, new information regarding presence or impacts to species, the USFWS recommends that CPRA and the USACE contact the Service and LDWF for additional consultation if: 1) the scope of location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat, 3) the action is modified in a manner that causes effects to listed species or designated critical habitat, or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made or finalized.

B. PILE DRIVING: A pile-driving plan to guide pile-driving operations will be developed. The plan will identify locations, approximate timing, and installation methods including any noise attenuation methods. This plan is required as part of the Endangered Species Act Consultation with US Fish and Wildlife Service and is intended to reduce potential impacts to listed species.

C. DREDGING: Should dredging (cutterhead/suction dredge) activities be necessary in the Mississippi River, the cutterhead must remain completely buried in the bottom material during dredging operation. If pumping water through the cutterhead is necessary to dislodge material or to clean the pumps or cutterhead, etc., the pumping rate will be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased. During dredging, the pumping rates will be reduced to the slowest speed possible while the cutterhead is descending to the channel bottom.

D. NESTING BIRDS: Prior to construction, a qualified biologist shall inspect the proposed construction site for the presence of documented and undocumented wading bird colonies and bald eagles. All construction activity during the wading bird nesting season (i.e., February through October 31) should be restricted within 1,000 feet of a wading bird colony[1]. If restricting construction activity within 1,000 feet of a wading bird colony is not feasible, CPRA shall coordinate with FWS to identify and implement alternative best management practices to protect wading bird nesting colonies. During construction activities, if a bald eagle nest is within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. The evaluation may be conducted online(http://www.fws.gov/southeast/es/baldeagle). Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary, and those results should be forwarded to this office.

E. PALLID STURGEON: The pallid sturgeon is found in the Mississippi River. CPRA and the USACE will coordinate with the Service to develop a Fish Monitoring and Removal Plan for pallid sturgeon. This plan will need to be completed and Service approved prior to the construction of the cofferdam and/or combi wall. Live sturgeon captured in the structure or cofferdam or combi wall area should be tagged and returned to the river.

F. WEST INDIAN MANATEE[2]: The West Indian manatee may be present in the project vicinity. The Contractor shall instruct all personnel associated with the project of the potential presence of manatees in the area, and the need to avoid collisions with these animals. All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the USFWS ESA and the MMPA. The Contractor will be responsible for any manatee harmed, harassed, or killed as a result of construction activities not conducted in accordance with these specifications. Special Operating Conditions If Manatees Are Present in the Project Area: (1) If a

manatee(s) is sighted within 100 yards of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet of a manatee. If a manatee is closer than 50 feet to moving equipment or the project area, the equipment shall be shut down and all construction activities shall cease to ensure protection of the manatee. Construction activities shall not resume until the manatee has departed and the 50-foot buffer has been re-established. (2) If a manatee(s) is sighted in the project area, all vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom, and vessels shall follow routes of deep water whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits. (3) If siltation barriers are used, they shall be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment. (4) Manatee Signs. Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8-1/2-inch x 11-inch reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3-foot x 4-foot sign reading "CAUTION: MANATEE AREA" shall be posted adjacent to the issued construction permit. A second temporary sign measuring 8-1/2-inch x 11-inch reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" shall be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction. Manatee Sighting Reports: Any sightings of manatees, or collisions with a manatee, shall be reported immediately to the CPRA. The CPRA will report and coordinate with the U.S. Fish and Wildlife Service Louisiana Ecological Services Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

G. BASIN DREDGING AND IN-TRANSIT VESSEL REQUIREMENTS: The Contractor will be required to adhere to:
    i. PROTECTED SPECIES CONSTRUCTION CONDITIONS[3], May 2021, NOAA Fisheries Southeast Regional Office SERO Protected Resources Division (PRD)

ii. NOAA-NMFS VESSEL STRIKE AVOIDANCE MEASURES[4], May 2021, and NOAA Fisheries Southeast Regional Office (SERO) Protected Resources Division (PRD).

SECTION 4: PROTECTION OF CULTURAL RESOURCES

This section is a Draft until construction measures for cultural resources protection are finalized between CPRA and the consulting parties for the Programmatic Agreement.

The following sections provide an overview of CPRA's information on the Unanticipated Discovery Plan.

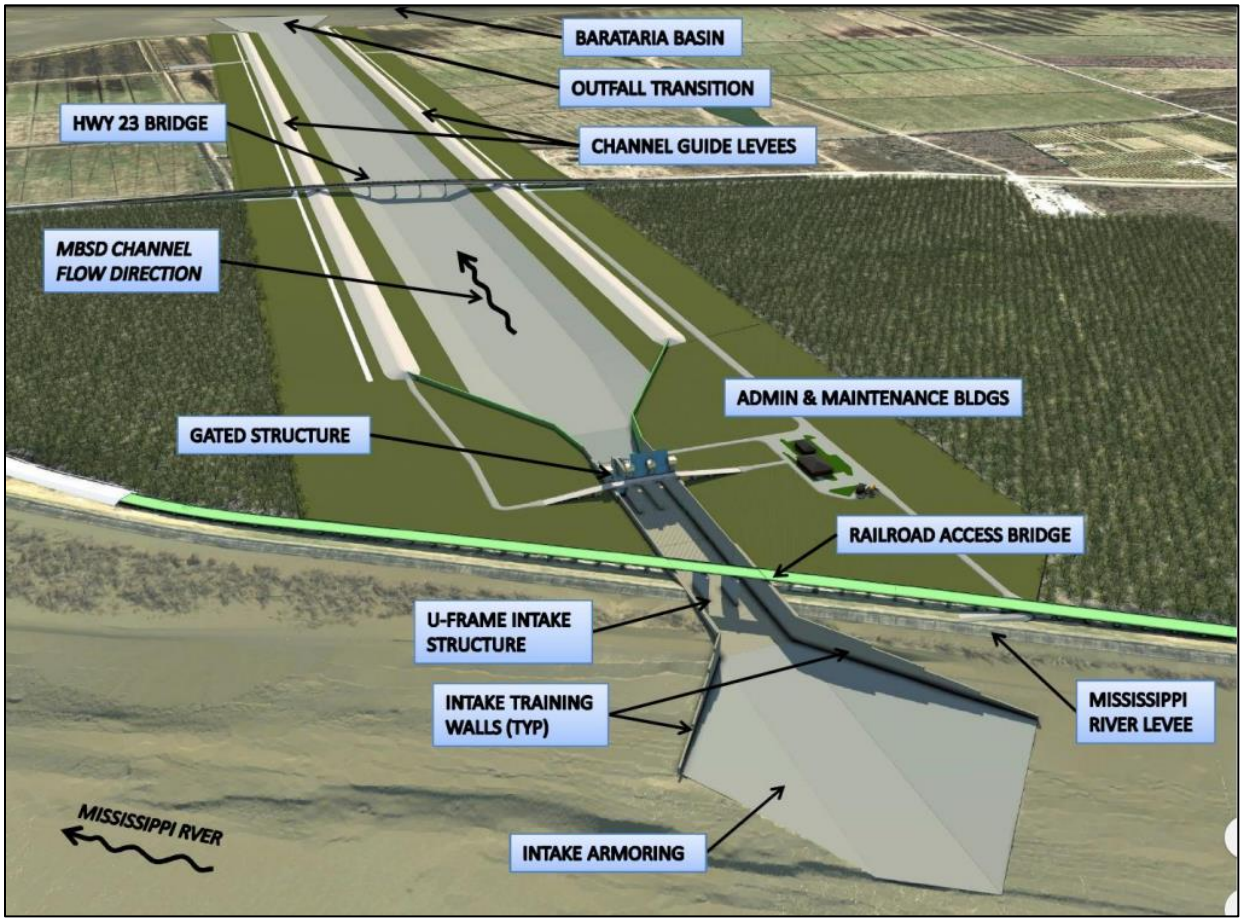
Unanticipated Discovery Plan (Draft Programmatic Agreement): All inspectors have the responsibility to monitor the construction sites for potential cultural/archaeological remains throughout construction. If any cultural materials (such as arrowheads, ceramic sherds, bricks, worked wood or bone, metal, or glass objects) or other potential historic properties are encountered, then the construction contractor will immediately halt all construction activity at the location of discovery and a fifty (50) foot buffer zone will be defined in all directions and appropriate measures to protect the find from further disturbance will be identified and implemented. CPRA will supply a Secretary of Interior (SOI)-qualified archaeologist to evaluate the discovery and make a written recommendation to CEMVN on the nature and eligibility of the discovery. If the discovery is recommended eligible or of undetermined eligibility, and the CEMVN agrees, then CEMVN and CPRA will assess whether the discovery can be avoided. If the discovery can be avoided, CPRA will implement measures to avoid the discovery.
If abandoned cemeteries, unmarked graves, or human skeletal remains are found during construction, a stop work order will be issued, and CPRA will comply with the Louisiana Unmarked Human Burial Sites Preservation Act (R.S. 8:671-681). CPRA will notify local law enforcement and the Division of Archaeology within the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development by telephone to assess the nature and age of the human skeletal remains within twenty-four (24) hours of the discovery of unmarked human remains and will accompany local law enforcement personnel during all field investigations. If the appropriate local law enforcement official determines that the remains are not a crime scene, and the remains are more than 50 years old, LDOA has jurisdiction over the remains. In no instance will human remains be removed from the discovery site until jurisdiction has been established. In cases where the LDOA assumes jurisdiction and the remains are determined to be American Indian, LDOA will consult with Tribes, CEMVN, and CPRA to determine the appropriate course of action.

[1] https://www.fws.gov/southeast/pdf/guidelines/colonial-water-birds-and-wading-birds-louisiana.pdf
[2] https://www.fws.gov/southeast/pdf/guidelines/standard-manatee-conditions.pdf
[3] https://media.fisheries.noaa.gov/2021-06/Protected_Species_Construction_Conditions_1.pdf?null
[4] https://media.fisheries.noaa.gov/2021-06/Vessel_Strike_Avoidance_Measures.pdf?null

[i] 33 C.F.R. § 320.4.
[ii] 33 C.F.R. § 320.4.
[iii] 33 C.F.R. § 320.4(r).
[iv] 40 C.F.R. § 230.93(a)(1).
[v] 33 C.F.R. Part 332; 40 C.F.R. Part 230.
[vi] 40 C.F.R. § 230.93(a)(1).
[vii] 40 C.F.R. § 230.93(e).
[viii] 40 C.F.R. § 230.93(e).
[ix] 33 U.S.C. § 408(a).
[x] USACE, EC 1165-2-200 (2018), available at, https://www.publications.usace.army.mil/Portals/76/Publications/EngineerCirculars/EC_1165-2-220.pdf?ver=2018-09-07-115729-890.
[xi] 50 C.F.R. § 402.14(g)(3), (4).
[xii] 50 C.F.R. §402.02.
[xiii] 50 C.F.R. § 402.14(i).
[xiv] 16 U.S.C. § 662.
[xv] 16 U.S.C. § 662 ("The reporting officers in project reports of the Federal agencies shall give full consideration to the report and recommendations of the Secretary of the Interior and to any report of the State agency on the wildlife aspects of such projects, and the project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits.").
[xvi] 1981 Fish and Wildlife Service Mitigation Policy, 46 Fed. Reg 7644-7663 (Jan. 23, 1981). FWS adopted the 1981 guidance for personnel involved in making recommendations to protect or conserve fish and wildlife resources, including under the Fish and Wildlife Coordination Act.
[xvii] 16 U.S.C. § 1852(h)(1). The applicable regulations define "council" as including the Secretary, as applicable, when preparing certain FMPs. 50 C.F.R. § 600.810(a).
[xviii] 16 U.S.C. § 1853(a)(7).
[xix] *Id*. § 1802(10). The FMPs must include a textual description of the EFH as well as maps that display the geographic locations of EFH, explicitly distinguish EFH from non-EFH areas, and any habitat areas of particular concern. 50 C.F.R. §§ 600.815(a)(1)(iv)(B) & (a)(1)(v).
[xx] 16 U.S.C. § 1855(b)(2). While state agencies are not required to consult with NMFS on state actions that may adversely affect EFH, NMFS is required to provide EFH conservation recommendations for any state action that would adversely affect EFH. *Id*. § 1855(b)(4)(A); 50 C.F.R. § 600.925(c)(1).
[xxi] 16 U.S.C. § 1855(b)(2).
[xxii] NMFS, Essential Fish Habitat Consultation Guidance, Version 1.1 (2004).
[xxiii] 16 U.S.C. § 1855(b)(4).
[xxiv] 36 C.F.R. part 800.
[xxv] 36 C.F.R. § 800.6.

R2: Monitoring and Adaptive Management (MAM) Plan

MONITORING AND ADAPTIVE MANAGEMENT PLAN
FOR THE
MID-BARATARIA SEDIMENT DIVERSION PROJECT
(CPRA PROJECT NUMBER BA-0153)



5 July 2022

Recommended citation:
Coastal Protection and Restoration Authority and Louisiana Trustee Implementation Group. 2022. Monitoring and Adaptive Management Plan for the Mid-Barataria Sediment Diversion Project (CPRA Project Number BA-0153). 145 pages.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF ACRONYMS

Acronym	Description	Page First Used
ADCIRC	Advanced Circulation Model	13
ADCP	Acoustic Doppler Current Profiler	31
AM	Adaptive Management	1
AMO	Atlantic Multi-decadal Oscillation	7
AMT	Adaptive Management Team	15
APA	Applicant's Preferred Alternative	24
BACI	Before-After-Control-Impact (Study)	23
BBES	Barataria Bay Estuarine Stock	64
BICM	Barrier Island Comprehensive Monitoring	26
CASM	Comprehensive Aquatic Systems Model	13
CEM	Conceptual Ecological Model	5
cfs	Cubic Feet per Second	24
Chl	Chlorophyll	9
CIMS	Coastal Information Management System	107
CMP	Coastal Master Plan	2
CMR	Capture Mark Recapture	65
CoC	Contaminant of Concern	74
CoNED	Coastal National Elevation Database	39
CPRA	Coastal Protection and Restoration Authority	1
CRHA	Capture Release Health Assessment	65
CRMS	Coastwide Reference Monitoring System	23
CTD	Conductivity/Temperature/Depth	34
DIVER	Data Integration, Visualization, Exploration, and Reporting	108
DMT	Data Management Team	102
DWH	Deepwater Horizon	1
DO	Dissolved Oxygen	9
DRT	Dolphin Resource Team	64
E&D	Engineering and Design	11
eDNA	Environmental DNA	65
ENSO	El Niño Southern Oscillation	7
EwE	Ecopath with Ecosim (and Ecospace) Model	13
FEIS	Final Environmental Impact Statement	1

LIST OF ACRONYMS (*continued*)

Acronym	Description	Page First Used
FEMA	Federal Emergency Management Agency	76
FIMP	Fisheries-independent Monitoring Program	24
FRP	Final Restoration Plan	1
FWOP	Future Without Project	13
FWP	Future With Project	13
GOHSEP	Governor's Office of Homeland Security and Emergency Preparedness	76
GRSLR	Gulf-regional Sea Level Rise	7
HABFB	Harmful Algal Bloom Forecasting Branch	54
HCAB	Harmful Cyanobacterial and/or Algal Bloom	55
HSI	Habitat Suitability Index	12
IMPLAN	Impact Analysis for Planning	14
LA TIG	Louisiana Trustee Implementation Group	1
LCA	Louisiana Coastal Area (Ecosystem Restoration Study)	13
LDEQ	Louisiana Department of Environmental Quality	21
LDH	Louisiana Department of Health	21
LDWF	Louisiana Department of Wildlife and Fisheries	21
LiDAR	Light Detection and Ranging	39
LMRFC	Lower Mississippi River Forecasting Center	31
LOI	Loss on Ignition	45
MAM	Monitoring and Adaptive Management	1
MMSN	Marine Mammal Stranding Network	67
MR	Mississippi River	4
MR&T	Mississippi Rivers & Tributaries Project	7
MRHDMS	Mississippi River Hydrodynamic and Delta Management Feasibility Study	13
N	Nitrogen	34
NFWF	National Fish and Wildlife Foundation	2
NMFS	National Marine Fisheries Service	77
NOAA	National Oceanic and Atmospheric Administration	27
NRDA	Natural Resource Damage Assessment	1
OM&M	Operations, Maintenance and Monitoring	101

LIST OF ACRONYMS (*continued*)

Acronym	Description	Page First Used
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation	1
OMT	Operations Management Team	19
P	Phosphorus	34
PDARP	Programmatic Damage Assessment and Restoration Plan	1
PDDA	Project Delta Development Area	24
PDT	Project Design Team	13
PEIS	Programmatic Environmental Impact Statement	1
PIA	Project Influence Area	24
PRD	Protected Resources Division	77
QA/QC	Quality Assurance/Quality Control	20
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act	2
RM	River Mile	38
RPM	Reasonable and Prudent Measure	77
RSET	Rod Sediment Erosion Table	47
RSLR	Relative Sea Level Rise	7
S	Sulfur	34
SAV	Submerged Aquatic Vegetation	9
SEFSC	Southeast Fisheries Science Center	78
SERO	Southeast Regional Office	78
SLR	Sea Level Rise	2
SME	Subject Matter Expert	21
SOP	Standard Operational Procedure	107
SWAMP	System Wide Assessment and Monitoring Program	23
TC	Total Carbon	46
TN	Total Nitrogen	46
TP	Total Phosphorus	46
TSS	Total Suspended Sediments	9
TWIG	The Water Institute of the Gulf	2
UAS	Unmanned Aircraft System	66
USACE	United States Army Corps of Engineers	2

LIST OF ACRONYMS (*continued*)

Acronym	Description	Page First Used
USDA	US Department of Agriculture	76
USFWS	United States Fish and Wildlife Service	74
USGS	United States Geological Survey	31
WY	Water Year	101

Page intentionally left blank

1. INTRODUCTION

1.1. Purpose of the Project Monitoring and Adaptive Management Plan

Following the 2010 Deepwater Horizon (DWH) explosion and oil spill, the Natural Resource Damage Assessment (NRDA) Trustees identified implementation of monitoring and adaptive management (MAM) as one of the NRDA programmatic goals in the Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS; DWH Trustees, 2016). As described therein, the MAM Framework provides a flexible, science-based approach to implement effective and efficient restoration over several decades and to provide long-term benefits to the resources and services injured by the DWH oil spill. This MAM plan for the Mid-Barataria Sediment Diversion Project (the Louisiana Coastal Protection and Restoration Authority's (CPRA's) Project Number BA-0153; hereafter 'the Project'), has been drafted by the State and federal Project partners on the Louisiana Trustee Implementation Group (LA TIG).

This MAM plan serves as a companion to the Project Final Phase II Restoration Plan (FRP); the Project Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Plan; and the Project Mitigation Plan prepared for the Project's Final Environmental Impact Statement (FEIS). This MAM plan provides a framework for adaptive management (AM) decision-making and implementation that:

- Discusses the basics of MAM and presents a conceptual understanding of a sediment diversion of Mississippi River water into the Barataria Basin that underpins the selection of key monitoring variables for the Project, and identifies key uncertainties that may affect the ability of the Project to achieve its restoration objectives (Section 1).
- Outlines the structure for governance of Project operations and AM, including specifying the roles and responsibilities of State and federal partners (Section 2).
- Identifies monitoring needs and the key performance measures associated with each objective that the State and the LA TIG will use to evaluate progress towards meeting the Project restoration objectives and to inform AM (Section 3). This includes describing assess progress toward meeting the restoration objectives as described in the FRP. This also includes the methods for specific types of monitoring and a discussion of the spatial and temporal extent of pre-operations baseline monitoring that will be conducted before, and post-construction monitoring that will be conducted after, the Project begins operating.
- Describes the framework for assessing Project success based on performance measures and potential AM actions, including potential operational shifts to minimize Project impacts if practicable given the Project's goals, objectives, and success criteria (Section 4), and the schedule for evaluating data that could lead to changes in management actions (Section 5).
- Discusses the above information in relation to the concurrent development of State and LA TIG programmatic adaptive management as outlined in the *Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations* (The Water Institute of the Gulf 2020), including data management (Section 6), and reporting (Section 7); and
- Establishes the basis for an estimated budget for Project-specific MAM (Section 8).

MAM Plans are by nature living documents and never "final". This Plan will be "draft" at least until if, and if so when, the US Army Corps of Engineers (USACE) New Orleans District issues approval and issuance of the permits and authorizations required for the Project. CPRA at that point will then add any Compliance Monitoring requirements contained in those permits to this Plan.

1.1.1. Purpose of Adaptive Management

A distinctive feature of coastal Louisiana is that its industry, natural resources, communities, and culture are intricately linked to, and reliant on, its wetland environment. Individually managing each of these systems is difficult due to their inherently uncertain and highly dynamic nature and the high level of integration between the systems. Predicting the effects of coastal Louisiana's restoration projects with complete certainty is impossible due to

- shifting ecological baselines associated with continued, ongoing land loss, including sea level rise (SLR), subsidence, water cycles, tropical storms and hurricanes;
- incomplete understandings of ecosystem structure and function; and
- imprecise and complex relationships between project features and corresponding outcomes.

Adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). The primary incentive for implementing AM is to increase the likelihood of achieving desired project outcomes given the identified uncertainties. It is an iterative process that integrates monitoring and evaluation of ecosystem variables in response to management actions with flexible decision-making, where management approaches are adjusted based on observed outcomes (NRC 2004). Adaptive management provides an organized, coherent, and documented process for promoting learning that will improve decision-making. Within the context of DWH NRDA restoration, AM includes informing the selection, design, and implementation of restoration projects; implementing corrective actions, when necessary, to projects that are not trending toward established performance criteria; and making adjustments over time to projects that require recurrent or ongoing decision making.

1.1.2. Overview of CPRA Programmatic Adaptive Management

The State of Louisiana has long recognized the importance of utilizing AM to improve its coastal program, and has conducted specific AM activities for implemented projects. Adaptive Management has been a key feature of Louisiana's Coastal Master Plan since 2012, thus allowing for flexibility in program implementation as conditions change, resolution of uncertainties to improve future decision-making, and modification of constructed projects while informing the development of future projects. Indeed, the Louisiana Legislature's mandate for CPRA to update Louisiana's Coastal Master Plan (CMP) every six years to account for changes in information, tools, and on-the-ground situations, is an example of, and a mandate for, AM.

In March 2018, the LA TIG funded a project focused on formalizing programmatic AM for restoration in coastal LA by describing the status of, and identifying opportunities for, institutionalizing AM within CPRA and the LA TIG. That work, conducted in partnership with The Water Institute of the Gulf (TWIG), was intended to integrate across the multiple implementing mechanisms (e.g., CPRA, LA TIG, the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE) Program, National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefits Fund) (The Water Institute of the Gulf, 2020). CPRA's programmatic AM will create a structure and process for building institutional knowledge, iteratively incorporating new information that continually improves our system understanding, facilitating informed adjustment of management actions, and improving decision-making to help achieve the long-term sustainability of our coast, and will build the knowledge base by engaging stakeholders and through internal and external

communication. The goal of CPRA programmatic AM is to maximize the success of the coastal protection and restoration program by utilizing robust decision-making.

1.1.3. Project-Level Adaptive Management

Project AM is particularly important because of its scale and scope. Project-level AM focuses on identifying project uncertainties (Section 1.4) and, where feasible reducing those uncertainties through project design, scientific analysis, or monitoring to inform management actions (Section 4 and Table 4.1-4). Conceptual (Section 1.3) and numerical modeling (Section 1.5) provides the expectations against which MAM Plan monitoring (Section 3) and evaluation (Section 4) has been developed, both with regards to anticipated Project effects and the constantly changing baseline. As outlined in Section 4, monitoring data and associated assessments will inform AM evaluations, decisions, and actions. Sometimes the ten steps in the iterative project-level AM cycle developed for the Louisiana TIG (Figure 1.1-1; The Water Institute of the Gulf, 2020) do not occur sequentially; it may be necessary to move forward or backward through the cycle or to repeat certain steps.

1.2. Restoration Type Goals, Project Purpose and Need, and Project Restoration Objectives

The DWH oil spill caused extensive impacts to marsh habitats and species in Louisiana. These habitats have a critical role in the overall productivity of the northern Gulf of Mexico. In DWH Trustees (2016), the DWH Trustees found that coastal and nearshore habitat restoration is the most appropriate and practicable mechanism for restoring the ecosystem-level linkages disrupted by this spill. Nearshore habitats provide food, shelter, and nursery grounds for numerous ecologically and economically important species, including fish, shrimp, crabs, sea turtles, birds, and mammals.

The overall programmatic goal for the Project is to Restore and Conserve Habitat. The Restoration Type is Wetlands, Coastal, and Nearshore Habitats Restoration. The goals of this Restoration Type, outlined in Section 5.5.2.1 of the PDARP/PEIS (DWH Trustees, 2016) are to:

- Restore a variety of interspersed and ecologically-connected coastal habitats in each of the five Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

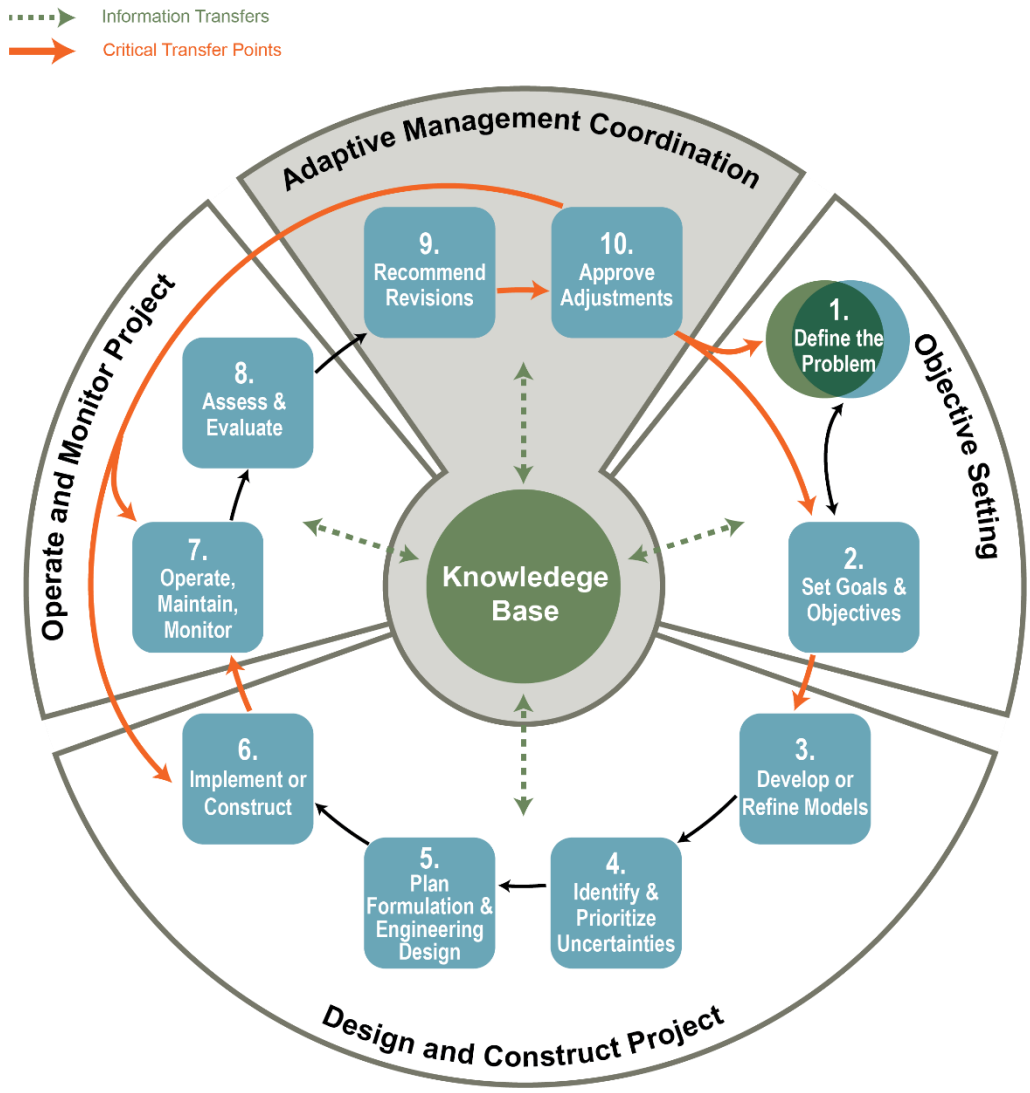


Figure 1.1-1. The four phases of a project-- Objective Setting, Design and Construct Project, Operate and Monitor Project, and Adaptive Management Coordination—each connect to the steps of the adaptive management cycle. All four phases include information capture and transfer to the knowledge base (e.g., annual reporting). Critical transfer points provide opportunities for increased information capture and transfer. Figure from The Water Institute of the Gulf (2020).

The Project's purpose and need, as articulated in the FEIS, is:

> "… to restore for injuries caused by the DWH oil spill by implementing a large-scale sediment diversion in the Barataria Basin that will reconnect and re-establish sustainable deltaic processes between the Mississippi River [MR] and the Barataria Basin through the delivery of sediment, freshwater, and nutrients to support the long-term viability of existing and planned coastal restoration efforts. The proposed Project is needed to help restore habitat and ecosystem services injured in the northern Gulf of Mexico as a result of the DWH oil spill."

Specific restoration objectives for the Project are to

- Deliver freshwater, sediment, and nutrients to Barataria Bay through a large-scale sediment diversion from the MR;
- Reconnect and re-establish sustainable deltaic processes between the MR and the Barataria Basin (e.g., sediment retention and accumulation, new delta formation); and
- Create, restore, and sustain wetlands and other deltaic habitats and associated ecosystem services.

Section 2.3.3 of the OMRR&R Plan and Section 1.5 of the FRP both describe operational features of the proposed Project.

1.3. Conceptual Ecological Model

1.3.1. Purpose of the Conceptual Ecological Model

Conceptual ecological models (CEM) are simplified, qualitative illustrations of the general relationships among the essential components of the ecosystem. CEMs help build understanding and consensus regarding the set of working hypotheses that explain the current natural system and the potential effects of the project on that system. The development of the CEM also helps to identify critical uncertainties and potential options to reduce these uncertainties. However, there are several types of CEMs, and the relative utility of each type depends on the management purpose (Fischenich 2008).

For the development of the Project CEM, a large number of models that were developed for other restoration projects and programs in Louisiana and the other Gulf states were reviewed. Relevant components from those past efforts were incorporated into a new Project-specific CEM to portray the status of knowledge about the Barataria Basin ecosystem and determine the components of the ecosystem that are most critical to monitor. The spatial scale of the Project CEM is the Barataria Basin, and the temporal scale is a 50-year Project timeframe and planning horizon.

The Project CEM starts with the idea that historical hydrologic alterations underlie the impaired status of the ecosystem. The CEM represents the current condition where levees and other anthropogenic alterations, sea level rise and climate change combine to create a dysfunctional system compared to pre-European settlement. The model can also represent the potential for a sediment diversion project to address some of those hydrologic alterations and associated impacts.

1.3.2. Components of the Conceptual Ecological Model

To inform this Plan, the Project partners developed a driver-stressor type of CEM (Fischenich 2008) that generally follows the top-down hierarchy similar to CEMs developed for Louisiana Coastal Area Program projects (e.g., CPRA and USACE, 2010, 2011). This CEM (Figure 1.3-1) identifies specific external *Drivers* and *Stressors* on the existing Barataria Basin, the *Effects* of those drivers, or processes occurring within the ecosystem, and the physical, chemical, biological, and/or ecological *Attributes* that can best serve as indicators of ecosystem condition. In doing so, the CEM helps identify the specific parameters to monitor to assess ecosystem change (both benefits and impacts) resulting from the proposed actions.

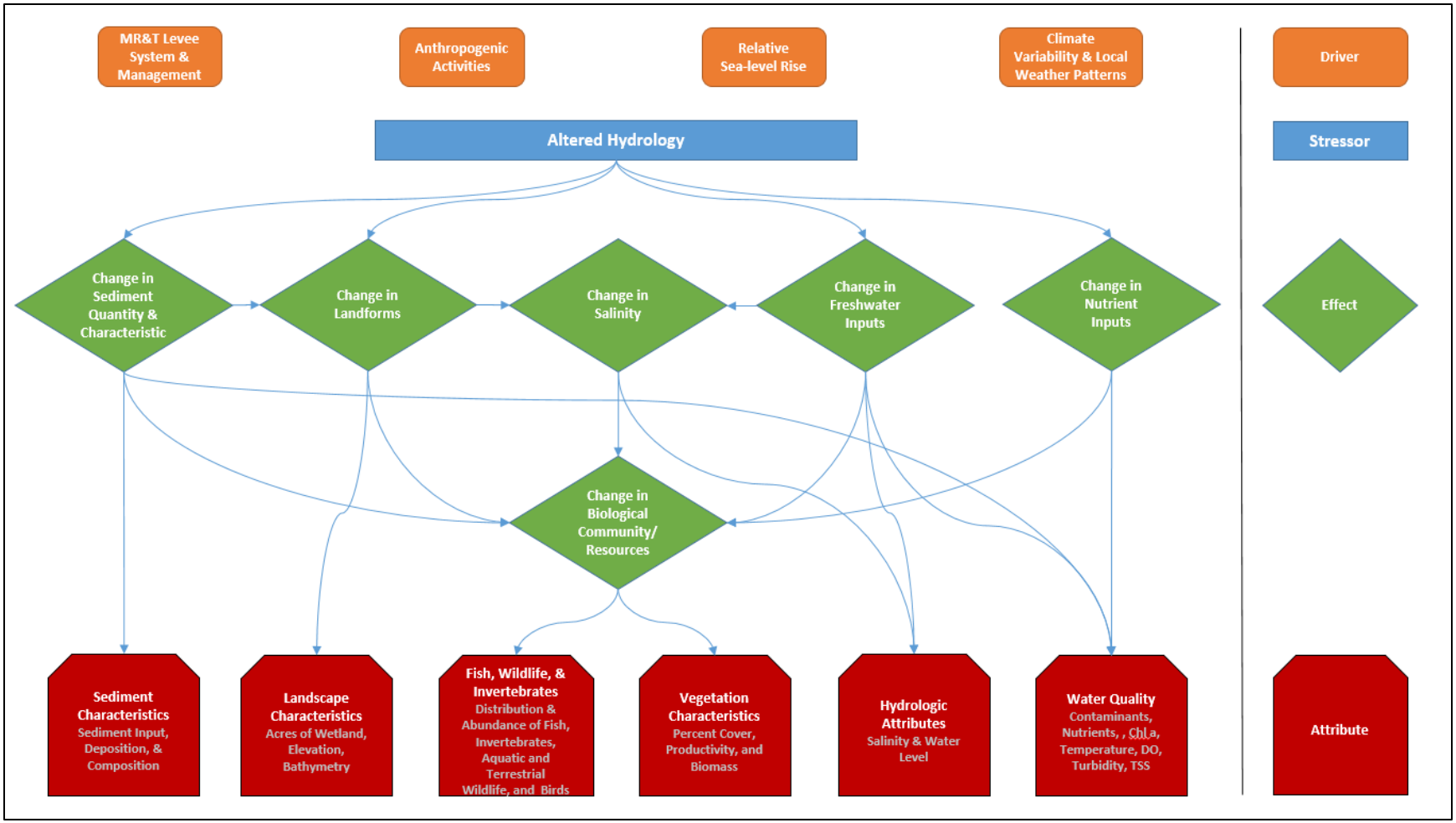


Figure 1.3-1. Conceptual Ecological Model for the Barataria Basin Sediment Diversion project developed by the Trustee Implementation Group's Monitoring and Adaptive Management Team. The Attributes listed are a subset or examples of the full set of monitoring parameters proposed in Section 3.

1.3.2.1. Drivers

Drivers are the major, natural and/or anthropogenic external forces that influence and govern system outcomes. The drivers that were identified as the major influences on the Project are

- The Mississippi Rivers and Tributaries (MR&T) Levee System and Management: Land loss in the Mississippi River Delta has been primarily attributed to levee system construction limiting the flow of sediment and water into embayments and surrounding wetlands.
- Anthropogenic Activities: Additional alterations to the Barataria Basin landscape besides the construction of levees have further altered hydrologic patterns. Land loss within the basin has been exacerbated by canal construction; conversion of natural habitat to agricultural, industrial, and other suburban and urban uses; and catastrophic events like the DWH oil spill.
- Relative sea level rise (RSLR), which refers to local perceived rates of SLR once Gulf-regional SLR (GRSLR) is combined with either uplifting or subsiding vertical land motions. Local rates of RSLR may be lesser or greater than regional SLR depending on the nature and magnitude of those land motions. For project-effects modeling associated with the 2017 CMP, 2015-2065 GRSLR scenarios varied between 0.43 and 0.83 m (Pahl, 2017). Plausible subsidence across southeastern Louisiana varies substantially (Figure 1.3-2).
- Climate Variability and Local Weather Patterns: Climate has been described as "what you expect" and weather as "what you get." Specific forces that result in changes in local weather patterns drive climate and climate change. The primary driving force of annual climate cycles is the sun, while longer and more aperiodic climate cycles like the Atlantic Multi-decadal Oscillation (AMO) and El Nino-Southern Oscillation (ENSO) influence hurricane activity and rainfall patterns and intensity. Climate change is affecting these patterns by the heating of the ocean, causing a rise in sea-surface water temperature and thermal expansion affecting SLR. Local weather patterns affect rainfall, evapotranspiration, wind, and temperature. Rainfall and evapotranspiration affect the amount of freshwater within Barataria Basin through direct effects on the basin and driving sources of freshwater (surface and groundwater) entering the system, influencing local salinities both seasonally and between years. Wind can drive substantial fluxes of water into and out of estuarine systems. North winds can force water out of estuaries and south winds can raise water levels by up to 0.5 meters (Reed et al., 1995). Wind-driven tides can override lunar tidal cycles. Wind-driven waves can cause marsh erosion and re-suspend sediment (Allison et al., 2017). As described above, temperature affects climate cycles; on the local level, temperature is an important factor controlling the productivity, biomass and composition of phytoplankton, vegetation, and faunal species (Nuttle et al., 2008).

1.3.2.2. Stressors

Stressors are natural systems physical or chemical changes produced or affected by drivers, and are directly responsible for significant changes in biological components, patterns, and relationships in natural systems. Altered hydrology is the primary stressor manifested in Barataria Basin because of the interactions between the aforementioned drivers, and that describes the intended effects of the Project. The Project would construct a controlled breach in the levee system, resulting in the reconnection of the MR to the Barataria Basin and re-establishment of sustainable deltaic processes within the Basin.

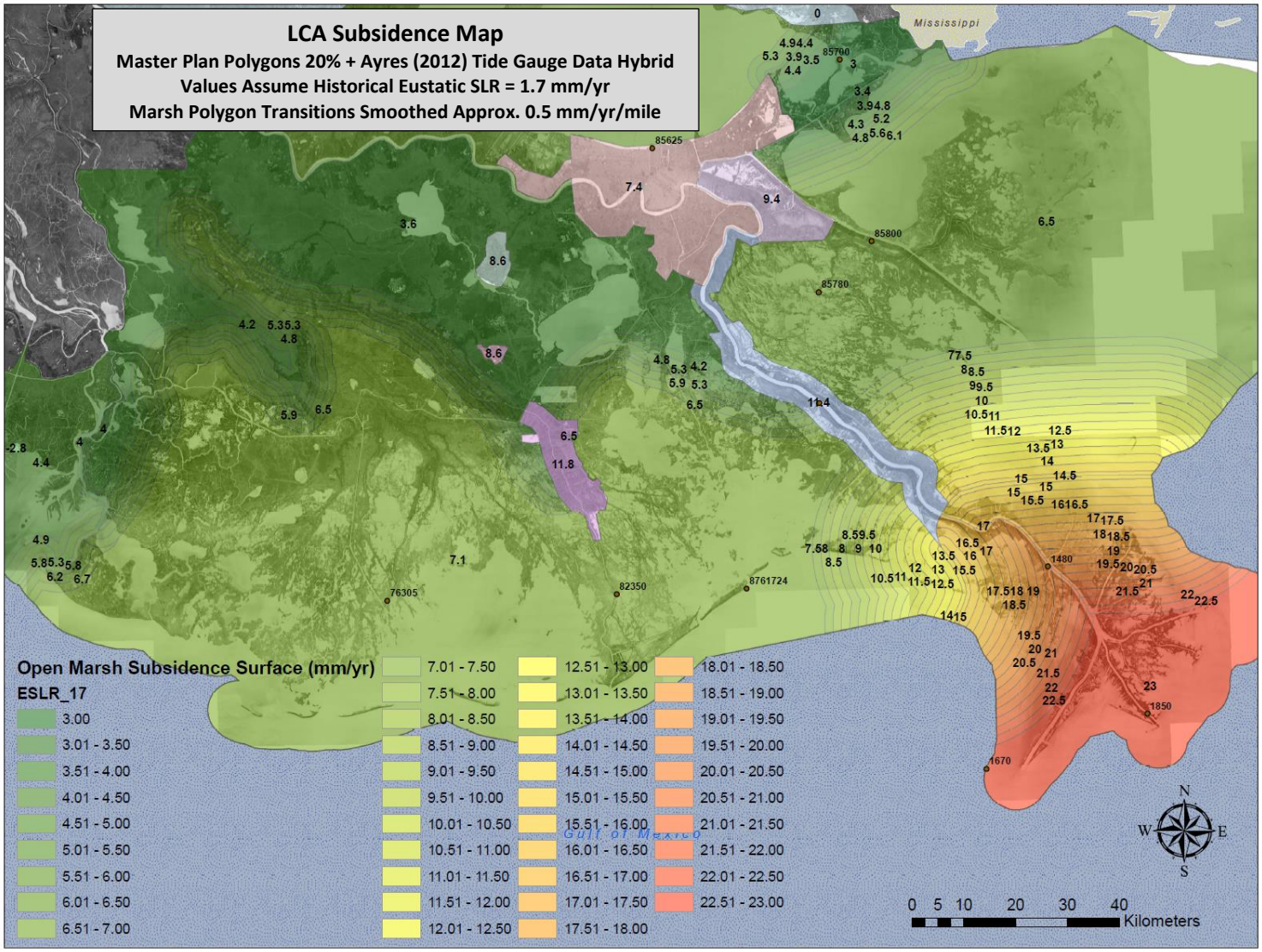


Figure 1.3-2. Estimates of plausible, spatially-variable subsidence developed for the Louisiana Coastal Area Program Delta Management Feasibility Study investigations were used as inputs for the Delft3D Basin-wide Model-based Project alternatives analysis.

1.3.2.3. Effects

Effects are biological, physical, or chemical responses within the natural system that are produced or affected by Stressors. The Effects listed in Figure 1.3-1 represent those physical and ecological phenomena whose patterns of occurrence are potentially attributable to alterations in Barataria Basin hydrology. The processes that are initially affected by changes in hydrology would be the amount of sediment, freshwater, and nutrients entering Barataria Basin. Altering sediment delivery through diversion operation would change Basin landforms, beginning with delta formation at the outfall. Altering freshwater inflow would change the salinity in parts of the Basin, especially in the outfall area. These alterations along with changes in nutrient inputs would affect Basin flora and fauna.

1.3.2.4. Attributes and Relevant Monitoring Parameters

Attributes are a representative subset of all potential elements or components of natural systems. Attributes may include populations, species, communities, or chemical processes. Changes in the processes have effects on the attributes of Barataria Basin, including the landscape, sediment, fauna, flora, water quality, and hydrology. The specific parameters that will be assayed to define and describe these attributes are discussed in more detail in Section 3, and include

- Landscape Characteristics
    - Acres of Wetland, by type (freshwater swamp; fresh + intermediate, brackish, and salt marsh; submerged aquatic vegetation (SAV), etc.)
    - Wetland Surface Elevation
    - Estuarine Open Waterbody Bathymetry
- Sediment Characteristics
    - Sediment Input
    - Organic Matter Composition
    - Mineral Sediment Composition
- Fish, Wildlife & Invertebrates
    - Distribution and Abundance of Fish, Invertebrates, Aquatic and Terrestrial Wildlife (including dolphin health), and Birds
    - Alligator Nest Success
- Vegetation Characteristics
    - Percent Cover
    - Productivity
    - Biomass
- Hydrologic Attributes
    - Salinity
    - Water Level
- Water Quality
    - Contaminants
    - Nutrients
    - Chlorophyll (Chl) a
    - Temperature
    - Dissolved Oxygen (DO) Content
    - Turbidity
    - Total Suspended Sediments (TSS)

1.3.2.5. Use of the Conceptual Ecological Model

Tracing any single path in Figure 1.3-1 from Drivers through Attributes represents an individual logic flow through the CEM. A survey of each unique logic flow through the model by members of the LA TIG MAM Working Group found that some flows are more certain than are others. Other logic flows are burdened by a rapid accrual of uncertainty from top to bottom; especially longer logic flow paths and those flows that rely on processes or attributes that are driven by multiple variables.

For example, consider the relatively short logic flow through the model that states

"Levees may lead to
→Altered Hydrology, which may result in a
→Change in Freshwater Inputs, which can be monitored through
→Hydrologic Attributes."

This is one of the shortest logic flows in the model (three steps from top to bottom) and is one that the LA TIG MAM Working Group associated with a relatively low level of uncertainty. Contrast that to the logic flow that states

"Climate Change may lead to
→Altered Hydrology, which may result in a
→Change in Sediment Quantity & Characteristic, which may result in a
→Change in Landforms, which may result in a
→Change in Salinity, which may lead to a
→Change in Biological Community and/or Resources,
which can be monitored through
→Vegetation Characteristics."

This is one of the longest logic flows in the model (six steps from top to bottom). It also involves three processes (Change in Landform, Change in Salinity, and Change in Biological Community/Resources) that have multiple influencing variables, any one of which is providing only a partial influence on the Process in question. The Working Group associated longer, more complex logic flows with more uncertainty.

The LA TIG MAM Working Group generally agreed it would not be appropriate to focus adaptive management decision making for the Project strictly around the logic flows in the model, since the CEM does not explicitly identify uncertainties, particularly human system uncertainties. Instead, the group decided that the value in the CEM is as a broader and more general representation of the potential influences of Altered Hydrology on the monitoring parameters chosen to represent specific ecosystem Attributes.

1.4. Sources of Critical Uncertainty

The CEM represents a simplification of many phenomena that will be occurring in and interacting with the landscape through time. While information flow through the CEM may appear deterministic and predictable, it is only so within the confines of the current state of the science regarding each of the Drivers, Stressors, Effects, and Attributes represented in Figure 1.3-1. In reality, uncertainty exists around every individual factor and process represented in the CEM. While the Project partners strove to

account for those uncertainties, they do remain, and constrain both the conceptual and numerical modeling frameworks.

1.4.1. Environmental Driver Uncertainties

Each of the drivers in the CEM has a certain level of uncertainty both as to how that driver will change in the future and as to how the diversion will interact to bring any change in that driver. For example, the purpose of the MR levee system and management is to prevent flooding. Much work is occurring during Project Engineering and Design (E&D) to ensure that neither construction nor operations of the Project will compromise that purpose. The levees, however, resulted in channelizing flow within the MR&T Project system rather than allowing flow into the estuaries via overbank flooding and crevasses, thereby limiting the delta-building process. More natural delta building has continued where the MR&T levees have been degraded (Bohemia Spillway) or absent (in the modern Balize Delta lobe downriver of Venice, LA). However, at present the mouth of the primary river distributaries in the Balize Delta (Pass a Loutre, South Pass, Southwest Pass) are on the edge of the continental shelf near the transition to the continental slope, which constrains further lateral expansion of subaerial wetlands.

Relative sea level rise, climate change, and local weather patterns likewise have substantial residual uncertainties. The 2017 CMP reviewed and used the most recent projections of GRSLR (Pahl 2017) and developed a lower and upper bound scenario for sensitivity and modeling. Reed and Yuill (2017) also developed Moderate and Less Optimistic Scenarios for subsidence by region. However, while the plausible outcomes of GRSLR and subsidence are projections informed by the current scientific literature, the actual Gulf-regional and relative SLR rates that the Deltaic Plain will experience over the next 50 years are uncertain.

The MR watershed encompasses 40% of the contiguous U.S., which means that the climate and weather patterns that affect the diversion include those in the central U.S. The seasonality of weather produces generally-known temperature and weather patterns, including the generally-predictable hydrograph of the MR flow that will be used in the operation of the diversion. There is also a general predictability in the seasonality of extreme events such as winter fronts and hurricanes. Longer-term intensity and location of impact of those events is less predictable, as is how climate change may affect precipitation patterns within the MR basin, frequency of high flow events.

Climate patterns provide some level of predictability of effect, although specific recurrence intervals are more correctly defined as temporally aperiodic. On short timescales, the ENSO has a predictable effect on temperature and rainfall in regions of the U.S. On longer timescales, the North Atlantic Oscillation and AMO influence temperature and precipitation, as well as extreme events, on what are broadly ±30-year cycles. Over the longer term, gradual but persistent warming from climate change has the potential to alter current climate patterns. The annual cycle of Project operation planning provides the opportunity to identify shifts in patterns of climate and weather, and to incorporate new scientific knowledge, to plan for operations in the next year.

1.4.2. Uncertainty in the Degree of Altered Hydrology (Stressor)

Leveeing of the Mississippi River altered natural hydrology by hydrologically isolating the Barataria Basin from the river. To reverse that alteration, the proposed Project structure design relies on the difference between the stage of the MR and that of the Barataria Basin receiving waters (head differential) to facilitate the diversion of river water and the sediments and nutrients therein. As such, the most

important assumption governing Project structure operations, in that it drives the presumed head differential, is the MR hydropattern. For the alternatives analyses in support of the FEIS, the historical 1964-2013 Mississippi River hydrograph was put into the Basin-wide Model as the MR condition for the 2020-2070 Project analysis period. It is highly likely, if not a near certainty, that the 1964-2013 hydrograph will not be the actual river condition during the first 50 years of Project operations. Thus, the actual schedule of opening and closing the diversion beyond the base flow remains highly uncertain because it will depend on actual MR stages throughout the Project's operational life.

1.4.3. Uncertainties in Responses of Environmental Resources to Project Inputs

There is a substantial amount of uncertainty surrounding individual physical and ecological phenomena represented in the CEM. Uncertainties of environmental resource response predominantly lie within the effectiveness of the diversion in transporting riverine sediment, freshwater, and nutrients into the receiving basin. Uncertainties associated with the calculations of critical model variables and how they influence key model outputs remain. The actual balance between land building and water quality impacts is also uncertain. Continued baseline and future effectiveness monitoring (Section 3) will improve the predictability of resource response. Future marsh experiments in controlled environments and in greenhouses, such as those conducted in the past by Graham and Mendelssohn (2014) and Poormahdi et al. (2018), can lead to a better understanding and predictability of how forming delta marshes incorporate the sediment and nutrients from the diversion. For now, uncertainties will be cataloged by the Project AM team (Section 12) for determination of priority and source of funding. Uncertainties are described in more detail in Section 4, and a learning strategy to address each uncertainty is identified in Table 4.1-4.

1.4.4. Uncertainties in Human Systems Response

Human community or socio-economic attributes (also known as human dimensions data) are priority datasets for management decision-making. However, the complexity in meaningfully collecting sociological data and the substantial uncertainty in either conceptual or numerical models has generally limited their formal inclusion in AM schemes.

Outputs from the Habitat Suitability Index (HSI) models, and even some of the Delft model outputs, are generally incompatible with available human system models, which ideally would be used to project catch or some other measure of resource exploitation based on population size, on which to underpin subsequent socioeconomic effects. As well, there is, in general, a very high degree of uncertainty in trying to model human response to projected biophysical and resource changes in either individuals or communities. Critical to this uncertainty is the ability or willingness to adapt, both of which can vary widely between communities, and even between individuals within a particular community.

1.5. Use of Numerical Models within Project Adaptive Management

1.5.1. Numerical Models Used in Project Planning

Project alternatives analysis was largely (but not solely) based on comparing the results of a suite of numerical models, within which ecosystem responses to proposed Project alternatives were analyzed. Numerical models were also used to inform Project E&D and MAM Plan monitoring and evaluation. The

Project modeling suite contained the following specific numerical models.

- Version 3 of the Delft3D Basin-wide Model, developed by TWIG, simulated morphological changes and water quality-related dynamics in the Mississippi River, the Barataria and Breton Sound basins and the Balize Delta (Sadid et al., 2018). The Delft3D model is a modeling suite developed by Deltares (2014) and designed to model "hydrodynamics, sediment transport and morphology and water quality for riverine, estuarine, and coastal environments" (Sadid et al., 2018). The Basin-wide Model integrates hydrological, morphological, nutrient, and vegetation dynamics. Vegetation dynamics were modeled using two specific Louisiana vegetation models to simulate the spatial distribution of wetland vegetation and allocate above- and below-ground biomass.

  The Louisiana Coastal Area (LCA) Ecosystem Restoration Study's Mississippi River Hydrodynamic and Delta Management Feasibility Study (MRHDMS) originally developed the Basin-wide Model. Alternatives evaluations for the Project's EIS were informed by projections of how conditions would change over 50 years, expressed as the difference between a "future with project" (FWP) and "future without project" (FWOP) scenario, where each of the proposed alternatives were modeled as separate FWP scenarios.

- A Delft3D-based Diversion Outfall Model, first developed by TWIG and subsequently adapted by the Project Design Team (PDT, specifically Baird Engineering, Inc.), predicted input of river flows at the discharge location, suspended sediment flow rate and duration, and sand and silt volumes conveyed into the basin for land building. The spatial domain of the Diversion Outfall Model is smaller geographically but higher in resolution than the Basin-wide Model, allowing for model use for Project E&D.

- The Advanced Circulation Model (ADCIRC) estimated the wave environment and propagation of storm surges in Barataria Basin resulting from landscape changes projected to result from the Project alternatives. Originally developed by Drs. Rick Luettich and Joannes Westerink, "ADCIRC is a system of computer programs for solving time dependent, free surface circulation and transport ..." (https://adcirc.org/). ARCADIS runs ADCIRC for the Project partners.

- HSIs for a set of 11 aquatic and four terrestrial species or species groups project the response of higher trophic levels to proposed Project alternatives, and inform both the Project EIS and adaptive management. Some of the HSIs originated with the Department of Interior in the mid-1980s, while others were developed and updated to inform the State of Louisiana's Coastal Master Plan. Inherent to the nature of HSIs is that they only predict the suitability of a habitat, not actual habitat occupation by organisms, organismal populations or species biomass. As well, many of the available HSIs for commercially-valuable fish and shellfish species only provide suitability projections for certain life-history stages, such as larvae and/or juveniles, and not for the adults that are generally the targeted resources in coastal fisheries.

- Two Barataria Basin-specific ecosystem response models, the Comprehensive Aquatic Systems Model (CASM) and Ecopath with Ecosim (and with Ecospace; EwE), were originally developed for the LCA MRHDMS, and are being used to inform the Project EIS. Given the current predictive limitations of each model (Ainsworth et al., 2018), they were used to characterize the existing food web structure of the estuary. This helped understand potential pathways for change and informed the monitoring component of this plan.

- The Project Socio-Economic Working Group utilized the IMPLAN Company's Impact Analysis for Planning (IMPLAN) software to develop estimations of the benefits and impacts of Project alternatives on human systems. IMPLAN uses output datasets from the Basin-wide Model, ADCIRC, and the HSIs as input datasets for its calculations, as well as additional socio-economic data developed specifically for the Barataria Basin.

The uncertainty structure around the model suite was a factor of

1. Uncertainty associated with empirical datasets that served as inputs to each model. For example, there was uncertainty associated with the water level and salinity datasets (measurement error) used to initialize the Basin-wide Model; and
2. Uncertainty associated with the ability of any one individual model to predict the response of a specific parameter. For example, we have already clarified that the uncertainty of Delft Basin-wide Model estimates of salinity at a particular space and time was on average +/- 3.5 parts per thousand. This uncertainty then defined the uncertainty of a specific output dataset, which then served as an input dataset to the next subsequent model in the chain.

Uncertainties associated with any one model in the modeling suite perpetuate with information exchange with the next subsequent model, and so the total uncertainty compounded for any one alternative was evaluated through the sequence of models. Evaluations of the results of individual models without the acknowledged compounding uncertainty from previous models risk subsequent false assumptions of model output precision.

In the case of alternatives modeling for the Project EIS, there were uncertainties in the input datasets feeding the Basin-wide Model, and inherent limitations in the model to predict salinities, water levels, land building, and other outcomes. Model outputs should therefore be considered projections, not predictions, because they represent *what would have happened* had the set of conditions in the model been in place at the onset of a particular model production run, rather than a guarantee of *what will happen*. Accordingly, alternatives analysis was, for the most part, limited to the comparison between alternatives, e.g., FWP vs. FWOP, or FWP alternative A vs. FWP alternative B.

CPRA therefore prefers that the numerical modeling conducted for the FEIS not be used directly or solely to establish specific temporal benchmarks of project performance upon which the Project MAM plan will be based. These projections better serve as order-of-magnitude comparative benchmarks for a constrained set of biophysical parameters (e.g., amount of sediment transported through the Project structure), with perhaps some adjustment to acknowledge the model uncertainties.

1.5.2. Use of Data and Numerical Models to Inform Project Monitoring and Adaptive Management

Complex models such as the CASM and EwE ecosystem models listed above are also useful for identifying proxy variables for monitoring when the specific metric of interest cannot feasibly or effectively be monitored directly. For example, the EwE and CASM models will be used to identify additional future monitoring parameters, locations, and frequency (e.g., long-term biomass monitoring, lower trophic level organisms, detritus) to evaluate the Project's influence on food web dynamics. Those additional monitoring parameters may be incorporated into this MAM plan.

Numerical considerations of the data for monitoring parameters binned as Range variables in Section 4 could also be informed by historical data from within the Barataria Basin, although Project operations may lead to data values in time and space outside the available historical ranges. For the remainder of the objectives-related monitoring parameters outlined in Section 3, trends from the modeling are likely more appropriate points of comparison. Operational planning will occur on an annual cycle, allowing an AM approach to test and understand the most effective actual operation of the diversion, considering the uncertainties of annual river flow and how the climate and weather patterns drive basin hydrology.

Throughout the operational life of the diversion, CPRA will periodically utilize numerical modeling to better examine system responses, confirm project performance assumptions that are not directly measurable, and test the potential effects of adaptive operational modifications. The schedule for that modeling will depend on the frequency of Project operations and evaluations of the supporting monitoring data (Section 4).

The Project Adaptive Management Team (AMT) will utilize the most appropriate modeling tools to address AM-related questions. Currently, the CASM and EwE models are being used to assess baseline condition and, in the future, may be used to assess project-driven effects such as potential changes to aquatic biodiversity, trophic linkages and pathways, and overall assemblage structure. Additional refinements may be made to make the models more suitable for evaluating potential adaptive management actions. To accomplish this, additional modifications to the current ecosystem modeling tools must be accomplished to determine model predictive ability to examine potential adaptive management options. Initially, the AMT will focus on the EwE and CASM models used in project planning. In the future, the team may evaluate additional models for use in adaptive management.

To address the use of the models to predict changes under with-project conditions the EwE and CASM models will undergo sensitivity analyses to analyze response of the modeled food web to changes in salinity. A specific series of steps for a multi-model analysis will be identified to improve predictive capabilities and enable bracketing of the uncertainty associated with model projections. For example, two benthic-to-pelagic metrics, biomass and productivity, will be added as output to the two models and examined as time-series outputs including inter-annual and seasonal variability, to understand whether the metrics are sensitive to year-specific conditions or instead are very consistent between years and therefore unlikely to vary in the future. The variability in these metrics will then undergo a statistical analysis to relate them to the environmental conditions used as input to the models. New simulations will be performed by varying environmental conditions in a systematic way to attribute responses of the food web to changes in salinity.

The EwE and CASM models described above will be periodically updated with data collected during pre-operations and post-construction of the Project. Pre-operations data will be used to refine responses of the individual components to environmental drivers. Post-construction monitoring data will be incorporated into model refinement to test, predict, and evaluate responses under with-project conditions.

Periodic evaluations of the models listed in Section 1.5.1, updates to working models including incorporation of new data, the state of the science regarding new models that may be developed over the Project life, and the appropriate use of those existing or new models, will be planned and led by the AMT.

Page intentionally left blank

2. PROJECT OPERATIONAL AND ADAPTIVE MANAGEMENT GOVERNANCE

2.1. Description and Scope

This section outlines the makeup, roles, and responsibilities of the State of Louisiana (CPRA) as the NRDA Implementing Trustee responsible for the governance of the Project, as well as the non-State entities that will inform the implementation of this plan. Figure 2.1-1 shows the general relationship between CPRA as the Implementing Trustee and the LA TIG. CPRA will have responsibility for the operation of the Project, within the limits of the permits and permissions granted to the Project and within the Project purpose, as found in the PDARP (DWH Trustees, 2016), and subsequent Restoration Plans that examine and authorize the Project. Proposals for operations or adaptive management decisions that would be outside the Project purpose or permitted constraints would require consultation with the LA TIG Agencies and Regulatory authorities.

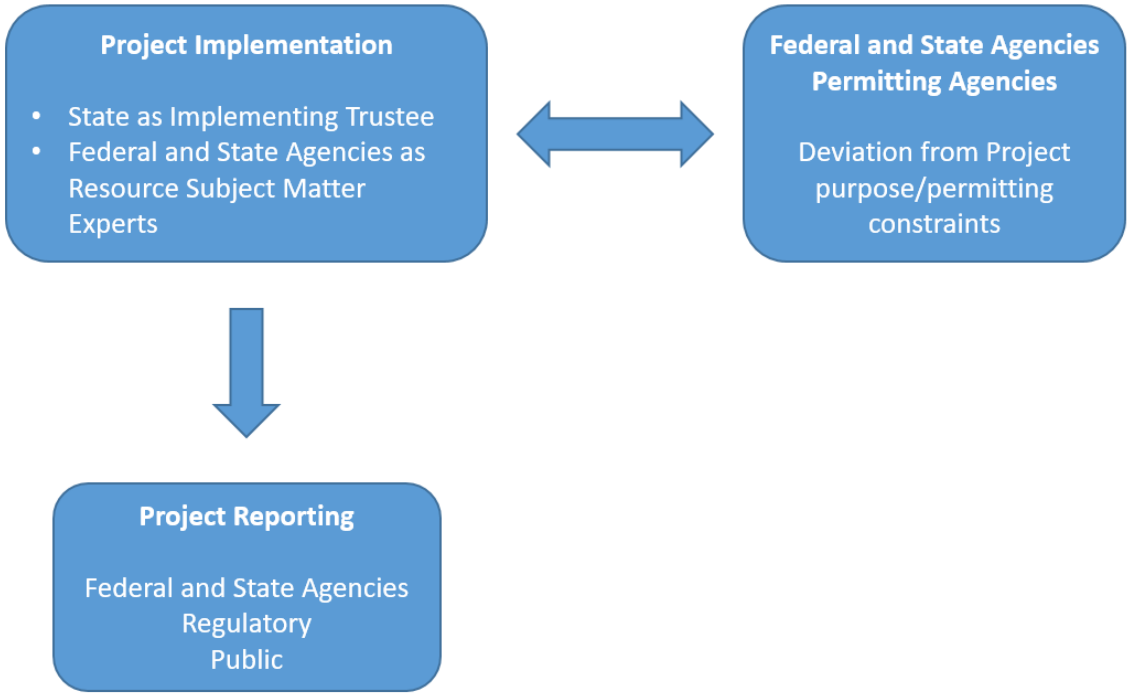


Figure 2.1-1. Relationship between the State of Louisiana and Federal Agencies regarding governance of Project operations and adaptive management decision making. Section 7 contains information on Project Reporting.

In the context of the Project, governance refers to how CPRA, with input from other stakeholders, will make decisions over the life of the Project (Figure 2.1-2). Decisions will include, but not be limited to, continuation of and changes to Project operations, riverside management, monitoring, maintenance, and adaptive management actions.

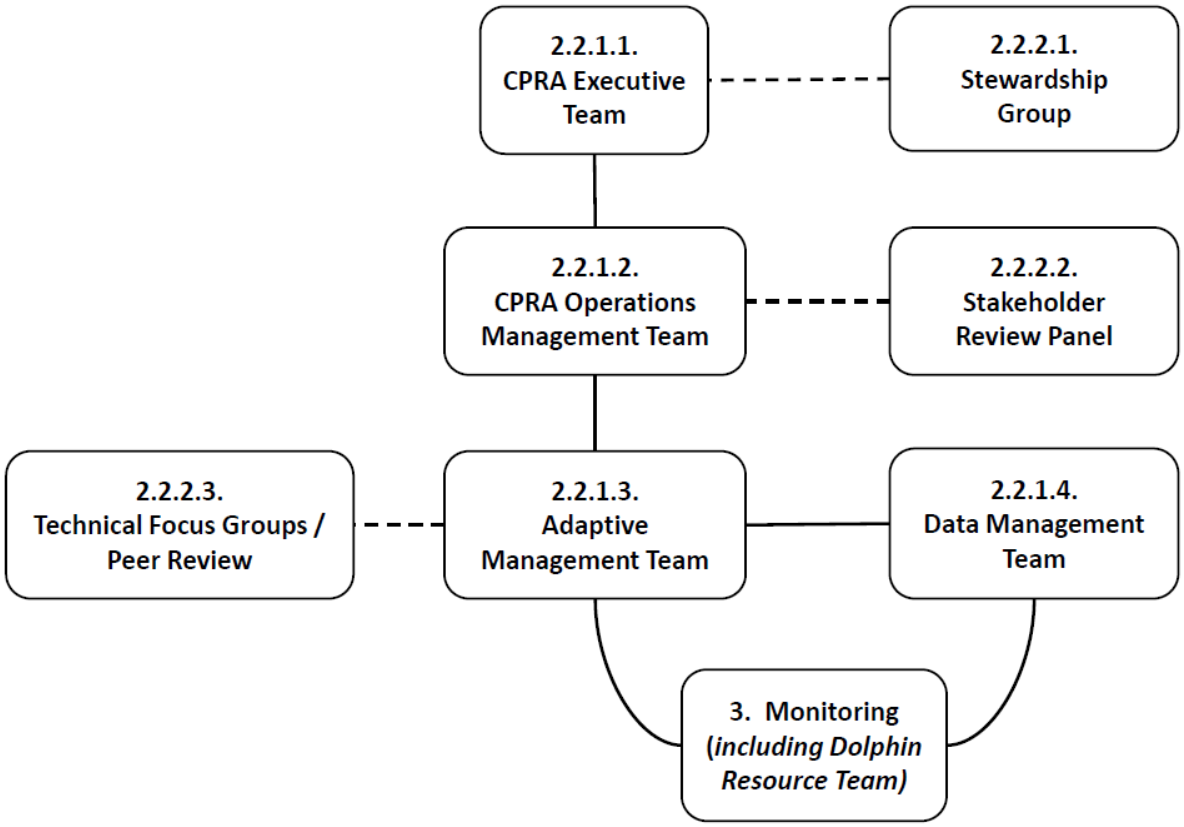


Figure 2.1-2. Information flow between the Project governance elements outlined in this section. Numbers refer to sections of text that further describe each governance element or activity. Solid lines indicate information flow underpinning CPRA Project operations and adaptive management decision making. Dashed lines indicate advisory opportunities from outside CPRA.

2.2. Governance Structure

2.2.1. Project Implementation Teams

2.2.1.1. CPRA Executive Team

2.2.1.1.1. Membership

- Executive Director
- Deputy Executive Director
- Engineering Division Chief
- Operations Division Chief
- Planning & Research Division Chief
- Project Management Division Chief

2.2.1.1.2. Responsibilities

- Approve overall recommendations and annual plan from the Operations Management Team (OMT) and AMT for Project operations; consider adaptive management actions on an event, annual, and multi-year timeline (see Section 5 for additional detail).
- Adopts the Project Annual Operations Plan into the larger CPRA Annual Plan to authorize action and funding
- Interacts with CPRA Board and State Legislature
- Interacts with Stewardship / Associated Actions Group
- Chairs and hosts the public meetings of the Stakeholder Review Panel

2.2.1.2. Operations Management Team

2.2.1.2.1. Membership

- CPRA Operations Division/Diversion Program Assistant Administrator
- CPRA Project Engineer
- Additional State Agency support as needed

2.2.1.2.2. Responsibilities

- Operates structure in accordance with the water control plan: works on day-to-day issues of diversion operation.
- Works with AMT team on efficiency and project performance issues.
- Conducts public and stakeholder review panel meetings.
- Receives information from data team, public information/comments from panel (described below), recommendations from panel
- Develops draft and final annual operations plans, maintain decision log, outfacing data reports, assessment.
- Considers AMT event-based and annual recommendations; implements directly or further discusses recommendations with the CPRA Executive Team.
- Maintains the Project Decision Tracker, which will be a living document, available for public view, that tracks and documents potential management decisions, outcomes, and rationales. This tracker will include all suggestions and comments from public input, and document how each was addressed by CPRA

2.2.1.3. Adaptive Management Team

2.2.1.3.1. Membership

- CPRA Adaptive Management Lead and team
- CPRA Executive Division Senior Scientist
- CPRA Operations Division Monitoring Manager and Project Team
- CPRA Planning & Research Division Senior Scientists
- CPRA Planning & Research Division Liaison
- State and Federal Agency Technical Representatives for Aquatic Resources

2.2.1.3.2. Responsibilities

- Focuses on the long-term achievement of the Project's performance and reducing Critical Uncertainties through Learning Strategies.
- Develops and submits event-based and annual recommendations, such as changes to operations, data collection, or other adaptive modifications, including MAM Plan revision, to the OMT.
- Manages the models and outputs. In addition, they may be called upon to evaluate questions and/or issues that arise during operational periods.
- Authors the periodic Adaptive Management Report that provides a longer-term view for planning purposes, including model outputs and evaluations of potential project features, alternate operations regimes, etc. The AMT may engage Technical Focus Groups (2.3.2.3.) to provide input and/or review of the report. See Section 5.2.3 for the planned reporting schedule.
- Directly authors and/or manages development of issue-specific reports to address questions and concerns that arise from stakeholders. The AMT may convene Technical Focus Groups (2.3.2.3) to assist in evaluation and reporting as needed.
- Coordinates with overall Coastal Program Project Planning.

2.2.1.4. Data Management Team

2.2.1.4.1. Membership

- CPRA Planning & Research Division/Research Section Data Manager
- Additional State Agency support

2.2.1.4.2. Responsibilities

- Manages (collate, host and archive) project monitoring data.
- Manages and/or directly conducts Project data Quality Assurance/Quality Control (QA/QC).
- Works with the OMT and AMT to develop data reports and data interpretations and assessments.
- Works with the AMT, Technical Focus Groups and/or the External Peer Reviewers (2.3.2.3).

2.2.2. Other Teams

2.2.2.1. Stewardship Group

2.2.2.1.1. Membership

- State and Federal agency representatives engaged in implementation of stewardship measures.

2.2.2.1.2. Responsibilities

- Provides insight, comments, and guidance on the Annual Operations Plan is at relates to the effective implantation of Project stewardship measures.

2.2.2.2. Stakeholder Review Panel

2.2.2.2.1. Membership

- CPRA Executive Director or designee (*Chair*);
- Barataria-Terrebonne National Estuarine Program;
- Louisiana Mid-Continental Oil & Gas Association;
- Commercial fisheries:
    - Crab fisheries;
    - Finfish fisheries;
    - Oyster fisheries;
    - Shrimp fisheries;
- Federal agencies;
- Marsh property owners;
- Navigation;
- Parish governments:
    - Jefferson Parish;
    - Lafourche Parish;
    - Plaquemines Parish;
    - St. Charles Parish;
- Protected property owners;
- Recreational fisheries;
- State agencies:
    - Louisiana Department of Environmental Quality (LDEQ);
    - Louisiana Department of Health (LDH);
    - Louisiana Department of Natural Resources;
    - Louisiana Department of Wildlife and Fisheries (LDWF).

2.2.2.2.2. Responsibilities

- Provide insight and comment on a draft Annual Operations Plan
- Share expertise and perspectives on short-term issues
- Disseminate information to other stakeholders / public (each group's representative will report back to their respective group as they see fit)

2.2.2.3. Technical Focus Group(s) / Peer Review

2.2.2.3.1. Membership

- Federal Subject Matter Experts (SMEs)
- State SMEs
- Non-agency (e.g., academic, non-governmental, private sector) SMEs

2.2.2.3.2. Responsibilities

- Provide technical support and use in long-term project planning.
- Assist in the evaluation and interpretation of project monitoring

- External peer review of the Multi-year Monitoring and Adaptive Management Report, outside of the Technical Focus Groups, may be needed or desired
- Groups will be constituted and convened on an as-needed basis.
- Evaluate the state of science concerning adaptive management and tools for adaptive management

2.3. Data and Information Requirements

It is important that project decisions are transparent and data and science-based to the extent possible. This will require:

- A Monitoring Plan that outlines monitoring for sediment delivery efficiency and both ecological and sociological response.
- Data Analysis: The AMT (2.3.1.3) will analyze the Project data. A data analysis plan that provides details on when, where, and how data will be analyzed and what will be produced as a result of the assessment(s).
- Project-specific recommendations for adaptive management actions based on the data assessments, with input from the Technical Focus Groups (2.3.2.3) as needed. Draft recommendations will be assembled into a draft operations plan. It will be important to address and incorporate, to the extent practicable, public input into the operation plan early in the process.

A Data Management Plan to describe how Project-specific data need to be managed to facilitate analysis (Section 7 of this Plan).

3. PROJECT MONITORING PLAN

3.1. Monitoring Plan Development

This section describes the plans to collect pre-operations and post-construction data. With collaboration with the partner resource agencies, CPRA, as the Implementing Trustee, has developed the draft plan with guidance from the Monitoring and Adaptive Management Procedures and Guidelines Manual (DWH Natural Resource Damage Assessment Trustees 2017). The plan describes the types of sampling, methods, and other data that will be used to evaluate Project performance and natural system change and inform AM decision making (Section 4). Monitoring variables were selected to evaluate Project performance in meeting objectives, inform modeling and projection, and conform to accepted measurement techniques.

The pre-operations and post-construction monitoring plans have the following goals:

1. Outline the early deployment of monitoring equipment and sites to ensure the pre-operations conditions are adequately characterized prior to Project implementation;
2. Identify essential variables for evaluating progress towards meeting Project restoration objectives, detecting system change and improving analytical tools over time; and
3. Ensure the update or development of standard operating procedures and quality plans.

3.2. Baseline and Project Monitoring Approach

Pre-operations baseline data collection defines current conditions and trends to compare against observed changes in the system that will occur following initiation of operations. The 'Before-After-Control-Impact' (BACI; Underwood 1992, Smith et al. 1993) monitoring approach in areas anticipated to change is commonly applied with ecosystem restoration projects, and will be used to evaluate parameter data as they pertain to the Project objectives (see Section 4). The long-standing network of existing gauges and sample locations across the Barataria Basin will enable a robust baseline for the Project, against which to compare post-construction data. Additionally, the network of Coastwide Reference Monitoring System (CRMS)-*Wetlands* and System-wide Assessment and Monitoring Plan (SWAMP) sites across coastal Louisiana will be used to understand broader regional drivers and ecosystem trends that may be separate from Project effects. As described in detail below, some of the CRMS-*Wetlands* and SWAMP sites, together with to-be-constructed sites dedicated to Project effects monitoring, will also provide direct observations of Project effects.

3.3. Monitoring and Assessment Design

The sampling design for SWAMP and the additional project-specific sampling proposed herein meets requirements for assessment and AM in the following ways:

- The design provides the basis to reduce uncertainty, improve analytical solutions, and support effective decisions that meet the infrastructure, resource, and social requirements.
- The system variables are measured at frequencies and spatial scales to support evaluation of Project performance.

- Consistency with existing long-term data collection facilitates multiple comparisons (e.g., BACI, baseline, gradient) of Project data. Long-term sampling such as CRMS and the LDWF fisheries-independent monitoring program (FIMP) will provide a solid baseline that can be followed and estimated through the Project life.
- The SWAMP coast-wide spatial coverage increasingly will help separate otherwise potentially confounding regional processes (e.g., RSLR, temperature), event perturbations (e.g., storms, drought,) and climate cycles from real Project effects

The locations, types of data collected, and frequency of post-construction data collection will be reviewed and refined during the Project lifespan to improve operations (e.g., sediment capture from the river and sediment retention in the basin). Monitoring design refinement may involve

- identifying and addressing spatial or temporal data gaps,
- adding or modifying parameters (e.g., physical, biological, chemical, geologic),
- changing, adding and/or removing data collection station locations, and
- undertaking special research or studies (e.g., landscape hydraulic studies; habitat mapping).

3.3.1. Sampling Stratification

A stratified sampling approach will

- structure sampling based on known landscape or population (fish and wildlife, human) attributes,
- improve sampling efficiency and thereby reduce monitoring effort and costs, and
- reduce the uncertainty of population estimates within each stratum, which could reduce the number of plot measurements.

Given the dynamic nature of the environment and Project, fixed sampling locations may need to be changed before and after the onset of Project operations. Thus, re-stratification may be necessary over the life of the Project. Examples of habitat strata (Figure 3.3-1) could include, but are not limited to, created and natural wetlands, marsh type, and land/terrestrial vs. open water/aquatic.

3.3.2. Estimation of Project Delta Development and Project Influence Areas

The proposed Project would introduce sediment, freshwater, nutrients and flows into the Barataria Basin, beyond that already provided by the Davis Pond Freshwater Diversion Project and the Naomi and West Point a la Hache siphons. Operational histories of those other projects will need to be examined to be able to parse out Project effects from those other structures. The extent of the area of influence will be different for specific system resources.

To guide selection of locations for pre-operations monitoring where potential data gaps may occur, two areas of projected Project effects were defined. A smaller Project Delta Development Area (PDDA; Figure 3.3-2) was defined as the spatial extent that the Delft Basin-wide Model projected bed elevation differences would occur between the FWOP and the FWP alternative corresponding to the Applicant's Preferred Alternative (FWP/APA) of a 75,000 cubic feet per second (cfs)-capable diversion structure without associated terraces. A slightly larger Project Influence Area (PIA; Figures 3.3-3 and 3.3-4) was defined that approximates the geographical extent that the Basin-wide Model projected water level

differences between the FWOP and the FWP/APA.

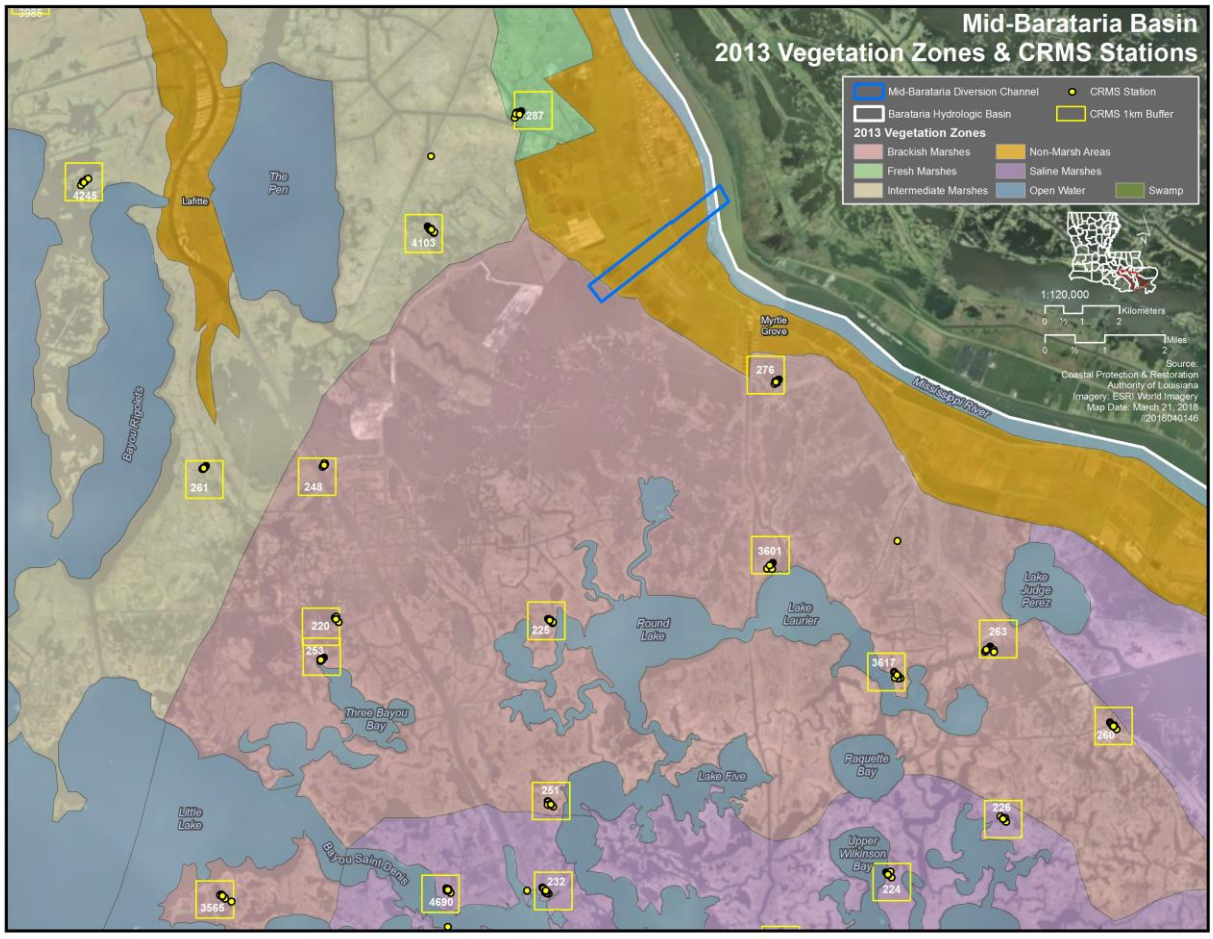


Figure 3.3-1. Example of supporting data to inform stratification and potential selection of additional sites based on vegetation community type from CRMS-*Wetlands* sites and other survey data in the diversion primary influence area. The blue polygon shows the location and orientation of the proposed Project conveyance channel.

While the geographic scope of the monitoring plan is therefore focused on the middle portion of Barataria Basin, it does include the entire basin. Additionally, the PDT is developing riverside monitoring. The Plan was developed with existing monitoring locations and expert knowledge, and is partially informed by statistical analyses completed coast-wide and for Barataria Basin (Hijuelos and Hemmerling 2016).

The monitoring plan includes continuous and discrete sampling of natural system variables, collecting and analyzing remotely-captured data (satellite, aerial), and periodic large-scale surveys. Continuous monitoring refers to the collection of data using automated data recording systems that are permanently deployed with constant and evenly-spaced sampling intervals (e.g., hourly). Discrete monitoring refers to on-the-ground collection usually conducted between longer intervals. Continuous sampling satisfies needs for rich temporal data, while discrete sampling allows for greater spatial information.

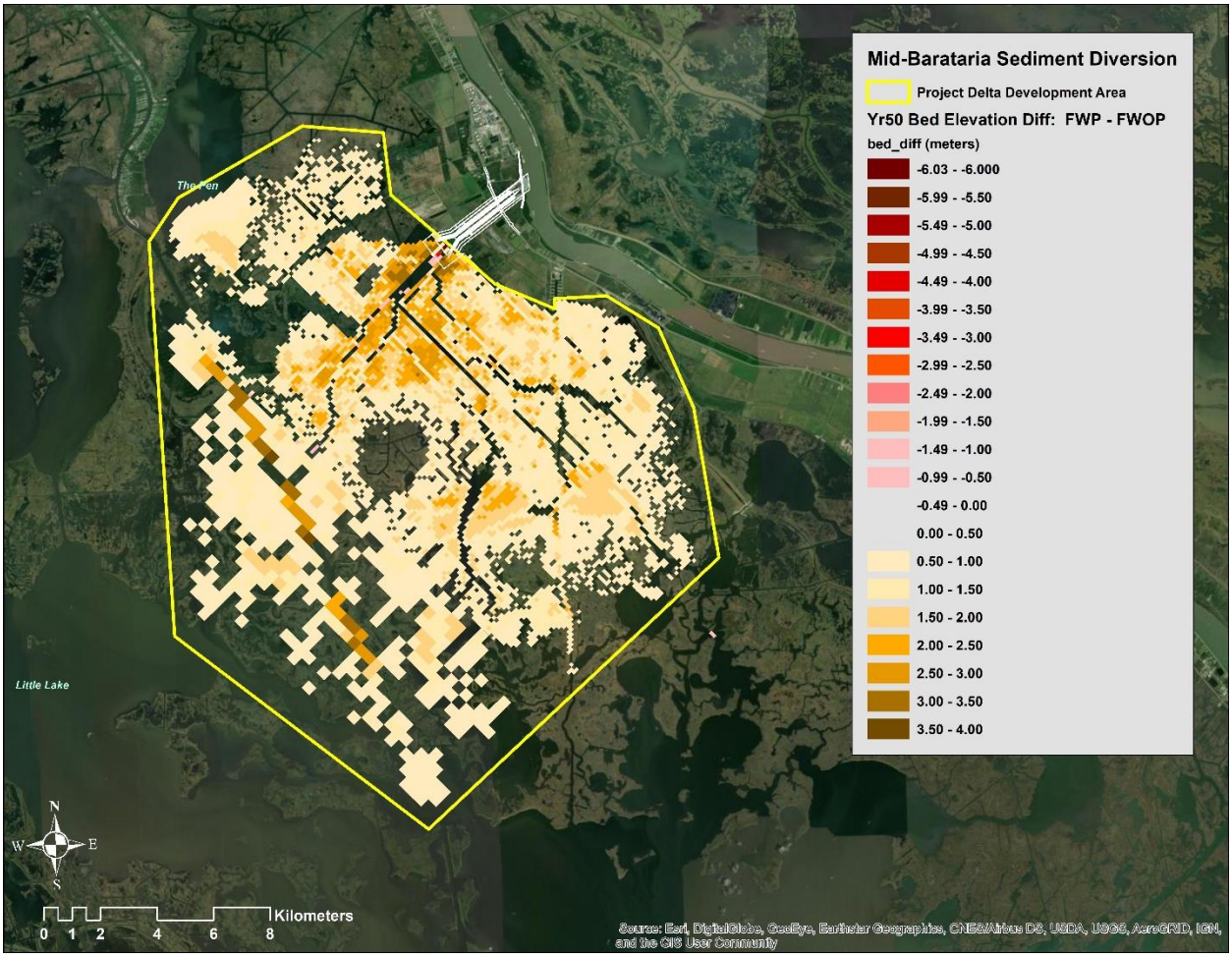


Figure 3.3-2. A Project Delta Development Area (yellow polygon) was defined around the Project outfall as the extent of the area where the Delft Basin-wide Model projected bed elevation differences greater than 0.5 meters between the Future without Project and the Future with Project for the 75,000-cfs Project alternative without terraces after 50-years of Project-effects modeling.

Project alternatives numerical modeling suggested that Project operations may have effects on ecosystem resources in the lower Breton Sound Basin and Mississippi River Balize Delta. Current plans are to rely on the existing SWAMP network sites to continue characterizing the status of those basins.

3.4. Data Sources

The field data to support assessment of baseline and project conditions for the Project have long-standing historic value and are expertise-driven.

3.4.1. CPRA-Coordinated Monitoring Data

CPRA, cooperating State and federal agencies, and TWIG have contributed to the development and ongoing implementation of SWAMP, which is being implemented throughout the Louisiana coastal zone as a long-term monitoring program to ensure a comprehensive network of data collection activities is in place to support the development, implementation, and AM of restoration and risk-reduction projects. While the Barrier Island Comprehensive Monitoring (BICM) and CRMS-*Wetlands* programs have been

well established, SWAMP has also deployed monitoring stations in the bays, lakes, and bayous of the Barataria Basin to provide a more extensive spatial and temporal capacity to detect change and system function. The SWAMP monitoring design provides the framework upon which additional Project-specific locations and variables will be needed to evaluate Project effects.

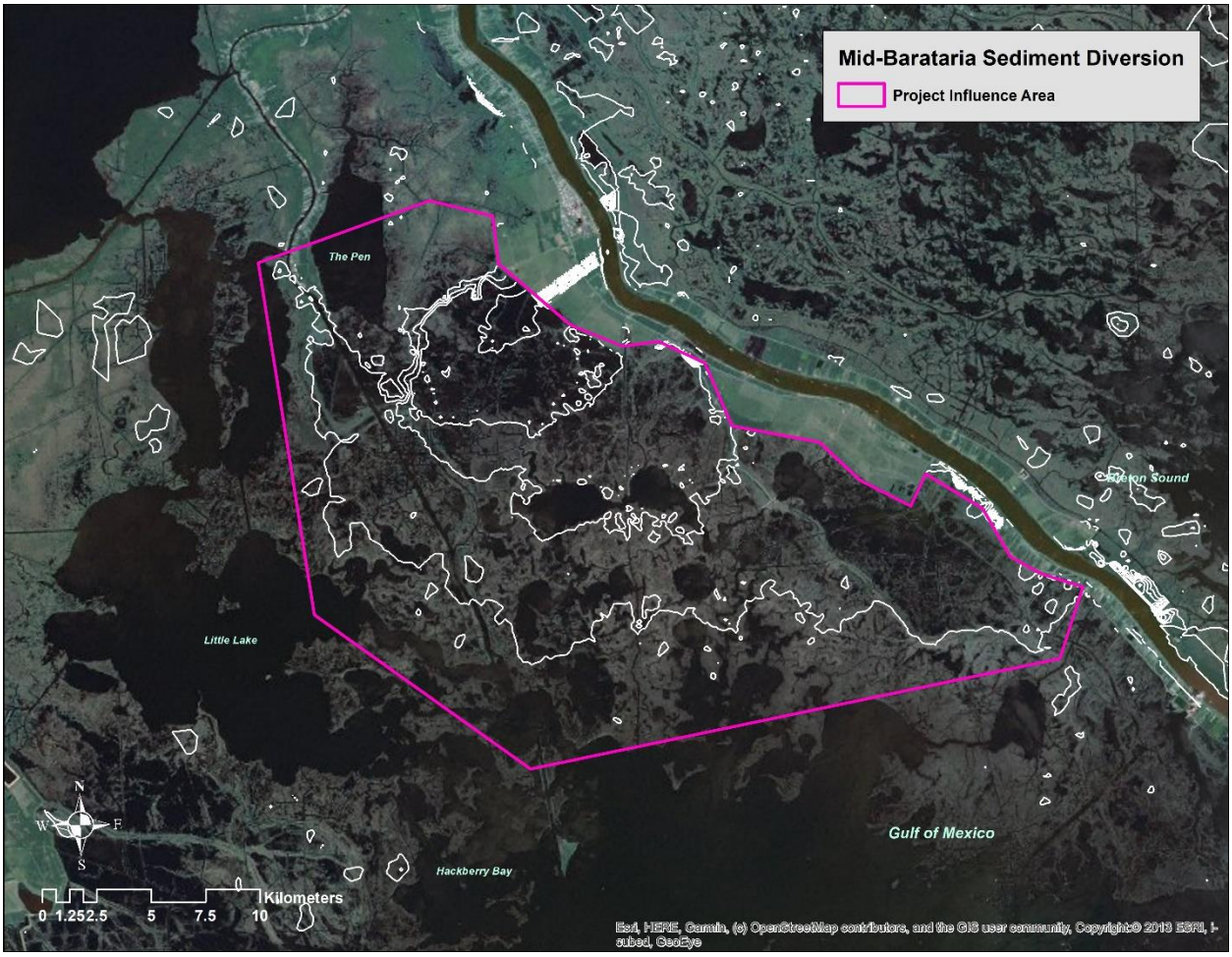


Fig. 3.3-3. A Project Influence Area (magenta polygon) was defined around the Project outfall as the maximum extent of the area where the Delft Basin-wide Model projected water level differences of at least 0.5 meters (white lines) between the Future without Project and the 75,000-cfs Applicant's Preferred Alternative without terraces. The water level differences shown are specifically for the third week of May during the first decade modeled, using a 2011 Mississippi River hydrograph.

3.4.2. Other Monitoring and Survey Data

There are numerous historic and ongoing data collection efforts in Barataria Basin that will provide data for baseline and project assessments of system resources and change (Hijuelos and Hemmerling 2016). CPRA is coordinating with other State and federal agencies to supplement and maintain quality long-term data collection efforts in the basin (e.g., LDWF fish and invertebrate sampling programs; LDEQ water quality sampling; repeated National Oceanic and Atmospheric Administration (NOAA)/DWH-funded marine mammal surveys). Monitoring of previously-constructed restoration projects in the Project area (Figure 3.4-1) and Barataria Basin will provide valuable data to define historic and current trends, and thus clarify Project effects and potential synergistic or antagonistic responses from those of

other restoration and risk reduction efforts in the basin. CPRA will continue to evaluate other sources of research, surveying, and monitoring data that are acceptable for Project use to reduce monitoring costs.

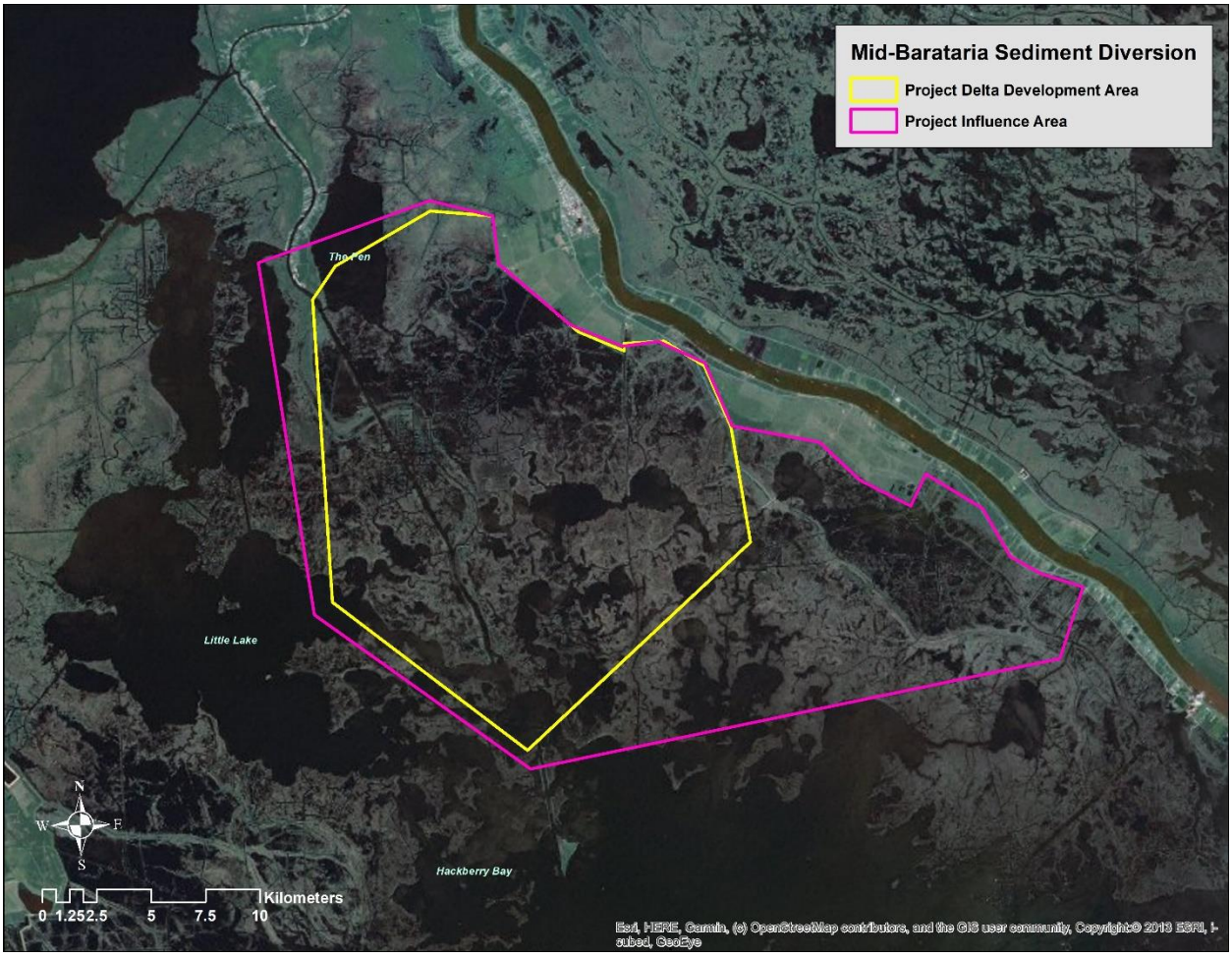


Figure 3.3-4. Comparison of the spatial extent of the Project Delta Development Area (yellow polygon) and the Project Influence Area (magenta polygon).

3.5. Pre-Operations (Baseline) Monitoring

To establish baseline conditions in the main stem of the MR and in the Barataria Basin, data will be collected prior to the onset of Project operations upriver of the diversion structure, from the Alliance South lateral sandbar in front of the eventual diversion structure, from near the planned structure intake, and from environmental gradients radiating from the outfall into Barataria Basin and from existing SWAMP monitoring stations in the Breton Sound Basin and the modern Balize Delta. In addition to the existing SWAMP monitoring locations, monitoring plans will evolve as needed to include additional variables and/or locations where data collection will be required to evaluate system change and Project performance. For example, the types and locations of river monitoring to inform operations will progressively be elaborated upon with progress on the design of the intake and conveyance structure and physical modeling.

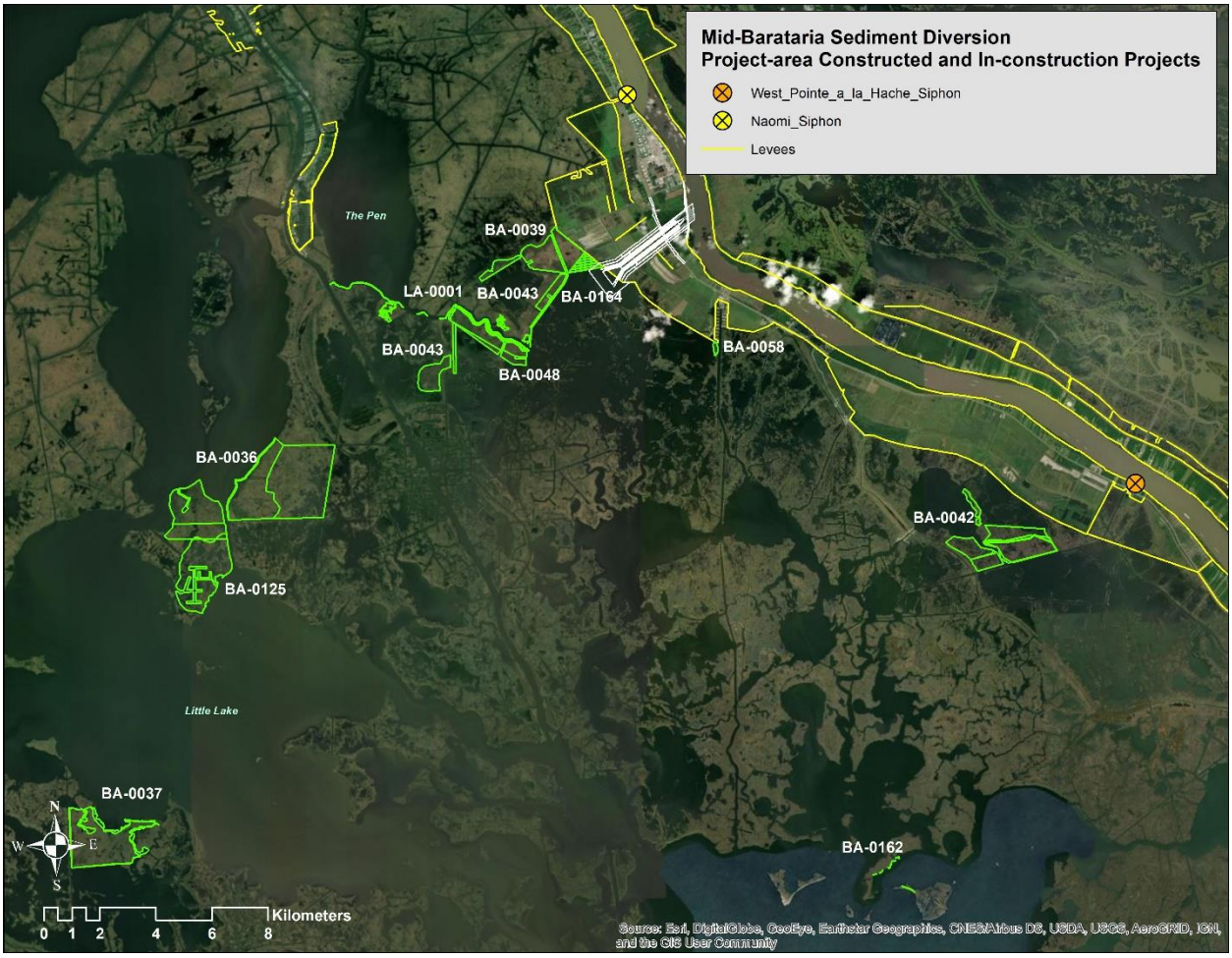


Figure 3.4-1. Previous restoration projects in the Project region are shown with the green polygons, and in relation to the locations of the existing freshwater siphon projects in the area. The white polygon shows the location and orientation of the proposed Project conveyance channel. Yellow polygons indicate levees.

Components of SWAMP monitoring in Barataria Basin are operational and others are in development, consistent with the SWAMP implementation strategy for the basin (Hijuelos and Hemmerling, 2016). Additional Project-specific monitoring sites (such as hydrographic and water quality data collection platforms) will be established to better inform Project effects. Specific locations for some additional monitoring sites have been identified, while decisions on others are still pending. While Project-specific baseline data will be collected for a minimum of three years prior to the onset of Project operations, the Plan will further describe other relevant long-term data that will be used to strengthen baseline trends assessment. For example, wetland condition variables and process rates have been monitored extensively in Barataria Basin at 65 CRMS-*Wetlands* sites for more than 10 years. In addition, there are numerous CPRA-coordinated project data sets and other long-term natural systems data that have been collected by researchers and both State and federal agencies that support comprehensive ecosystem and project-scale assessment (Hijuelos and Hemmerling 2016).

3.6. Post-Construction (Operations) Monitoring

Following the onset of Project operations, data collection will continue as discussed in Section 3.5 above, and from within the diversion conveyance channel. Post-construction, hydrographic stations in the MR will be real-time and accessible from satellite networks to enable forecasting water and sediment arrival. Along the gradient from the MR through the diversion and into the basin, CPRA is planning for the use of real-time data for key hydrographic variables (turbidity, stage, velocity, and water quality). CPRA will also monitor structural and operational features of the Project structure (see the OMRR&R Plan for those details).

3.7. Parameters for Evaluating Project Effectiveness and Ecosystem Response

Effectiveness monitoring provides the basis for determining whether the Project objectives outlined in Section 1.2 will be met. Those restated objectives (below) frame the structure and activities of the detailed pre-operations and post-construction monitoring plans that follow. The empirical parameters and any secondary calculations based on those parameters are outlined below relevant to each of the three Project objectives.

3.7.1. Objective #1: Deliver freshwater, sediment, and nutrients to Barataria Bay through a large-scale sediment diversion from the Mississippi River

Objective 1 reflects the primary operational goal of the Project and rationale behind the construction of a large sediment diversion, which is that operation of a diversion structure is the most efficient, effective and sustainable mechanism for moving large amounts of MR sand-size suspended sediments into the middle region of the Barataria Basin.

Many of the monitoring parameters and resulting calculations listed below will be limited to post-construction monitoring because they will involve monitoring aspects of the constructed Project structure. However, some in-river monitoring components will be developed for pre-operations monitoring to establish baselines of MR resource status and variability and to evaluate potential impacts in the MR and the Basin.

3.7.1.1. Empirical Monitoring Parameters in Support of Objective 1

3.7.1.1.1. Mississippi River water discharge

- Rationale: As proposed in the Project permit request, expectations for an MR discharge of 450,000 cfs on a rising limb at Belle Chasse will trigger Project operations beyond a base flow of up to 5,000 cfs. Sand-size sediment does not typically start mobilizing from lateral bars until the MR flow is at 600,000 cfs (Allison et al., 2012), but the first flush of fine sediments typically occurs at lower discharges. Mississippi River water discharge is thus fundamental to monitor throughout the Project life.

- Schedule: Real-time measurements planned currently for the entirety of both pre-operations and the 50 years of post-construction monitoring. Event-based transect monitoring will occur during the first five years of Project operations to confirm real-time estimates.

- Locations: Multiple upstream gauging stations will be monitored for different purposes. The U.S. Geological Survey's (USGS) Mississippi River at Memphis, Tennessee, gauge (#07032000) will be used to initiate planning for Project operations, given that typical water velocities in the MR mean that discharge at Memphis is a three-week lead-in to flows reaching the Project location. This data will be evaluated in concert with MR discharge forecasts provided daily by the National Weather Service's Lower Mississippi River Forecasting Center (LMRFC). Current plans are for observations at the USGS Mississippi River at Belle Chasse, LA gauge (#07374525), which is not included in LMRFC discharge forecasts to govern Project operations. Several years of anticipated pre-operations monitoring will allow for the confirmation of the mathematical relationship between Belle Chasse and the other gauges mentioned.

  The USGS Mississippi River at Baton Rouge, LA (#07374000) and the aforementioned Mississippi River at Belle Chasse, LA gauges will also be monitored to support continued estimations of coarse and fine suspended sediment load, as was done for the Delft Basin-wide Project modeling. This data will help verify past model estimates and support future modeling.

  The PDT has proposed that anticipated MR discharges at Belle Chasse of 450,000 cfs should initiate empirical, boat-based data collection of MR discharge at a cross-river transect (Table 3.7-1 and Figure 3.7-1) used during pre-operations to support E&D activities. The "2018 Reference Section" transect was used during the 2018 MR data collection.

  Table 3.7-1. Endpoint coordinates of Mississippi River Project cross sections used for preliminary E&D. All coordinates are in UTM 15N meters NAD83. Transect locations are shown in Figure 3.7-1.

Location	Right Water Edge/ Right Descending Bank (Northing, Easting)	Left Water Edge/ Left Descending Bank (Northing, Easting)
Primary Reference Section	3286460.680, 793822.861	3286655.441, 794486.710
2018 Reference Section	3285238.719, 793987.484	3285299.128, 794737.097

- Methodology:
  - Continuous estimated MR discharge is provided in real time by USGS at the Baton Rouge and Belle Chasse gauge locations referenced above.
  - Direct empirical estimations of velocity will be made during operational events using Acoustic Doppler Current Profilers (ADCPs; see Oberg et al. 2005 for discussion of the methodology). Measured concurrently with bathymetric measurements of the cross-sectional area of flow, these data allow an estimation of MR discharge via Equation 1.

    Discharge (cfs) = Cross-sectional area of flow (square feet) x velocity (f/s) ***Eqn. 1***

- Parties Responsible for Data Collection
  - Continuous discharge estimations at Mississippi River Memphis, Baton Rouge and Belle Chasse gauges: USGS
  - Boat-based direct empirical discharge estimations: CPRA contractor.

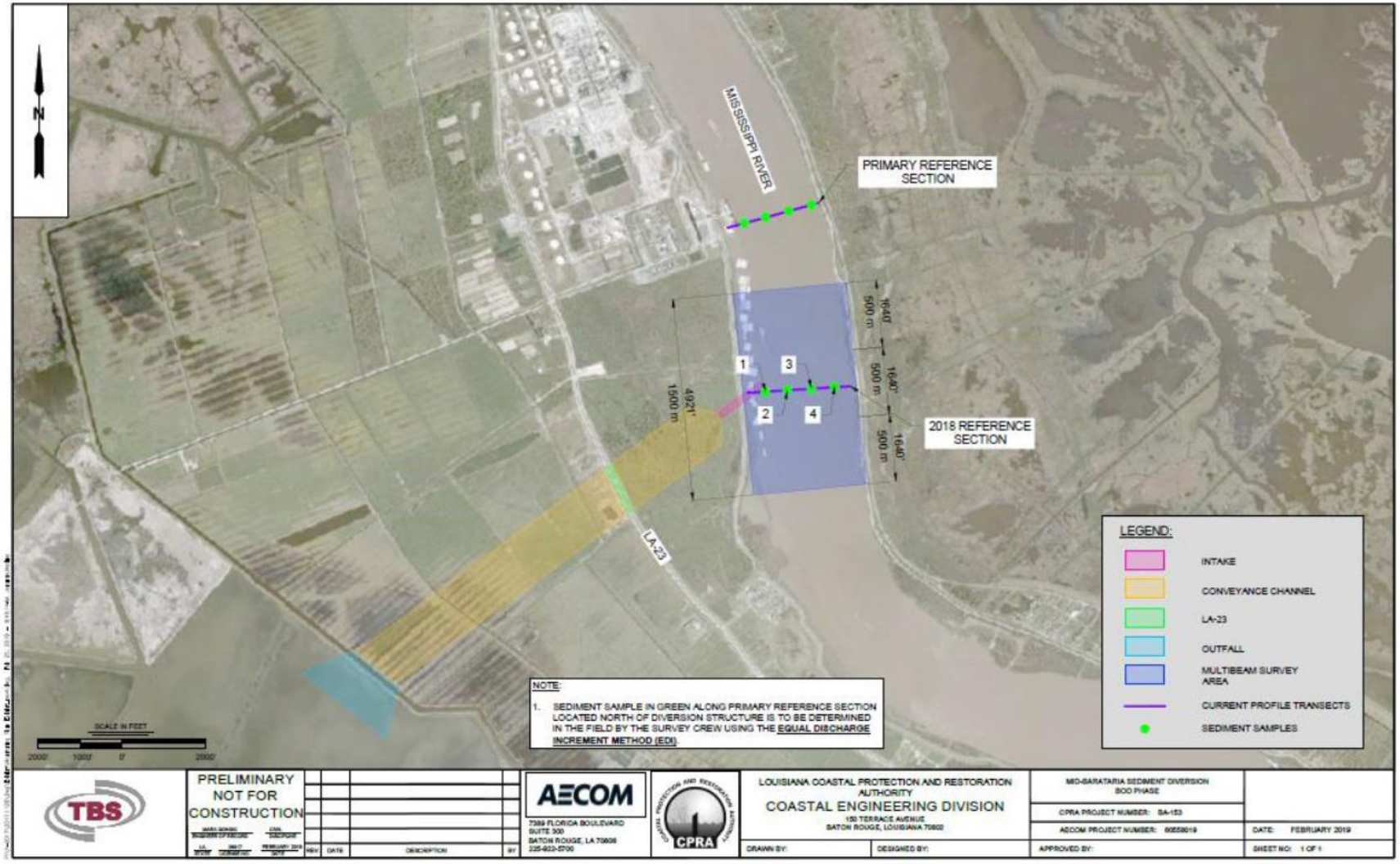


Figure 3.7-1. Location of the Mississippi River near the Mid-Barataria Sediment Diversion, showing transects and sampling points currently being studied for E&D purposes. The sampling points (green squares) on the two transects (purple lines) are shown in relation to the Project construction footprint, just south of the Alliance refinery.

3.7.1.1.2. Mississippi River suspended sediment concentrations

- Rationale: River suspended sediment measurements will provide estimations of the inorganic sediment load characteristic of the MR and the sediment load anticipated for the Project, analyzed on an event-by-event basis. Sediment characteristics in each flood event are dependent on weather and associated erosion within the entire MR watershed. As such, while each independent flood event may be similar to historical flood events, each event will be unique in the flow rates, wash load, duration, and ability to initiate bed load transport and suspension of sand within the diversion.

- Schedule: Real-time measurements are currently planned for the entirety of both pre-operations and the 50 years of post-construction monitoring at the USGS Baton Rouge and Belle Chasse gauges discussed for monitoring of *Mississippi River water discharge* (3.7.1.1.1). The PDT estimates five years of additional boat-based data collection at the Belle Chasse gauge and at or nearer the Project structure to refine sediment availability estimates.

- Locations: Suspended sediments will continue to be monitored at the USGS Baton Rouge and Belle Chasse stations to identify the sediment availability for the proposed diversions dependent on the characteristics of each individual flood event.

  The E&D activities are designed to investigate suspended sediment load at transects and sample points described in Table 3.7-1 and Figure 3.7-1 and those to be defined for the Project operational phase. Sediment concentration samples will be collected at four locations (vertical stations; Table 3.7-2) along each cross-section and at five depths at each of the vertical stations.

  Table 3.7-2. Coordinates of sampling points on 2018 Mississippi River cross-section. Points correspond to those shown in Figure 3.7-1.

Point	Northing	Easting
1	3285250	794121
2	3285260	794280
3	3285280	794453
4	3285300	794622

- Methodology:

  USGS currently monitors turbidity at the Baton Rouge and Belle Chasse gauges via continuously-recording turbidity probes. However, USGS does not regularly collect physical samples of suspended sediments for laboratory analysis of grain size, nor to support estimates of sediment load at Belle Chasse. Data and samples collected from October 2012 through May 2016 do show a strong direct relationship between turbidity and both total suspended sediment concentration (USGS P80154; $R^2 = 0.8262$; n = 55) and estimated total suspended sediment discharge (USGS P80155; $R^2 = 0.5699$; n = 55) at the site.

  There were direct relationships between turbidity and the percent of suspended sediments smaller than 0.0625 mm ($R^2 = 0.4961$) and smaller than 0.125 mm ($R^2 = 0.5278$) for December 2015 - June 2016 samples collected at Belle Chasse, but the number of observations were small

(n = 7 and 6, respectively), and the data reflect only a single MR flood season.

Observed gauge height did provide some predictability with suspended sediment mass for data and samples collected at Belle Chasse from December 2018 through January 2020. The direct relationship between gauge height and mass of suspended sediments larger than 0.063 mm (i.e., sand; USGS P91159) was strong (R^2 = 0.5636; n = 16), while the relationship between observed gauge height and the mass of suspended sediments smaller than 0.063 mm (i.e., silts and clays; USGS P91158) was weaker (R^2 = 0.2363; n = 16).

The USGS Mississippi River at Belle Chasse, LA gauge is roughly 13 miles north of the Project site. If used for the continuous monitoring of turbidity, discrete sampling of suspended sediments would be required at that site to establish the regression model needed to use turbidity as a surrogate for suspended sediments. Prior to selecting this site as the permanent continuous monitoring location for turbidity, suspended sediments sampling at the Project site may also be required to determine if there is a significant difference in turbidity between the two locations.

Sediment concentration samples at the reference and Project cross-sections will be taken using a P-6_200 isokinetic sampler. TSS and concentrations of sand (> 63 micron) and silt/clay (≤63 micron) will be determined using methods similar to the 2008-2011 (Allison, 2011) and 2018 (Allison et al., 2018) studies.

Replicate sediment concentration measurements will be made at the two most westward vertical stations at 70 and 90% water depth, to provide sufficient sand sample volume for sieve analysis. Conductivity/temperature/depth (CTD) casts will be made at the same time as the sediment concentration measurements at each vertical station to help calibrate measurements.

ADCP data will be collected during every isokinetic suspended sediment collection activity and the start and ending ensemble should be separately noted for the duration of each point collection (i.e., the interval between each bottle opening and closing). This data will be used to correlate the backscatter data to the sediment concertation data from the isokinetic sampling.

Sediment concentration samples will be collected at four locations (vertical stations) along each cross-section and at five depths at each of the vertical stations. The depths are 10, 30, 50, 70 and 90 percent of the local water depth. At each cross section, the Equal Discharge Increment method should be used in the field to determine the four vertical stations. The four vertical stations that were sampled at the 2018 cross section are located at coordinates in Table 3.7-2.

- Parties Responsible for Data Collection
    - Continuous turbidity and discrete suspended sediment load estimations at Mississippi River Baton Rouge and Belle Chasse gauges: USGS
    - Boat-based direct empirical suspended sediment load estimations: CPRA contractor.

3.7.1.1.3. Mississippi River nutrient concentrations

- Rationale: Nutrients in Mississippi River water, primarily nitrogen (N), phosphorus (P) and sulfur (S), are necessary for phytoplankton and emergent vegetation growth in estuarine ecosystems. While those resources in Barataria may benefit from diverted MR water, there are concerns that

nutrient delivery in excess of the needs of primary producers could lead to phytoplankton blooms in the open estuary, growth alterations to emergent vegetation, and increases in the rate of bacterially-mediated soil organic carbon decomposition. Measuring nutrient concentrations entering the diversion discharge will support the calculation of *Nutrient loads conveyed into Barataria Basin* (3.7.1.2.4).

- Schedule: Planned to occur once monthly for the first three years of Project operations to confirm relationships between the USGS regular monitoring at the Belle Chasse gauge. After that, the Project team plans to rely on ongoing USGS monitoring.

- Locations: Currently the USGS estimates MR (nitrate + nitrite)-N concentrations at the Mississippi River at Baton Rouge, LA gauge (#07374000) using a continuously-reading sensor. USGS periodically collects and analyses grab samples of river water at Baton Rouge for several chemical species of N, P and S.

- Methodology:

  USGS measures (nitrate + nitrite)-nitrogen at the Baton Rouge gauge using a continuously-reading sensor. USGS periodically collects and analyses grab samples of river water at both Baton Rouge and Belle Chasse for (nitrate + nitrite)-N (USGS P00631), (ammonia + ammonium)-N (USGS P00608, total Kjeldahl N (ammonia + organic N; USGS P00623), and total N (USGS P00602).

  Dissolved orthophosphate (PO_4^{3-}-P) is typically determined through wet chemistry of grab samples (USGS P00671), as is total P (USGS P00666). However, newer sensors that can detect orthophosphate may be installed at Baton Rouge and/or Belle Chasse. However, because orthophosphate adsorbs to clay particles in riverine water, it is necessary to use an acid digestion to free orthophosphate from suspended sediments to better characterize concentrations in the river. As well, total P in a sample of river water can be determined through similar laboratory analyses.

  Dissolved sulfate is likewise analyzed by USGS at the Baton Rouge gauge using the same grab samples and respective analytical chemical methods (USGS P00945).

- Parties Responsible for Data Collection

  Continuous sensor-based and discrete nutrient concentration sampling and analysis at the Mississippi River Baton Rouge and Belle Chasse gauges: USGS and/or CPRA contractor.

3.7.1.1.4. Bathymetry of the Alliance South sand bar

- Rationale: Multi-beam bathymetric measurements will support estimations of sediment consumption and replenishment, and thus the productivity and sustainability of the Alliance South lateral sandbar as a sediment source for the project through calculations of the change in volume of the Alliance South sand bar. The multi-beam bathymetry will also record the morphology of the lateral bar and provide a calibration data source for the Deltf3D Outfall Management Model.

- Schedule: Planned annually during the pre-operations period and both before and after each Project operational event for the first five years of post-construction monitoring. The Project Operations Team will evaluate then what frequency of operations will be maintained.

- Locations: The Alliance South sandbar (Figure 3.7-2; will be monitored routinely with high-resolution velocity and bathymetric surveys along transects that were established for design data collection and earlier studies. Transects were arranged to capture upstream and downstream bar morphology changes. The monitoring of the bar dynamics during and after annual operations will be essential to understanding stability of the sand-size sediment supply through both diversion and replenishment of the lateral bar.

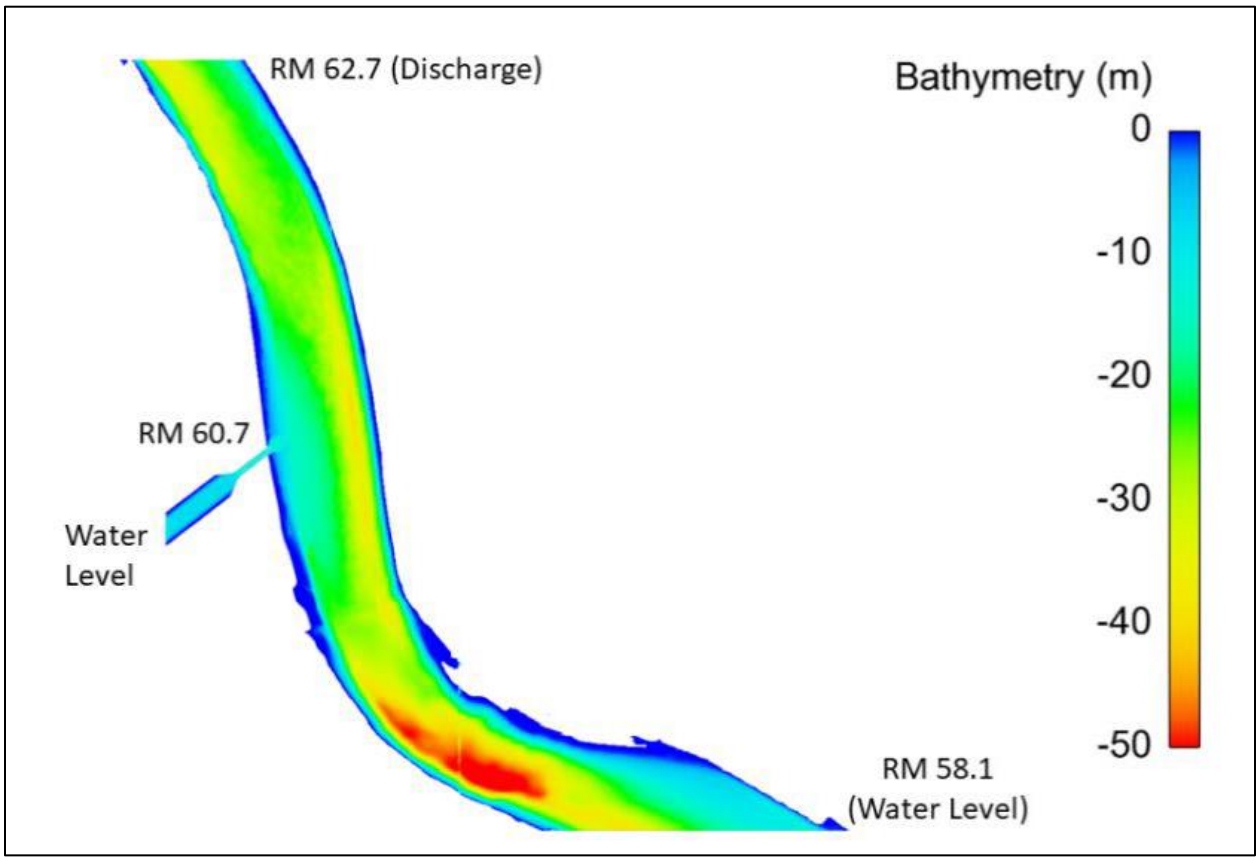


Figure 3.7-2. The lateral bar near the River Mile 60.7 diversion intake (area of shallow bathymetry in front of the diversion structure) will be monitored routinely with high-resolution velocity and bathymetric surveys along transects that have been established for design data collection and earlier studies. Figure from (Moffat & Nichol, 2012)

- Methodology: During Project E&D, the multi-beam surveys will be conducted during two discharge events and both before and after the flood season. The surveys during the flood event should be coordinated with the cross-section sampling, which will occur when the discharge at Belle Chasse is at least above 600,000 cfs. The PDT prefers that the other event survey occurs near 1,000,000 cfs or at the flood event peak, and then on the falling limb at 850,000 cfs or 600,000 cfs, depending on the flood event and the data needs for calibration/validation of the Delft Outfall Management Model.

The flood season survey should be made before the rising limb of the first event reaches 450,000 cfs at Belle Chasse and one during a falling limb of the river discharge at the end of the flood season, also below 450,000 cfs. These surveys should be carefully coordinated between CPRA, USGS and the sediment and water quality testing laboratories and monitoring teams.

The pre- and post-season surveys will cover the entire lateral bar, while the during-event surveys will be concentrated within 750 meters upstream and 750 meters downstream of the diversion sampling location. The event surveys will include the entire width of the river and be centered on the monitoring cross-section station. These during event surveys are required for tracking bed form movement and associated bed load transport. The bed load surveys shall be taken in 500-meter sections within the river to ensure an area is collected within an approximated 2-hour period. A 25-meter overlap between each 500-meter section is planned to provide adequate linkage of the survey transects. At each sampling station survey, there should be two surveys – one taken at the time of initial sediment sampling and the second survey should be taken within approximately 24 hours.

The rate and magnitude of change in the volume of the Alliance South sand bar will be calculated as

$$\textit{Rate of change} = \frac{(\textit{Volume of the Alliance South sand bar at time } x+1) - (\textit{Volume of the Alliance South sand bar at time } x)}{\textit{Time between measurements.}} \qquad \textbf{\textit{Eqn. 2}}$$

$$\textit{Magnitude of change} = (\textit{Volume of the Alliance South sand bar at time } x+1) - (\textit{Volume of the Alliance South sand bar at time } x) \qquad \textbf{\textit{Eqn. 3}}$$

- Parties Responsible for Data Collection
  - Repeated channel conditions surveys: USACE
  - Pre- and post-season surveys for at least the first five years of operations: CPRA contractor

3.7.1.1.5. Sedimentology of the Alliance South sand bar

- Rationale: Sediment sampling of the Alliance sand bar will support estimations of the sustainability of the sand bar as a coarse-grained sediment source for the project.

- Schedule: See discussion of schedule under *3.7.1.1.2. Mississippi River suspended sediment concentrations* (sampling will be coincident for both parameters).

- Locations: Sedimentology samples will be collected coincident with the *Bathymetry of the Alliance South sand bar* (3.7.1.1.4).

- Methodology: Bed samples will be taken at each vertical station using a BM-54 sampler (https://water.usgs.gov/fisp/products/4103004.html). These should be taken at the same time as the sediment concentration samples and CTD casts. The BM54 sampler will typically take a sample 3 inches deep into the sediment. Samples will be transported to the testing laboratory where the grain size of the sediment and sand- and silt-size sediment volumes will be determined. The PDT has coordinated with Mead Allison, who will be conducting a similar data

collection for the Mid-Breton Project, to assure that they will take a similar depth sample with the Shipek sampler (*sensu* Ramirez and Allison 2013) and thus provide consistency in measurements.

- Parties Responsible for Data Collection: CPRA contractor

3.7.1.1.6. River bathymetry at and around the Project structure inlet

- Rationale: Repeated bathymetric surveys of the MR and the Project structure inlet are necessary to support calculations of the rate and magnitude of change in river bathymetry at the Project structure inlet to determine if bed scour/erosion or shoaling are occurring. Both siltation and scour would limit Project operations and would form the basis for AM actions. Erosion has been seen at the mouth of the West Bay Sediment Diversion where it penetrates the right descending bank of the river downstream of Venice, Louisiana (Brown et al., 2009), and in the batture in front of Mardi Gras Pass on the left descending bank downstream of the terminus of the MR&T levee (Lopez et al., 2014).

  Calculation of the rate and extent of change in the elevation of the MR bottom at the Project inlet structure inlet will indicate if siltation or scour is occurring.

- Schedule: See discussion under *3.7.1.1.4. Bathymetry of the Alliance South sand bar*. Surveys will be coincident for the two variables.

- Locations: Specifics will be coordinated with the event surveys – standard and reference cross sections.

- Methodology: Boat-based multi-beam bathymetry on 50-foot centers at the structure inlet and for 1,500 feet both upstream and downstream of the structure. Exact methodologies are expected to be similar to those used by the USACE New Orleans District when they conducted a multi-beam bathymetric survey from Mississippi River Mile (RM) 0 – 324 during July 2011 – June 2013. Data are available at https://www.mvn.usace.army.mil/Missions/Engineering/Channel-Improvement-and-Stabilization-Program/2013MBMR/.

  The rate and magnitude of change in river bathymetry will be calculated as

$$Change\ rate = ((River\ bathymetry\ at\ the\ Project\ structure\ inlet\ at\ time\ x + 1) - (River\ bathymetry\ at\ the\ Project\ structure\ inlet\ at\ time\ x)) / (Time\ between\ measurements)$$

Eqn. 4

$$Change\ magnitude = (River\ bathymetry\ at\ the\ Project\ structure\ inlet\ at\ time\ x + 1) - (River\ bathymetry\ at\ the\ Project\ structure\ inlet\ at\ time\ x)$$

Eqn. 5

- Parties Responsible for Data Collection: CPRA contractor

3.7.1.1.7. Topography/bathymetry of the Project Influence Area

- Rationale: Repeated topographical/bathymetrical monitoring of the Project Influence Area will support calculations of the rate and magnitude of change in topography/bathymetry of the Project outfall area and ensure the viability of the Project to convey river water, sediment and nutrients into Barataria Basin. Calculation of the rate and magnitude of change in landscape elevations (topography and bathymetry) of the PIA will indicate if siltation or scour is occurring.

- Schedule: Planned for both pre-operations and post-construction monitoring. Topography and bathymetry will be assayed once prior to the onset of Project operations, annually for years 1-5 after the onset of Project operations, and then at years 10, 15, 20, 30, 40 and 50. Light Detection and Ranging (LiDAR) surveys will be scheduled preferentially in winter to survey as much as possible a "leaf off" environment, but that may not always be possible.

- Locations: The Basin-wide Model projected the extent of the PIA as shown in Figure 3.3-3. The actual extent of detailed receiving basin topographical and bathymetric monitoring may be modified as required based on the first five years of surveys.

  Elevation surveys may also need to be conducted up to two times at up to two additional wetland areas. A conventionally restored wetland and an unrestored wetland, as described in Section 4.1.3, may be used to assess the relative performance of different marsh restoration treatments.

- Methodology: Subaerial elevation surveys will require LiDAR and processing to reduce error associated with plant canopy. The bathymetric surveys may include traditional point survey and other instruments (fathometer, multi-beam) depending on the water depth and vertical/horizontal resolution required. CPRA expects that data collection will be similar to that used by USGS during collection of northern Gulf of Mexico combined bathymetric and topographic data within its Coastal National Elevation Database (CoNED), accessible at https://www.usgs.gov/land-resources/eros/coned

  The rate and magnitude of change in topography/bathymetry of the Project delta development area will be calculated as

  Rate of change = ((Topography/bathymetry of the Project delta development area at time x+1) – (Topography/bathymetry of the Project delta development area at time x)) / (Time between measurements)

  Eqn. 6

  Magnitude of change = ((Topography/bathymetry of the Project delta development area at time x+1) – (Topography/bathymetry of the Project delta development area at time x)

  Eqn. 7

- Parties Responsible for Data Collection: CPRA contractor

3.7.1.1.8. Water volume conveyed into Barataria Basin

- Rationale: Measuring the discharge of water through the diversion structure will provide direct estimates of riverine freshwater transfer into Barataria Basin and support estimations of *Sediment:water in the flows conveyed into Barataria Basin* (3.7.1.2.2), *Sediment volume conveyed into Barataria Basin* (3.7.1.2.3), and *Nutrient loads conveyed into Barataria Basin* (3.7.1.2.4). As per the Project permit request submitted to USACE, Project discharge will be capped at 75,000 cfs at *Mississippi River water discharges* (3.7.1.1.1) greater than or equal to 1,000,000 cfs.

- Schedule: Planned only for post-construction monitoring during the entire flood season each year for the life of the Project.

- Locations: Specifics locations within the conveyance channel will be identified by CPRA.

- Methodology: At the entrance of the intake and the bar area, it is anticipated that an array of velocity and turbidity instrumentation will be deployed. It is uncertain if sediment, water, and nutrient capture is best monitored in the conveyance channel. The most advantageous locations are under consideration by the PDT.

- Parties Responsible for Data Collection: CPRA contractor

3.7.1.1.9. Sediment concentrations in the flows conveyed into Barataria Basin

- Rationale: Measuring inorganic sediment concentrations in the diversion discharge will support the calculation of *Sediment:water in the flows conveyed into Barataria Basin* (3.7.1.2.2) and *Sediment volume conveyed into Barataria Basin* (3.7.1.2.3).

- Schedule: Planned only for post-construction monitoring during the entire flood season each year for the life of the Project.

- Locations: Sample locations will be the same as those developed for *Water volume conveyed into Barataria Basin* (3.7.1.1.8).

- Methodology: See discussion under *Water volume conveyed into Barataria Basin* (3.7.1.1.8). Analyses of sediment samples taken from the conveyance channel, including calculations of Sediment:water *in the flows conveyed into Barataria Basin* (3.7.1.2.2) and *Sediment volume conveyed into Barataria Basin* (3.7.1.2.3), will include measurement by primary grain size (sand/silt/clay).

- Parties Responsible for Data Collection: CPRA contractor

3.7.1.2. Multi-Parameter Calculations in Support of Objective 1

3.7.1.2.1. Mississippi River sediment load

- Rationale: The intent of the Project is to capture a substantial portion of the Mississippi River's sediment load for transport through the Project structure and into the receiving basin.

- Schedule: Planned for both pre-operations and post-construction monitoring.

- Locations: Sample locations will be the same as those developed for *Mississippi River water discharge (3.7.1.1.1)* and *Mississippi River suspended sediment concentrations (3.7.1.1.2)*.
- Methodology:

Mississippi River sediment load = Mississippi River water discharge (3.7.1.1.1) x Mississippi River suspended sediment concentrations (3.7.1.1.2)

Eqn. 8

3.7.1.2.2. Sediment:water in the flows conveyed into Barataria Basin

- Rationale: Based on extensive empirical data collection and numerical modeling, the Project is being designed to optimize the delivery of sediment into the Barataria Basin. Calculation of cumulative inorganic sediment:water is the fundamental metric of the efficiency of diversion sediment transport. Estimating the actual Project sediment:water through the calculations below is needed to confirm those design assumptions, or it could suggest opportunities for additional operational modifications to achieve subsequent improvements in sediment:water. These estimations will also be needed for subsequent numerical model refinement.

- Schedule: Planned only for post-construction monitoring.

- Locations: Depends on the specific monitoring locations developed for *Water volume conveyed into Barataria Basin* (3.7.1.1.8) and *Sediment concentrations in the flows conveyed into Barataria Basin* (3.7.1.1.9)

- Methodology:

$$SWR = \frac{\left(\frac{Sediment\ Concentrations\ in\ the\ flows\ conveyed\ into\ Barataria\ Basin\ (3.7.1.1.9)}{Mississippi\ River\ suspended\ sediment\ concentrations\ (3.7.1.1.2)}\right)}{\left(\frac{Water\ volume\ conveyed\ into\ Barataria\ Basin\ (3.7.1.1.8)}{Mississippi\ River\ water\ discharge\ (3.7.1.1.1)}\right)}$$

Eqn. 9

3.7.1.2.3. Sediment volume conveyed into Barataria Basin

- Rationale: This calculation will establish estimates of the amount of inorganic sediment transported by the structure.

- Schedule: Planned only for post-construction monitoring.

- Locations: Same sampling stations identified for *Water volume conveyed into Barataria Basin* (3.7.1.1.8), and *Sediment concentrations in the flows conveyed into Barataria Basin* (3.7.1.1.9)

- Methodology:

Sediment volume = *Water volume conveyed into Barataria Basin (3.7.1.1.8) * Sediment concentrations in the flows conveyed into Barataria Basin (3.7.1.1.9)*

Eqn. 10

3.7.1.2.4. Nutrient loads conveyed into Barataria Basin

- Rationale: Nitrogen and phosphorus are the primary inorganic nutrients that support primary production in the estuarine emergent wetlands and open water bodies. Concerns exist that excess nutrient delivery to Barataria Basin could lead to phytoplankton blooms (see Section 3.7.3.9), harmful algal blooms (3.7.3.10) and/or the development of low dissolved oxygen (see Section 3.7.3.7). This calculation will establish estimates of the amount of nutrients transported by the structure.

- Schedule: Planned only for post-construction monitoring.

- Locations: Same sampling stations identified for *Mississippi River nutrient concentrations (3.7.1.1.3)* and *Water volume conveyed into Barataria Basin* (3.7.1.1.8)

- Methodology:

N/P/S load = *Water volume conveyed into Barataria Basin (3.7.1.1.8) * Mississippi River nutrient concentrations (3.7.1.1.3)* **Eqn. 11**

3.7.2. Objective #2: Reconnect and re-establish sustainable deltaic processes between the Mississippi River and the Barataria Basin

3.7.2.1. Empirical Monitoring Parameters in Support of Objective 2

3.7.2.1.1. Water velocities at multiple locations in the Barataria Basin

- Rationale: The fundamental objective of hydrography is to document changes to the horizontal and vertical movement of water within the Project area. This has bearing on changes to the physical environment as well as to the deposition of sediments and the zonation and persistence of wetland vegetation.

- Schedule: Planned for both pre-operations and post-construction monitoring.

- Locations: Two velocity meters are currently being installed in Barataria Basin (Figure 3.7-3), with another four proposed. Project-specific velocity meter locations are still being determined.

- Methodology: Use of real-time or continuous ADCPs to determine velocity of water movement, may be depth-averaged or point values

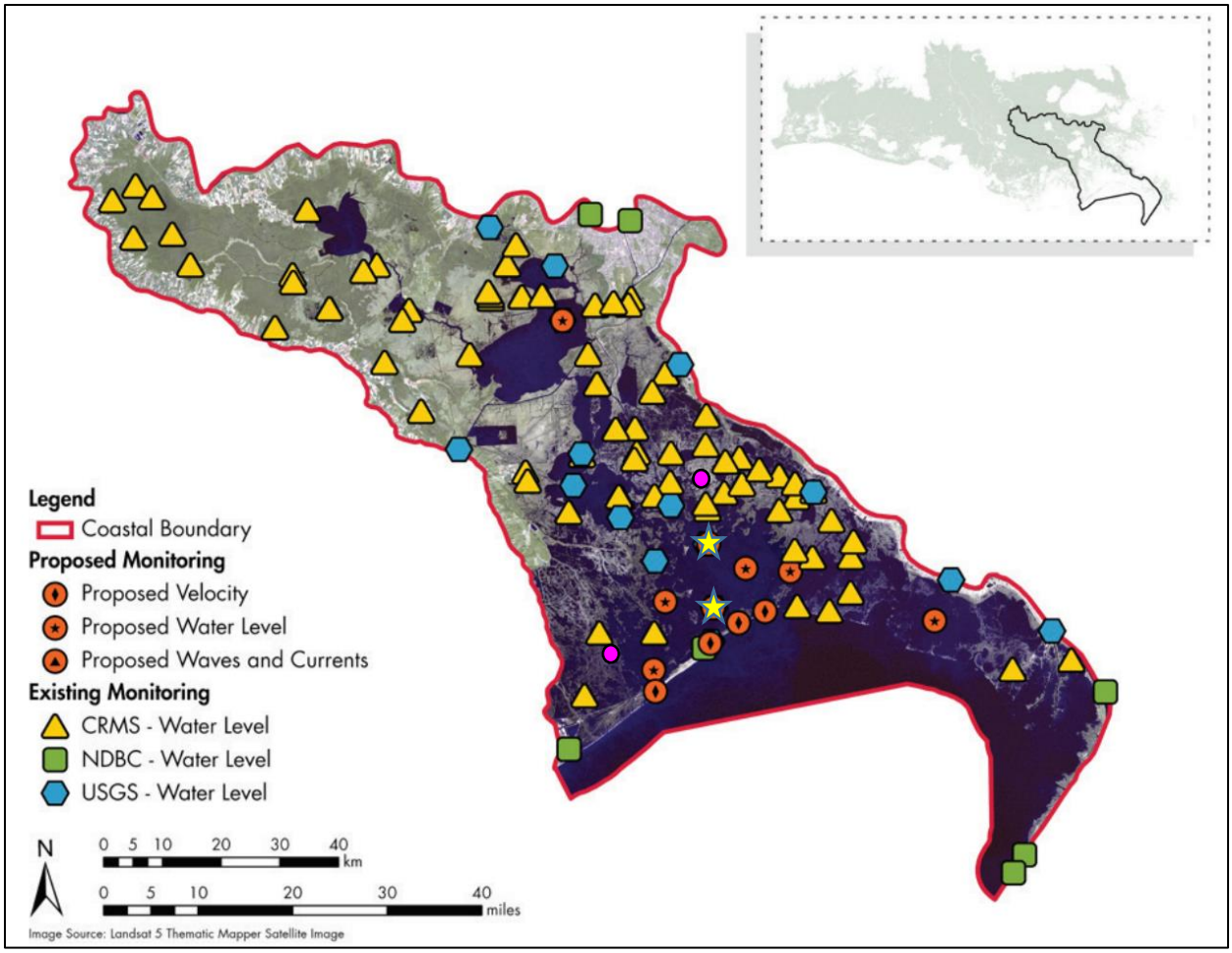


Figure 3.7-3. Existing hydrologic sampling stations within the Barataria Basin. The approximate location of two stations that CPRA contracted USGS to install are shown with magenta circles. Two ADCPs are currently being installed at the locations shown with the yellow stars.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.2. Frequency, depth and duration of inundation at multiple locations on the marsh in the Project Influence Area

- Rationale: Measure the variability and patterns of water movement within the Project Influence Area and suitability for different types of habitats and organisms. Coastal water levels are important to understanding short term, high-intensity events that regulate organism access and materials exchange to and from the wetland surface. Long-term trends of optimal or prolonged inundation influence wetland plant productivity.

- Schedule: Planned for continuous collection during both the pre-operations and post-construction monitoring phases.

- Locations: Currently there are 65 CRMS-*Wetlands* water level gauges (56 shown in Figure 3.7-3) and 15 data collection platforms in Barataria Basin. CPRA proposes to install five new CRMS-*Wetlands* stations in the basin, in the immediate outfall area. Up to three will be installed

during pre-operations monitoring in existing PIA marshes, while up to two will be installed in the PIA after the onset of operations results in the subaerial development of new wetlands.

- Methodology: Empirical measurements of the height of the water level surface referenced to a geodetic or tidal datum will be made at the locations described above (Folse et al. 2020). Frequency, depth and duration of inundation will be calculated as

Frequency of inundation = Number of days annually where water level exceeds marsh surface elevation / 365 (366 for leap years)

Eqn. 12

Depth of inundation = Water depths at multiple locations on the marsh in the Project Influence Area – Marsh surface elevation

Eqn. 13

Duration of inundation = Number of consecutive days where water level exceeds marsh surface elevation

Eqn. 14

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.3. Soil bulk density

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties and sustainability in Barataria Basin. Soil bulk density is useful in understanding the relative exposure of an area to fluvial or marine sediment sources, and for a better understanding of the response of other soils parameters.

- Schedule: Planned for both pre-operations and post-construction monitoring. Soils at existing CRMS-*Wetland* stations within Barataria Basin are sampled every 10 years. Soils from CRMS-*Wetlands* stations and new transect stations (below) in the PIA will be sampled shortly prior to the onset of Project operations, and every five years after the onset of Project operations.

  Locations: Existing and up to five new CRMS-*Wetlands* stations in the PIA (Figure 3.7-4). CPRA may augment that sampling with up to 15 points along three transects (five points per transect) radiating from the Project outfall to encompass the PIA, if the existing and new CRMS stations are judged to be insufficient. Exact transect locations will be determined by the Project AMT.

- Methodology: Soil cores will be obtained with a push corer (Folse et al. 2020). Bulk density will be determined for 4-cm depth increments within cores. Mass per unit volume of water and soil particles on a dry and wet basis will be calculated.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.4. Soil organic matter content

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties and sustainability in Barataria basin. Organic matter content of wetland soils is a key determinant of soil development and quantifies organic contributions to soil

volume. Organic matter burial is especially important for maintaining soil elevation and positive feedback from plant productivity of existing wetlands. Carbon accumulation in emergent wetlands is also an important ecosystem service of these communities.

- Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be sampled shortly prior to the onset of Project operations, and every five years thereafter.

- Locations: Same sampling locations identified for *Soil bulk density* (3.7.2.1.3).

- Methodology: Soil cores will be obtained with a push corer. Organic matter content will be determined by loss on ignition (LOI), wherein a soil sample is combusted at a temperature that burns off organic matter and retains mineral content. LOI will be determined for 4-cm depth increments within cores as per the existing CRMS methodology (Folse et al. 2020).

- Parties Responsible for Data Collection: CPRA contractor.

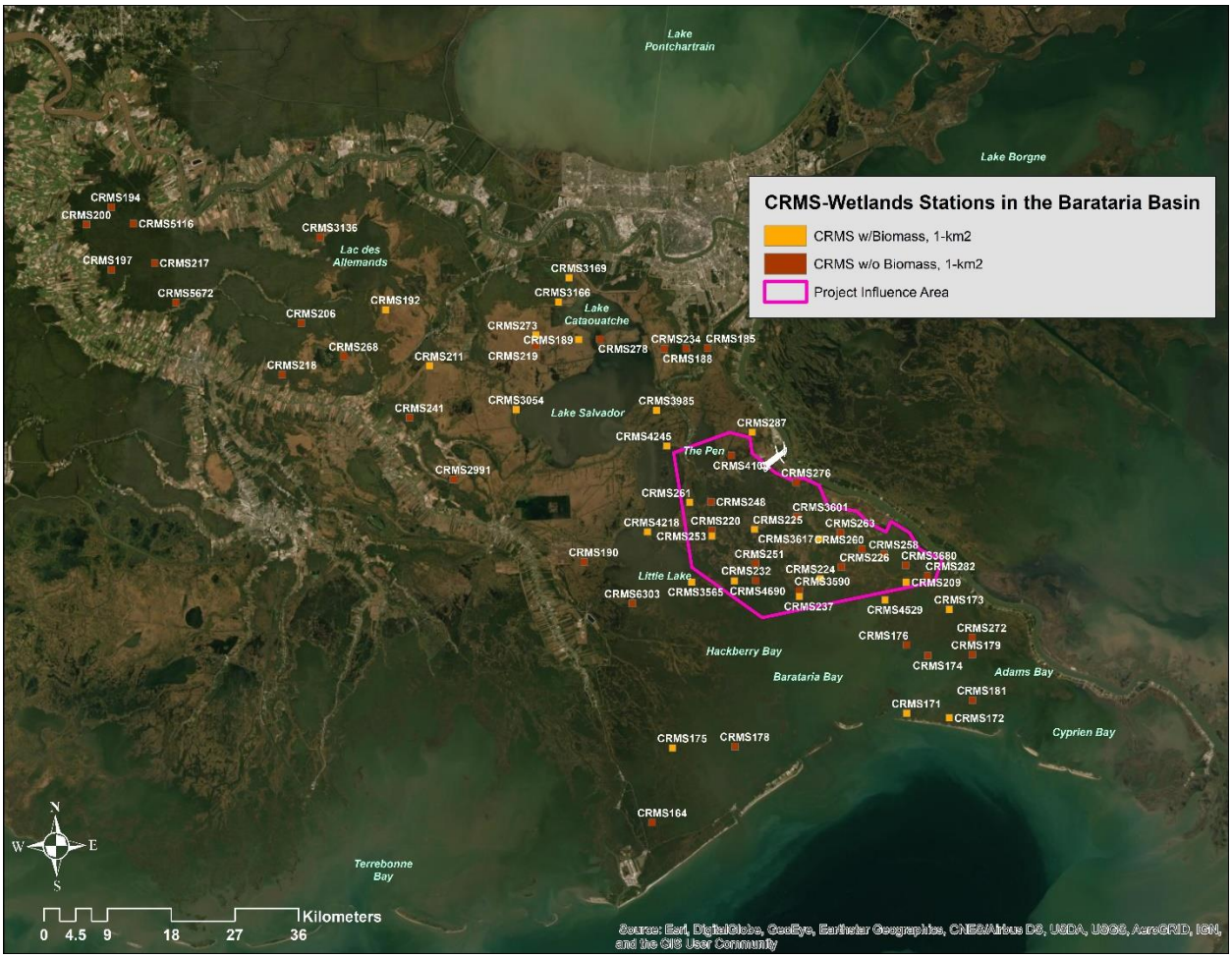


Figure 3.7-4. Existing CRMS-*Wetlands* locations for vegetation community sampling in Barataria Basin.

3.7.2.1.5. Soil mineral matter grain size

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties and sustainability in Barataria Basin. Mineral content of wetland soils is a key determinants of soil development and are often used to describe the role of mineral contributions to soil volume.

- Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be sampled shortly prior to the onset of Project operations, and every five years thereafter.

- Locations: Same sampling locations identified for *Soil bulk density* (3.7.2.1.3).

- Methodology: Soil cores will be obtained with push corer. Grain size will be determined on residual mineral matter following *Soil organic matter content* (3.7.2.1.4) (Folse et al. 2020).

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.6. Soil total nutrients

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties and sustainability in Barataria Basin. The soil biogeochemical environment determines nutrient availability and the capacity for plants to uptake essential macro- and micro-nutrients for growth. Soil nutrition can provide an understanding of nutrient limitation to plant vigor. Measurements of soil total nutrients (i.e., TN, TP, TC), when coupled with other measures, can provide an understanding of what nutrients limit plant production and the burial rate of common limiting nutrients, such as nitrogen and phosphorus.

- Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be sampled shortly prior to the onset of Project operations, and every five years thereafter.

- Locations: Same sampling locations identified for *Soil bulk density* (3.7.2.1.3).

- Methodology: Soil cores will be obtained with a push corer. Soil total carbon is a direct measure of total carbon content with combustion and gas analysis. Indirectly, a conversion factor applied to the organic matter content can be used to determine soil carbon content based on literature or local relationships. Direct measure of total nitrogen with combustion and gas analysis. Direct measure of total phosphorus content with spectrophotometry following acid digestion.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.7. Rate of accretion above feldspar marker horizons

- Rationale: Understand the spatial extent and magnitude of effect of the Project on building and sustaining emergent wetland elevation.

- Schedule: Planned annually for both pre-operations and post-construction monitoring.

- Locations: Existing CRMS-*Wetland* stations within the Project Influence Area (Figure 3.7-4), plus five additional CRMS or CRMS-like stations installed within the Project outfall area.

- Methodology: Installation of feldspar marker horizons and determination of mass/volume of material deposited above the horizon will be as per the CRMS-*Wetlands* Standard Operating Procedures (Folse et al., 2020).

  Rate of accretion is determined as the slope of repeated measurements of accretion over time above feldspar marker horizons.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.8. Soil strength

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties and sustainability in Barataria basin and enable identification of changes and suitability for various types of habitats and organisms. Also, determine whether total organic matter changes following diversion operation. Measures of soil strength may be deemed important for understanding resistance to erosion.

- Schedule: Planned for both pre-operations and post-construction monitoring.

- Locations: See discussion of CRMS-*Wetland* and additional Project-specific stations under *Rate of accretion above feldspar marker horizons* (3.7.2.1.7).

- Methodology: Methodology for sampling soil strength will be identified after consultations with the academic community (see discussion in Jafari et al. (2019). Both *in-situ* and laboratory instruments are available for measuring the shear failure or 'strength' of soils, depending on depth and soil type.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.1.9. Marsh surface elevation change rate in the Project Influence Area

- Rationale: Understand trends of vertical soil elevation change rates within the project area in relation to measured geodetic datums. Rod sediment erosion table (RSET) pin heights form the basis for calculations of marsh surface elevation change.

- Schedule: Planned for both pre-operations and post-construction monitoring. Marsh surface elevation change will be calculated semi-annually, consistent with existing CRMS-*Wetlands* protocols.

- Locations: See discussion of CRMS-*Wetland* and additional Project-specific stations under *Rate of accretion above feldspar marker horizons* (3.7.2.1.7).

- Methodology: Installation of RSETs and measurement of average elevation of the marsh surface will be as per the CRMS-*Wetlands* Standard Operating Procedures (Folse et al., 2020). The rate of change of marsh surface elevation is determined as the slope of repeated measurements over time of RSET pin heights.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.2. Calculations in Support of Objective 2

3.7.2.2.1. Sediment dispersal and retention on the emergent marsh surface

- Rationale: Estimate the amount of sediment retained in geographic areas of the project area.

- Schedule: Planned for both pre-operations and post-construction monitoring. Sampling sites will be visited twice annually. Calculations will be made annually.

- Locations: See discussion of CRMS-*Wetland* and additional Project-specific stations under *Rate of accretion above feldspar marker horizons* (3.7.2.1.7).

- Methodology: Mineral sediment content in the material accreting on the marsh surface will be determined following collection of *Rate of accretion above feldspar marker horizons* (3.7.2.1.7) and S*oil organic matter content* (3.7.2.1.4).

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.2.2. Soil organic matter density

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties in Barataria basin

- Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be sampled shortly prior to the onset of Project operations, and every ten years thereafter.

- Locations: Same sampling locations identified for *Soil bulk density* (3.7.2.1.3).

- Methodology: Conversion: soil organic matter percent is converted into a mass per unit volume

- Parties Responsible for Data Collection: CPRA contractor.

3.7.2.2.3. Soil mineral matter density

- Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent wetland soil properties in the Barataria basin

- Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be sampled shortly prior to the onset of Project operations, and every ten years thereafter.

- Locations: Same sampling locations identified for *Soil bulk density* (3.7.2.1.3).

- Methodology:

  Mineral density = *Soil bulk density* (3.7.2.1.3) – *Soil organic matter density* (3.7.2.2.2) **Eqn. 15**

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3. Objective #3: Create, restore, and sustain wetlands and other deltaic habitats and associated ecosystem services

The objective of physical terrain measurements is to determine topographical and areal changes of natural or restored landscapes and built structures that are vulnerable to submergence. The physical terrain of the coastal environment in this context refers to natural land (e.g., wetlands, barrier islands, uplands, ridges). The coastal terrain serves a multitude of functions from buffering storms, filtering nutrients, pollutants, and sediments, and supporting a variety of flora and fauna. Land submergence threatens all aspects of the coastal ecosystem, from increasing fetch in open water bodies to reducing habitat for ecologically important fish and wildlife (Chesney et al., 2000; Fagherazzi & Wiberg, 2009).

3.7.3.1. Land and water extent / Area of new delta formation in the Project Influence Area

- Rationale: The Project is intended to build and more importantly sustain new emergent wetlands during 50 years of operations. Extent of land and water within the Barataria Basin is thus a fundamental metric for determining Project success. Periodic monitoring of land and water extent will allow for calculation of area of new delta formation.

- Schedule: Planned once pre-operations and every three years post-construction.

- Locations: Project Influence Area within the Barataria Basin (see Figure 3.3-3).

- Methodology: Remote sensing / satellite imagery will be used to determine the spatial extent of emergent wetland and open water areas within the basin, consistent with the methods used for the CRMS Program (Folse et al. 2020). The area of new delta formation is calculated as

  Area of new delta formation = (Land and water extent within the Barataria Basin at time x) - (Land and water extent within the Barataria Basin prior to onset of operations) **Eqn. 16**

- Parties Responsible for Data Collection: USGS, possibly a CPRA contractor in the long-term.

3.7.3.2. Emergent wetland area

- Rationale: Measure changes in wetland spatial extent by traditional wetland type (fresh + intermediate, brackish, and salt marsh; to relate to Basin-wide Model projections) and by recent Louisiana Vegetation Class (*sensu* Snedden 2019) in the Project area.

- Schedule: See Schedule under *3.7.3.1. Land and water extent / Area of new delta formation in the Project Influence Area*. The data collection efforts for both parameters will be coincident.

- Locations: Project Delta Development Area within the Barataria Basin (see Figure 3.3-2).

- Methodology: Specification of some of the satellite-based data under *Land and water extent within the Barataria Basin* (3.7.2.1.3) to parse out vegetated emergent wetlands (i.e., will not include non-vegetated subaerial flats), as described in Folse et al. (2020).

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.3. Vegetation Cover, Abundance, and Height

- Rationale: Assess condition and changes in vegetation in the Basin. Data collected form the basis for assignment of *Emergent and submerged vegetation community type* (3.7.3.5) and detection of invasive species (e.g., hydrilla, water hyacinth, salvinia) presence and location as an indicator of ecosystem change and range shift.

- Schedule: Data are and will be collected annually both pre-operations and post-construction.

- Locations: 65 existing and five new Project-specific CRMS-*Wetlands* stations (Figure 3.7-4).

- Methodology: Permanent plots. Methods are detailed in Folse et al. (2020).

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.4. Submerged aquatic vegetation area

- Rationale: SAV provides fish and shellfish habitat, improves water quality, and contributes organic matter to the estuarine ecosystem. Measuring changes in SAV spatial extent in Barataria Basin is therefore important for multiple stakeholders. The objective of the Project to build emergent wetlands in existing open water bodies does imply localized losses of SAV, particularly close to the Project outfall. As well, SAV abundance and distribution is highly variable year to year, which will be necessary for Project partners to consider in data evaluation.

- Schedule: Planned twice pre-operations and once every five years post-construction.

- Locations: Barataria Basin

- Methodology: Boat-based transects or point observations in the PIA, and remote sensing-based analyses of SAV area for the full Barataria Basin, using algorithms for coverage developed by LSU and USGS. The boat-based information will be used to further develop the remote sensing-based estimates, and the Project partners anticipate that at some point the boat-based surveys in the PIA will be replaced by remote sensing analyses for the entire Basin, including the PIA.

- Parties Responsible for Data Collection:
    - Boat-based surveys: CPRA or CPRA contractor
    - Remote sensing: CPRA contractor

3.7.3.5. Emergent and submerged vegetation community type

- Rationale: Assess changes in vegetation structure in the Barataria Basin, including both the PIA and PDDA.

- Schedule: Planned annually for both pre-operations and post-construction monitoring. See Schedule under *3.7.3.1. Land and water extent / Area of new delta formation in the Project Influence Area*. The data collection efforts for both parameters will be coincident

- Locations: 65 CRMS-*Wetlands* and 5 new Project-specific stations (Figure 3.7-4)

  Methodology: Permanent plots, data collected at the end-of-season; visual estimate of the percentage cover by plant species; different canopy heights are measured (carpet, understory, overstory). Data document changes in the coverage of all species and note any presence of invasive species. Methods are detailed in Folse et al. (2020). Community type will also be determined for a broader area from aerial imagery.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.6. Emergent vegetation biomass in the Project area.

- Rationale: Assess changes in vegetation structure in the Project Influence Area.

- Schedule: Planned for both pre-operations and post-construction monitoring. The SWAMP Program is collecting both above- and below-ground biomass at a subset of CRMS-Wetlands stations coast-wide, and is currently planning on a 5-year return rotation for that sampling. CPRA will rely on that same return schedule, and conduct two pre-operation biomass samples and post-construction samples every five years throughout the 50-year Project study period.

  Locations: The SWAMP Program is augmenting the non-destructive *Vegetation Cover, Abundance, and Height* (3.8.3.3) at 25 of the 65 existing CRMS-*Wetlands* stations in Barataria with plots for the destructive sampling of aboveground and belowground biomass (Figure 3.7-10). Not all of the CRMS-Wetlands stations in the Project Influence Area have been identified for biomass collection (e.g., CRMS stations 225, 232, 253, 3617, and 4103). CPRA will extend biomass collection to those stations for purposes of supporting Project adaptive management, and will include biomass collection in the 3-5 new CRMS stations that will be established in the Project outfall area.

- Methodology: Direct measure of standing live and dead plant material that is destructively harvested for herbaceous wetlands. Live aboveground biomass will be separated and measured for each species in the harvest plot. Species-specific biomass data support an understanding of individual species tolerance and/or competitiveness with system change. The production of belowground biomass often exceeds that of aboveground biomass. The total live belowground biomass

may complement measurements of soil strength. Disparities in root-to-shoot biomass may provide an indicator for plant health.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.7. Dissolved oxygen in Barataria Surface Waters

- Rationale: DO monitoring is necessary for understanding pelagic and benthic respiration (Kemp et al., 1992) and it affects the availability of nutrients (Valiela, 1995). Chronic or acute effects of low DO could cause displace organisms or change community structure of aquatic fauna.

- Schedule: Planned monthly at all stations listed below, for both pre-operations and post-construction monitoring.

- Locations: 23 SWAMP stations in the Barataria Basin, and 26 LDEQ stations in the Barataria and Mississippi River Delta Basins (Figure 3.7-5). For reference, seven of the SWAMP stations are also USGS *in situ* gages There is an additional station (USGS 07380255 Bayou DuPont), not shown in Figure 3.7-5, that also collects DO in the basin.

  Dissolved oxygen measurements in the Gulf of Mexico along Louisiana are not being collected as part of this MAM Plan. However, annual baseline data (1985-2021) are available and similar data collections to map Gulf are expected to continue (see www.gulfhypoxia.net). These data are relevant to the uncertainty around Project influence on the size, shape, and severity of the Gulf Hypoxic zone.

- Methodology: Concentration of oxygen dissolved in water or percentage saturation. Measured as mg oxygen per liter sampled discretely, or by *in situ* sonde.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.8. Salinity in Barataria Surface Waters

- Rationale: Estuarine salinity affects the distribution, growth, and productivity of nekton communities (Minello et al., 2003; Zimmerman et al., 2000), vegetation community composition (Pennings et al., 2005), and ultimately the functions and services that wetlands provide (Odum, 1988).

- Schedule: Continuous monitoring planned for both pre-operations and post-construction monitoring.

- Locations: 77 stations currently monitored continuously in Barataria Basin: 65 CRMS-Wetlands stations and 12 SWAMP stations. See Figure 3.7-6.

- Methodology: Concentration of dissolved ions or salts in water typically measured with conductivity probes and may be reported in practical salinity units (PSU) or other (reference SWAMP)

- Parties Responsible for Data Collection: CPRA contractor.

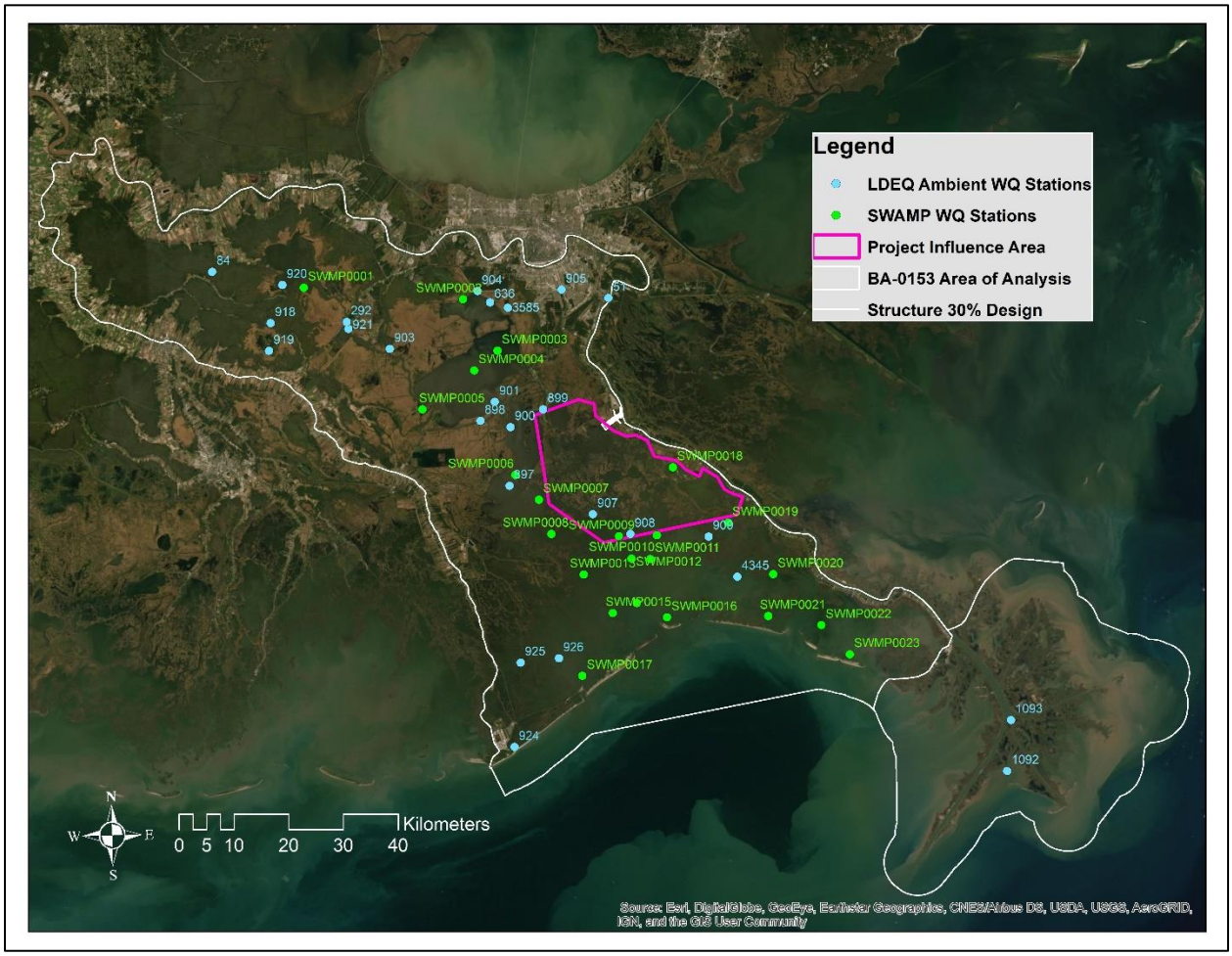


Figure 3.7-5. Existing locations of LDEQ and SWAMP discrete water quality sampling in Barataria Basin, shown in relation to the Project Influence Area.

3.7.3.9. *Chlorophyll a in Barataria Surface Waters*

- Rationale: Chlorophyll *a* is an indicator of the presence of water column primary production by phytoplankton, and thus aids estimates of the total quantity of carbon produced by primary producers.

- Schedule: Planned for both pre-operations and post-construction monitoring. Schedule varies by method. Water is sampled at least hourly at eight USGS gauges using *in situ* instruments (e.g., sondes) and is sampled monthly at 23 sites via boat-based grab samples. Additionally, remote sensing using satellite imagery will be collected and analyzed daily (when possible; e.g., cloud cover may limit usable data) to detect high biomass blooms.

- Locations: Monthly water samples will be collected at 23 SWAMP stations in the Barataria Basin. Seven of those stations that are also USGS *in situ* gauges that already collect hourly Chlorophyll *a* fluorescence (Figure 3.7-5).

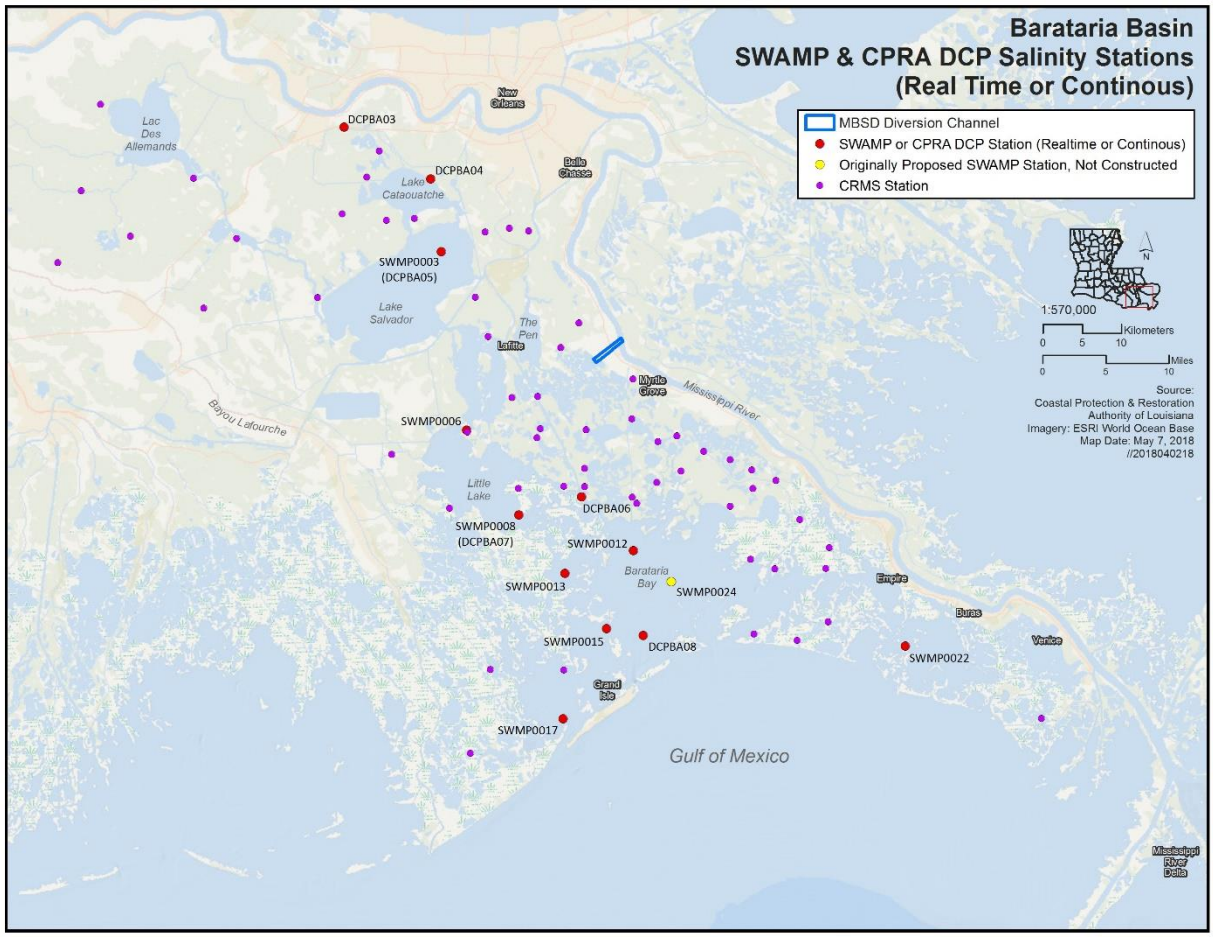


Figure 3.7-6. Existing locations for salinity sampling in Barataria Basin.

- Remote sensing products will cover the entire Project Area of Analysis (white polygon in Figure 3.7-5 encompassing both Barataria and the Mississippi River Delta). Additional discrete sampling locations would occur in response to observations of increased Chlorophyll *a* not coincident with existing stations (e.g., observations via remote sensing or other relevant data such as CPRA survey flights, LDH Molluscan Shellfish Program, NOAA Phytoplankton Monitoring Network).

- Methodology: Multiple methods are used because algal blooms can initiate and intensify over the course of days or weeks, may occur in areas that are not routinely monitored by fixed instrumentation and regularly-schedule discrete sampling, and because different technologies have different strengths and shortcomings (e.g., biofouling of continuous monitors if not serviced biweekly, while turbidity reduces remote sensing accuracy). Concentration of Chorophyll *a* in discrete water samples is measured in the lab with fluorescence techniques (*sensu* USEPA Method 445) to estimate the biomass of phytoplankton (Hijuelos and Hemmerling 2016).

  Remote sensing products will be consistent with the Cyanobacteria Index calculated by the Harmful Algal Bloom Forecasting Branch of the National Centers for Coastal Ocean Science (Wynne et al. 2018). Those products employ algorithms to detect high biomass blooms in the surface water layer and to separate bloom types by measuring proxies that estimate Chlorophyll

a, the main component of the blooms, or to look at the optical characteristics of the bloom and surrounding waters in which they occur (NCCOS 2017). Analysis of the remote sensing products over several days will document the size, location, development, and movement of the bloom, initiate additional boat-based response sampling that would be necessary to identify species and sample for potential analysis of toxins, and can also fill data gaps when routine *in situ* monitoring plans are interrupted (e.g., gauge damage from hurricanes, COVID-19 disruption of field work).

- Parties Responsible for Data Collection:
    - Hourly *in situ* sampling: USGS;
    - Monthly discrete sampling: CPRA contractor;
    - Remote sensing data products: NOAA.

3.7.3.10. *Phytoplankton Species Composition (including Harmful Cyanobacterial/Algal Bloom Species)*

- Rationale: Phytoplankton blooms are controlled by several factors, such as nutrient type and loading rate, light availability, water residence time, temperature, and grazing by zooplankton and benthic filter feeders (Boyer et al., 2009). Determination of the cyanobacterial and/or eukaryotic algal species present can provide an indication of the ecological effects of a bloom, whether known harmful cyanobacterial and/or algal bloom (HCAB) species (e.g., *Microcystis* spp.) are present, and whether follow-up sampling for associated toxins is warranted. Because toxins can reach levels of concern before or after Chlorophyll *a* counts are high (e.g. for *Pseudo-nitzschia* and *Dinophysis)*, and because bloom toxicity is difficult to predict, species composition monitoring is independent of Chlorophyll *a* thresholds.

- Schedule: Planned monthly for both pre-operations and post-construction monitoring, with additional sampling in response to observations of elevated *Chlorophyll a in Barataria Surface Waters*, increases in the ratio of Chlorophyll to Phycocyanin (a pigment-protein complex that is specific to cyanobacteria, described in section 3.7.3.11), estimated from remote sensing (3.7.3.9), or observed in other relevant data (e.g., CPRA survey flights, LDH Molluscan Shellfish Program, NOAA Phytoplankton Monitoring Network, and other Chlorophyll *a* and HCAB monitoring programs).

- Locations: Samples will be collected at all *Chlorophyll a in Barataria Surface Waters* (3.7.3.9) sampling stations. Additional discrete sampling locations would be dependent on observations of elevated *Chlorophyll a in Barataria Surface Waters* (3.7.3.9), increases in the Phycocyanin:Chlorophyll ratio, or other relevant data as discussed under “Schedule” above.

- Methodology: Collected water samples will be analyzed for the Phycocyanin:Chlorophyll ratio (e.g., using CyanoFluor or another method; final determinations on methodology will be made if, and if so when, the USACE issues the Project permit to CPRA) to estimate the abundance of cyanobacteria in a mixed algal population. A spike in the ratio compared to preceding months would indicate a likely cyanobacteria bloom. Additionally, water samples will be examined in the lab for the presence of toxigenic HCAB species using microscopy or automated detection methods (e.g., Flowcam or Imaging FlowCytoBot), and cell counts of toxigenic HCAB species will be performed.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.11. *Harmful Cyanobacterial/Algal Bloom Toxins in Barataria Surface Waters*

- Rationale: Cyanobacterial and eukaryotic algal species capable of producing toxins that pose a risk to aquatic and human resources in the Barataria Basin include the toxic diatom *Pseudo-nitzschia* spp., raphidophytes, several species of toxic dinoflagellates (including *Akashiwo sanguinea*, *Alexandrium monilatum*, *Dinophysis* spp., *Gymnodinium* spp., *Heterocapsa*, *Lingulodinium polyedrum*, and *Prorocentrum* sppand *Dinophysis* spp.), the brown-tide alga *Aureoumbra*, and toxic cyanobacteria (*Anabaena* spp., *Anabaenopsis* cf. *elenkenii, Cylindrospermopsis raciborskii*, *Dolichospermum*, *Microcystis* spp., and *Raphidiopsis curvata*), and, if transported from the eastern Gulf, *Karenia brevis* (red tide). Toxicity varies depending on species, strains, and environmental conditions, so chlorophyll cannot be used to predict toxicity, though higher chlorophyll levels do indicate an increased likelihood that HCABs will occur.
- Several of these species are often observed in bloom abundances and may produce toxins that are known to accumulate in fish and shellfish which may serve as vectors of exposure to higher trophic wildlife (e.g., bottlenose dolphins) and people. Some toxins are transferred via the food chain, while others may affect wildlife through dermal (cyanobacteria) or aerosol (brevetoxins) contact. *Pseudo-nitzschia*, present during most of the year, occurs in high abundances inshore and offshore of Louisiana, and sometimes in estuaries over oyster reefs, and is likely to bloom in response to enhanced nutrient inputs. It produces domoic acid that is sometimes detected in filter feeders such as oysters and menhaden and in higher tropic species such as marine mammals. Cyanobacteria, commonly found within the fresh and brackish waters of many estuaries in Louisiana, are associated with hepatotoxin and/or neurotoxin production and likely to increase in low salinity environments and with enhanced nutrient inputs. Less frequently, blooms of raphidophytes occur and can produce brevetoxins.

- Schedule: Planned monthly for both pre-operations and post-construction monitoring, with additional sampling in response to observations of presence of cyanobacterial and/or eukaryotic algal species associated with harmful algal blooms, as determined in *Phytoplankton species composition in Barataria Surface Waters* (3.7.3.10).

- Locations: See discussion for *Phytoplankton species composition in Barataria Surface Waters* (3.7.3.10).

- Methodology: To identify particulate toxins in water, water samples will be collected whenever *Phytoplankton species composition in Barataria Surface Waters* (3.7.3.10) samples are collected for monthly sampling and additional discrete sampling. Samples will be filtered through an appropriate filter and frozen at -80°C. Toxin analysis will be done through both quick tests (using existing kits and filtered samples) and confirmatory methods (using laboratory analysis on some of the samples). During and after suspected bloom events, additional water sampling for dissolved and extracellular toxin may need to be conducted because filter analysis does not allow particulate intracellular and dissolved extracellular toxin determination.

- Cyanobacteria: If known harmful cyanobacteria species are observed during analysis of *Phytoplankton species composition in Barataria Surface Waters* (3.7.3.10), or if a bloom is suspected to have occurred within the previous month based on other observations, then the water samples will be tested for both particulate and dissolved forms of microcystin, the most common cyanobacteria toxin. If microcystin is not detected, then the water samples will be tested for other cyanobacteria toxins (e.g., anatoxin, saxitoxin).
- Harmful algae: For collected water samples with high *Pseudo-nitzschia* cell counts, or if a bloom is suspected to have occurred, then the water samples will be tested for domoic acid. If other harmful algal species are observed, then the water samples will be tested for other relevant toxins.

Additionally, to link toxins to potential food web impacts, whole filter feeding fish that are prey for bottlenose dolphins (e.g., anchovy, herring, menhaden, spot, mullet) will be collected based on phytoplankton cell counts and bloom locations. Toxins (domoic acid, brevetoxins, okadaic acid and related toxins) in fish tissue will be analyzed in the lab, and extracts will be frozen, using established methods.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.12. Nutrient constituents in Barataria Surface Waters

- Rationale: Nutrients stimulate the growth of aquatic primary producers. The primary limiting nutrients often include nitrogen, phosphorus, and silicate. The types of nutrients and ratios in Basin surface waters are subject to changes in MR concentrations (Turner & Rabalais, 1991) and operations of existing and proposed siphons and diversion structures.

- Schedule: Planned monthly for both pre-operations and post-construction monitoring.

- Locations: Same 23 SWAMP stations described for *Dissolved oxygen in Barataria Surface Waters* (3.7.3.7).

- Methodology: Concentration of selected elements or molecules dissolved in water (reference SWAMP). Measured as mass of nutrient per liter of sample. CPRA's current contract with ENCOS provides for monitoring TN, total Kjeldahl N, nitrate + nitrite, ammonium, TP, orthophosphate, and silica as SiO_2.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.13. Temperature of Barataria Surface Waters

- Rationale: Estuarine temperature affects the distribution, growth, and productivity of nekton communities (Minello et al., 2003; Zimmerman et al., 2000), vegetation community composition (Pennings et al., 2005), and ultimately the functions and services that wetlands provide (Odum, 1988).

- Schedule: Continuous monitoring planned for both pre-operations and post-construction monitoring.

- Locations: Same 153 stations described for *Salinity in Barataria Surface Waters* (3.7.3.8).

- Methodology: Temperature will be measured with thermometers or thermocouples and will be reported in degrees Centigrade.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.14. Turbidity of Barataria Surface Waters

- Rationale: The turbidity of Barataria Basin surface waters influences both primary producers (e.g., phytoplankton and SAV) and consumers (e.g., filter feeders and visual predators) in the estuary. Numerical modeling of Project alternatives supports an expectation of short-term increases in turbidity in Basin surface waters during Project operations.

- Schedule: Planned monthly for both pre-operations and post-construction monitoring.

- Locations: Same 23 SWAMP stations described for *Dissolved oxygen in Barataria Surface Waters* (3.7.3.7).

- Methodology: Optical (or other) measure of water clarity, which can be influenced by particles or dissolved colored materials and may be reported in various turbidity units (reference SWAMP). Measured as Nephelometric Turbidity Units.

- Parties Responsible for Data Collection: CPRA contractor.
-

3.7.3.15. Total suspended solids in Barataria Surface Waters

- Rationale: The transport of substantial amounts of suspended sediments in diverted Mississippi River water into the Basin will result in likely increases to localized suspended sediment concentrations in Barataria surface waters, especially during Project operational flows.

- Schedule: Planned monthly for both pre-operations and post-construction monitoring.

- Locations: Same 23 SWAMP stations described for *Dissolved oxygen in Barataria Surface Waters* (3.7.3.7).

- Methodology: Concentration of particles larger than 2 μm in the water column, comprising organic or inorganic matter, which are filtered from a complete water sample and then dried and weighed.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.16. Lower Trophic Level Organisms

- Rationale: Lower trophic level organisms (e.g., amphipods) are a foundational component of the Barataria Basin food web, and provide a critical link between wetland restoration and ecological service flows to injured fish and water column invertebrates. The Project may influence environmental conditions (salinity, sediment composition) that are known to regulate local distribution of lower trophic level assemblages in estuarine systems. Additionally, this data set was identified as needed for improvement of the CASM ecosystem model described in Section 1.5.1 by an independent, external advisory panel.

  There may be an opportunity to leverage other efforts to develop this dataset. In 2020, the LA TIG allocated funding, separate from this Project, to develop a plan to assess Lower Trophic Level organisms in the Barataria Basin (https://www.fws.gov/doiddata/dwh-ar-documents/1207/DWH-ARZ009103.pdf) and may consider a second phase to collect field data. In that case, the Project Management Team would coordinate with the separate LA TIG effort to develop an implementation plan that would also address the needs for this Project.

- Schedule: Once pre-construction to create a baseline inventory, and every ten years after operations begin, or in coordination with parallel sampling if funded, as described above.

- Locations: Sampling protocols will be designed to capture the spatial and temporal variation within the Barataria Basin and will be compatible and coordinated with the separate LA TIG planning effort described above.

- Methodology: Sampling protocols will be designed to capture the spatial and temporal variation within selected locations in the Barataria Basin and to address key management questions and data needed to refine ecosystem models of the Barataria Basin food web for application in the adaptive management framework. This will include benthic infauna and epifauna. Methodology will be compatible and coordinated with the separate LA TIG planning effort described above.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.17. Aquatic Invasive (Algae and Invertebrate) Species

- Rationale: The transport of substantial amounts of diverted Mississippi River water into Barataria Basin may result in the introduction of new invasive species, or increased numbers and/or spatial extent, of aquatic invasive species.

- Schedule: Planned for both once pre-operations and once every five years after operations begin.

- Locations: Will be identified following the onset of Project operations.

- Methodology: A rapid assessment survey will identify the presence of invasive algae and invertebrates (e.g., zebra mussel). A team of trained field samplers (scientists or trained volunteers) will visit in-water structures (e.g., marinas) and other selected habitats within Barataria Basin to observe, identify, and record estuarine algal and invertebrate organism

presence, abundance, and location. Samples will be collected for identification in a laboratory.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.18. Nekton (Fish and Shellfish) Species Abundance and Composition/Assemblage

- Rationale: Documenting the distribution and abundance of important fish and invertebrate species, within the project area allows for examination in trends of time (such as Catch per Unit Effort) or in space and allows for the detection of new or increased presence and range shifts or expansions, of aquatic invasive fishes and invertebrates.

  The objective of nekton community sampling is to document the population status of commercially- and recreationally-important fish and invertebrate species, as well as representative guilds. Sampling is designed to: (1) evaluate patterns of distribution, (2) evaluate changes in abundance and composition, and (3) evaluate habitat association patterns.

  To meet the monitoring objective for nekton community composition, sampling must be effective at detecting changes in abundance of resident and transient species to fully capture the diversity of species and their life stages. LDWF uses several fisheries-independent gear types across the freshwater to marine gradient (Table 3.7-3), including: entanglement nets, trawls, seine, and electrofishing. Collection of finfish and shellfish (shrimp, crab) using standardized gear can be used as an indicator of relative abundance and can be used to develop diversity indices and to quantify resource availability within estuarine habitats. Standardized gear also targets specific size classes, which provides an opportunity to examine ecological differences among life stages of a given species (Livingston, 1988). CPRA may additionally perform analyses to evaluate food web changes (e.g., stable isotope analysis on nekton gut contents).

  Table 3.7-3. Example fish and shellfish and the gear type that is generally used to assess abundance and other population characteristics.

Scientific Name	Common Name	Gear Type
Anchoa mitchilli	Bay anchovy	Trawls
Brevoortia patronus	Gulf menhaden	Trawl/Gillnet
Callinectes sapidus	Blue crab	Trawl/Seine
Cynoscion nebulosus	Spotted seatrout	Gillnet/Trammel Net
Farfantepenaeus aztecus	Brown shrimp	Trawl/Seine
Leiostomus xanthurus	Spot	Trawl/Seine
Litopenaeus setiferus	White shrimp	Trawl/Seine
Micropogonias undulates	Atlantic croaker	Trawl/Seine
Micropterus salmoides	Largemouth bass	Gillnet/Electrofishing
Paralichthys lethostigma	Southern flounder	Trawls
Scomberomorus maculatus	Atlantic Spanish mackerel	Gillnet/Trammel Net

- Schedule: Planned for both pre-operations and post-construction monitoring. See Table 3.7-4 for discussion of sampling frequencies for fisheries-independent data collection.

Table 3.7-4. Sampling details for selected fisheries-independent nekton community variables.

Gear Type	Sampling Frequency	Number of Sites
Trawl (6-ft)	Weekly: April – early May Semi-monthly: June-July	92
Trawl (16-ft)	Semi-monthly: April-July, December Monthly: August-November, January-March	92-102
Trawl (20-ft)	Semi-monthly: April, December Monthly: January, March, May, November	39
Seine	Monthly	102
Electrofishing	Monthly	12
Gill Net	Semi-monthly: April-September Monthly: October-March	52
Trammel Net	Monthly: October-March	45

- Locations: See Figures 3.7-7 and 3.7-8.

- Methodology: Individuals species sampling methods are as per LDWF 2018. Data collection for fisheries-dependent data collection is generally accomplished with creel surveys (weekly) and trip-ticket and oyster boarding (both variable in terms of frequency and number of data collection points.

- Parties Responsible for Data Collection: LDWF.

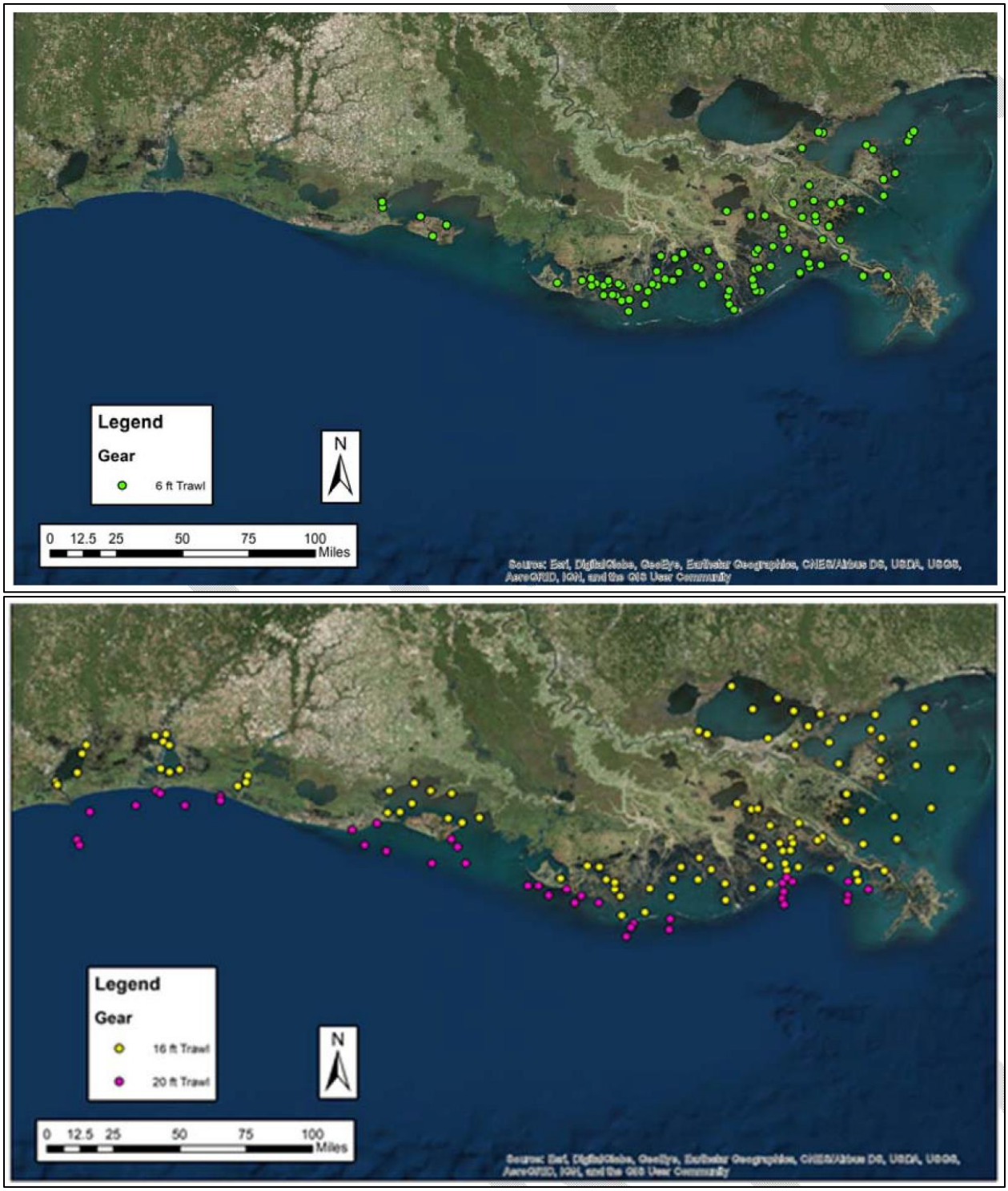


Figure 3.7-7. Existing LDWF trawl locations for along the Louisiana coast. Shown are locations of 6-ft (top) and 16-ft and 20-ft trawls (bottom). Figures from CPRA & LDWF 2019.

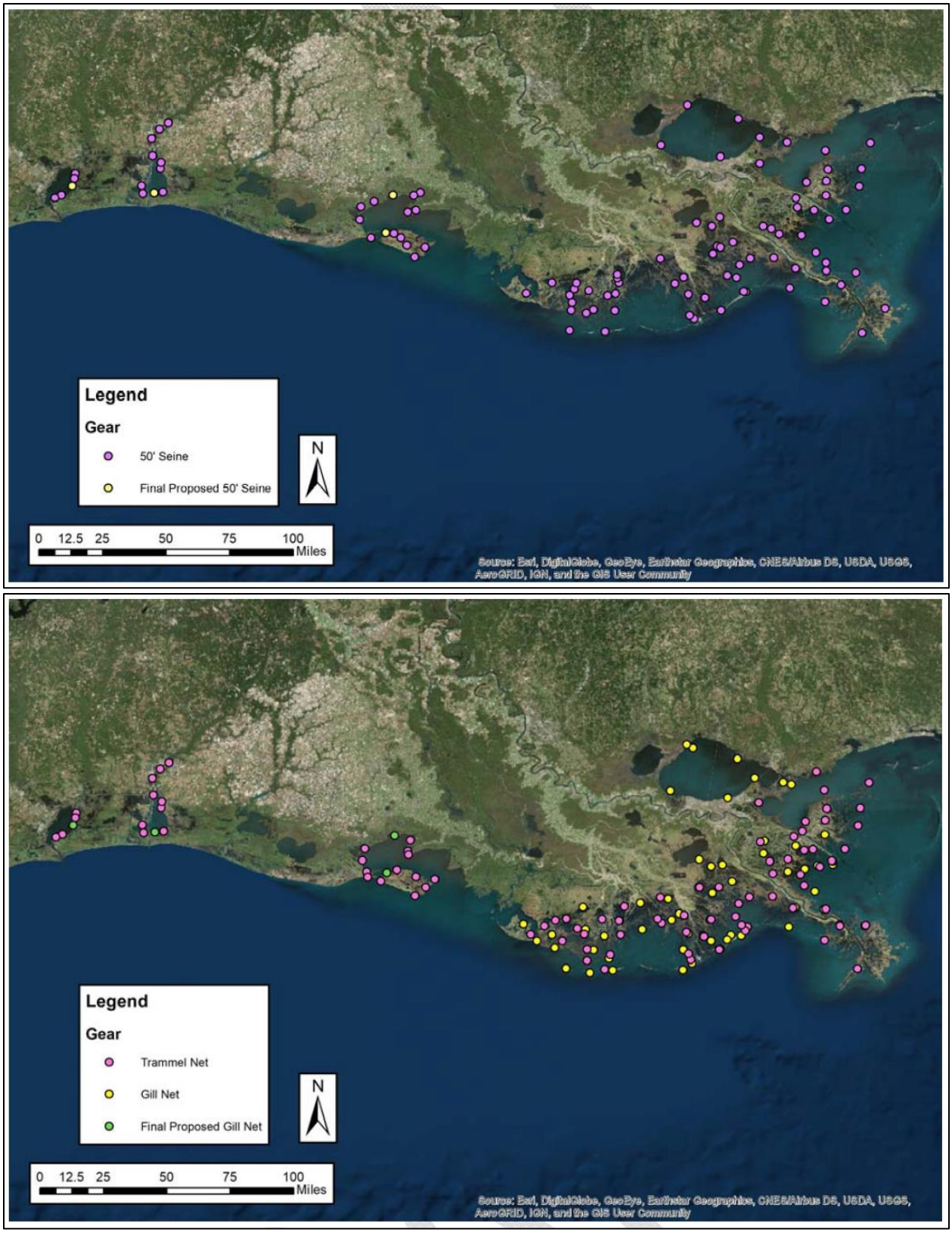


Figure 3.7-8. Existing LDWF seine (top) and trammel and gill net (bottom) sampling locations along the Louisiana coast. Figures from CPRA & LDWF 2019.

3.7.3.19. Atlantic Bottlenose Dolphins (Tursiops truncatus)

Rationale: Document changes to the abundance, distribution, population demography, density, survival, health and reproduction of the Barataria Bay Estuarine System (BBES) stock of bottlenose dolphins, their prey, and their habitat that may result from the operation of the Project and resulting low salinity. In addition, to the extent practicable and consistent with the purposes of the Project, minimize impacts on marine mammal species and stocks, and monitor and evaluate the impacts of the project on such species and stocks.

DWH Trustees have invested heavily in understanding the effects of DWH on the BBES stock of bottlenose dolphins. The BBES stock of dolphins was heavily impacted by the DWH oil spill (see the PDARP), and the DWH NRDA Trustees used a combination of stranding response and investigations, capture mark recapture, photo-ID surveys, remote biopsies, and capture release health assessments from April 2010 through 2015 to investigate the injury to the population. Additional studies on BBES dolphins were conducted using capture release health assessments, Capture-Mark-Recapture surveys, stranding response and investigations, and photo-ID surveys from 2016- 2019 to determine the long-term effects of the spill on this population. Dolphins are resident in Barataria Basin, and dolphins exposed to DWH oil during the spill continue to have underlying long-term health impacts from the spill.

In addition, this plan is being implemented in conjunction with planned mitigation and stewardship measures (see the Project Mitigation Plan) to address CPRA's responsibility under the Bipartisan Budget Act of 2018 (Public Law 115-123; hereafter the Budget Act). Section 20201 of the Budget Act indicates that

> *"(b) Upon the issuance of a [Marine Mammal Protection Act] waiver … the State of Louisiana shall, in consultation with the Secretary of Commerce [as delegated to NMFS]: (1) To the extent practicable and consistent with the purposes of the projects, minimize impacts on marine mammal species and population stocks, and (2) Monitor and evaluate the impacts of the projects on such species and population stocks."*

Adaptive management strategies to monitor, respond to, intervene, and minimize impacts on BBES dolphins from Project operations include a framework for data collection on dolphins and their environment, coordination between CPRA and the Dolphin Resource Team (DRT; composed of the group of individuals actively working on marine mammal data collection and stranding response in the Barataria Basin) before and during operations, an ongoing evaluation of the ability of diversion operations to be modified (to meet the purposes of the Project and reduce impacts to marine mammals), and the execution of those modifications. In addition to the contributions of data and information described here, the Dolphin Intervention Plan contains information about potential intervention activities to increase survival; reduce illness, pain, and suffering; and further contribute to the collection of scientific information that may inform mitigation activities and adaptive management of the monitoring and response activities.

- Schedule: Planned for pre-operations and post-construction monitoring. The schedule for sampling frequency for the various methods may be different in pre-operations and post-construction phases. To collect the data necessary to monitor and evaluate the impacts of the Project on dolphins and guide consideration of adaptive management actions, a variety of methods may be used. Efforts pre-operations and monitoring during the first year(s) of

operation will guide consideration of operational adaptive management decisions. Results from the first five years of monitoring during operational years will guide scheduling or the need for continuation of monitoring for future years.

- Pre-operations: During the five years prior to operations, several methods will be used to identify baseline information on the abundance, distribution, density, health, stranding rates/types/causes, survival and fecundity of the resident population prior to operations to be able to identify changes once the Project is operational. The data will also help update the Intervention Plan. Given the length of time between past data collection efforts and Project operations, this additional sampling is necessary. In addition, a single effort in any given year may not be sufficient given inter- and intra-annual variability, seasonal habitat and potential changes in dolphin spatial distribution within Barataria Basin. The plan below presents a reasonable sampling design to capture both inter- and intra-annual variability.
    - Enhanced stranding response and investigations (stranding rates, causes of illness and death, standardized effort) as part of this MAM plan would be ongoing beginning five years prior to operations.
    - Active surveillance surveys (stranding rates, causes of illness and death, standardized effort) will include a pilot study in the first two years. If those drone- or boat-based surveys increase/improve detection of carcasses, then consistent and standardized surveys will be conducted from years 3-5 prior to operations to establish baseline stranding rates.
    - Capture-Mark-Recapture (CMR) surveys (abundance, distribution, density) will be conducted basin-wide, including at least one survey during the pre-operations period (e.g., 4 years prior to operations).
    - Visual assessment surveys (skin health, body condition, and reproductive follow-up).
    - Capture Release Health Assessment (CRHA) sessions will be conducted to include animals captured in locations across the basin. Health data analyses will include a variety of samples and procedures.
    - Tagging (movement and possibly salinity) from several areas across the bay.
    - Biopsies (for omics, hormones, fecundity, nutrition, contaminants, and disease) and associated analyses in different geographic areas during years without a CRHA.
    - New technologies as they become available may be used to assist in assessing dolphin habitat use. For instance, the collection of environmental DNA (eDNA) data through boat-based water collections or from archival or continuous eDNA sensors might be paired with the continuous salinity sensor platforms. The remote dolphin targeted eDNA might provide dolphin presence or absence during periods in which boat access is not possible.
    - Baseline dolphin habitat water quality monitoring will be fulfilled through other ongoing or planned resource monitoring (e.g., 3.7.3.7 - 3.7.3.15).
    - Prey data (quantity, quality, species) will be collected and analyzed seasonally by the State's FIMP (Section 3.7.3.18), and from stranding samples. These data will be shared with the Dolphin Resource Team. Whole fish samples representative of dolphin prey (no less than 10 per prey type) will be collected, preserved and analyzed by calorimetry and other parameters for evaluation of the nutritional content of current pre-operations prey.
    - Analysis of dolphin samples for evidence of contaminants, HABs, or other

potential stressors will be closely coordinated in terms of time and scope with the results from similar analyses in other resources, such as dolphin prey or habitat quality monitoring (e.g., 3.7.3.24).

- The DRT will act as a technical focus group and will meet as needed (at least annually) to review monitoring data and adaptive management strategies, with one ongoing task of providing recommendations for potential adaptive management actions for minimizing impacts on dolphins. Pre-operations activities will include collating and assessing literature and data that can provide context for future decision making, including potential operational adaptive management actions in response to disasters (e.g., oil spills, hurricanes, etc.). The group will also assess Project-related pre-operations monitoring activities to evaluate potential dolphin-based or habitat-based indicators for informing specific adaptive management actions that are intended to be practicable and consistent with the purposes of the Project. Observations triggering potential adaptive management considerations may include response/intervention capacity, as well as morbidity and mortality of dolphins. The DRT will also evaluate the potential benefits and risks to dolphins for various operational adaptive management strategies to inform potential recommendations. In addition to activities/modifications related to managing daily, weekly, and/or monthly marine mammal response and data collection in real time, the DRT will provide the Adaptive Management Team with information to assist with their annual evaluations related to operational adaptive management actions.

- Post-Construction: Up to 10 years of post-construction monitoring will begin with the onset of Project operations to support understanding of the short and long-term impacts of the project on BBES dolphins. The DRT will review dolphin and environmental data as they become available and provide recommendations to the AMT on mitigation (including, but not limited to operation strategies, adaptive management of monitoring activities, and implementation of intervention strategies (based on the most recent version of the Intervention Plan), when warranted. The DRT will review datasets as needed. Annual review of the data collected, and results will inform planning for the following year's data collection efforts.
  - Enhanced stranding response and investigations (stranding rates, causes of illness and death, standardized effort, rapid response for live animals) as part of this MAM plan will be ongoing in the BBES and adjacent coastal areas.
  - Active surveillance (stranding rates, causes of illness and death, standardized effort, rapid response for live animals) as part of this MAM plan will be ongoing in the BBES and adjacent coastal areas (pending pilot study for effectiveness and feasibility).
  - CMR surveys bay-wide (abundance, distribution, density) will be conducted basin-wide periodically, including a survey at one year post-construction. It is anticipated that CMR surveys will be conducted during the early years of operations as this is the period of greatest expected change in survival rates.
  - Visual assessment surveys (skin health, body condition, reproductive follow-up) will be done via unmanned aircraft system (UAS; i.e., drone) and/or vessel-based assessments.
  - CRHA (health status) will be done periodically across geographic areas.
  - Biopsies (omics, hormones, fecundity, nutrition, contaminants, and disease) will be done during years without a CRHA.

- Tagging (movement and salinity) will include approximately 140 animals total over 10 years.
- Prey species abundance and assemblage (3.7.3.18), contaminants in fish, shellfish, and wildlife (3.7.3.23), and water quality data (i.e., salinity, dissolved oxygen, Chlorophyll *a*, phytoplankton, and biotoxins (3.7.3.7-11) provided from the monitoring programs described above will inform adaptive management guidance for the dolphin monitoring and intervention activities.
- Prey collected as part of nekton monitoring (3.7.3.18) will be analyzed twice in years 1-5, and every 3-5 years thereafter, for nutritional quality through methods such as whole fish calorimetry.
- Analysis of dolphin samples for evidence of contaminants, HABs, or other potential stressors will be closely coordinated in terms of time and scope with the results from similar analyses in other resources, such as dolphin prey (3.7.3.18) or habitat quality monitoring (3.7.3.23).
- The DRT will meet as needed (at least annually) to review monitoring data, operational conditions, triggers, and adaptive management strategies, to continue providing recommendations for potential adaptive management actions designed to minimize project impacts on dolphins. Rapid access to monitoring data (e.g., habitat and water quality parameters) for a core team of the DRT, Louisiana stranding network and others, as needed, will be critical to their ability to assess conditions for dolphins and provide timely recommendations for adjustments to the adaptive management program that minimize dolphin impacts (see Section 5).

- Locations: Basin-wide environmental data collected through the current and additional real-time salinity stations and other efforts (e.g., dolphin prey base collected through the FIMP program, contaminants, HCABs, salinity/temperature) will inform stranding investigation and monitoring efforts.
    - Pre-Operations: Basin-wide studies will occur as described above ensuring that the full areas of dolphin habitat within Barataria Basin are represented.
    - Post-Construction: The basin-wide abundance, distribution and density surveys identified above will continue post-operations. Initial health assessments will be focused basin-wide, with out-year locations being dependent upon potential changes in habitat and dolphin distribution. Year-round marine mammal and environmental monitoring and stranding response basin-wide.

- Methodology: The methodologies proposed here allow for data collection efforts supported through the Project. Data consistency and scientific integrity of the data will be important. Several categories of data must be collected to monitor and evaluate the effects of the Project on dolphins using various data collection methods (Table 3.7-5). Efforts carried out separately from the Project can be leveraged, but surveys specific to this plan must be able to be integrated with past, present and future data collection, including with the DWH NRDA long-term data set.
    - Enhancing the Marine Mammal Stranding Network (MMSN): At least five years prior to operations, the DRT core team will provide for an enhanced MMSN to establish baseline stranding information pre-operations. Support for stranding response personnel, outreach and education to the community to increase reporting, active surveillance for strandings (see next bullet), and diagnostic analyses to determine causes of illness and death will be necessary. For instance, if strandings increase above the pre-operation

level (for example, mean plus 2 standard deviations) or there is an increase in the proportion of cases with cause of illness/death determined to be low salinity exposure, then an increase in effort, analyses, and response will be initiated.

Table 3.7-5. Bottlenose dolphin monitoring parameters and associated methods. Note that each parameter relies on a suite of methods, and that each method contributes to the measurement of a suite of parameters, but that no one method can measure all parameters required for project evaluation and adaptive management.

Parameters	Methods						
	CMR Survey Photo-ID	Visual Surveys (UAS, Photo-ID vessel)	Captures	Tagging (with salinity sensors)	Biopsy	Stranding Response	Prey and Water Quality
Abundance, distribution, density	X			X			
Survival	X	X	X	X		Mortality Trends	
Reproductive status/success		X	X		X	X	
Body/skin condition/nutritional status	X	X	X		X	X	
Overall in-depth health assessment or cause of death/injuries or lesions			X (in-depth health and tagging)			X (cause of death/ lesions only)	
Prey or trophic level			X		X	X (stomach content)	X
Habitat (salinity, contaminant/HAB)	X	X	X	X	X		X

- Active surveillance: Dedicated survey effort to identify and recover marine mammal carcasses within defined search areas at consistent intervals will be crucial to address variation in effort and public reporting that confound development of reliable baselines and interpretation of changes in stranding rates. A pilot study 4-5 years prior to construction will include vessel- and UAS-based surveys to examine variability by region and season, as well as evaluate effectiveness and assess protocols for documenting carcasses by drone and/or photography. A standardized, consistent survey effort will then be designed based on the pilot study's findings and implemented to establish baseline stranding rates in the three years prior to operations and ongoing through the Project lifetime.
- Periodic visual health assessment in specific geographic areas: Use UAS, vessel-based, or alternative techniques to visually assess the health of dolphins as described above. The assessment will be adaptive. For instance, if mortality increases in specific regions, dolphin body condition decreases, or skin lesions become more prevalent, sampling frequency may be increased (see Table 4.1-3). This effort might be combined with stranding response active surveillance to maximize efficiency.
- CRHA with or without tagging: These assessments will be performed similar to the assessments from 2010-2018; however, diagnostics, tag types, and sample analyses may be different. Tagging would be performed depending on the timing of the assessments

and availability of satellite tags with or without salinity sensors.

- CMR Surveys: These surveys will be conducted similar to the 2019 CMR survey and may incorporate UAS and additional simultaneous photography for visual health assessments. If mortality or morbidity increases in specific areas, targeted CMR surveys may be implemented or increased in frequency.
- Remote biopsy studies: Remote biopsy may be undertaken particularly in years in which CMR or CRHA studies are not being completed and there is a need to have additional information on some health parameters, nutritional parameters, and hormone status, particularly reproductive hormones in the population. In addition, biopsy frequency or implementation may occur in response to increased morbidity or mortality. These studies provide information on pregnancy, other steroid hormone status that may inform nutritional status, and other parameters such as stable isotopes or contaminants.
- If fisheries surveys indicate that the prey base has shifted, and dolphin body condition decreases, a bioenergetics study would occur.
- Additionally, a monitoring lab and office will be established within an existing facility or via mobile facilities, with associated equipment (e.g., vessels, trailers, truck, freezer). The DRT will regularly evaluate: 1) the operational modifications that are appropriate for considering adaptive management and/or adjustments to monitoring plans and addressing data gaps, 2) monitoring data relevant to those operational modifications/data gaps, and 3) appropriate potential adaptive management actions for minimizing impacts on dolphins. Operational modifications could be based on dolphin stranding rates; prevalence of adverse health effects; dolphin movements; qualified personnel and resources available for response/intervention (e.g., stranding network capacity); impacts from disasters; and/or habitat/water quality. The DRT will be tasked with integrating various data sources and appropriate additional analyses to best consider recommendations to the Project AMT. The specific process by which the DRT will transmit their recommendations to the State, and the State responds to those recommendations, will be identified on further discussion.

- Parties Responsible for Data Collection

  CPRA and NOAA will ensure that the Marine Mammal Monitoring and Adaptive Management addresses their respective obligations under the Bipartisan Budget Act of 2018; and NOAA will ensure that the Marine Mammal Monitoring and Adaptive Management addresses their obligations under the MMPA.

  DRT activities related to mitigation, monitoring, and intervention will be led by NOAA with a dedicated liaison to the AMT. The DRT will execute the monitoring and AM strategy (which includes both live animal fieldwork and stranding response) for up to 15 years (five years pre-construction; 10 years post-construction). The group will consist of a core team of experienced dolphin staff (including NOAA and contractors) with assistance from additional experienced dolphin staff from partners, as needed. The core team and partners will accomplish the dolphin monitoring and response fieldwork, data and sample collection, data and sample analyses, data management, sample processing, necropsies, outreach/education, and information synthesis. In addition, the group will incorporate the relevant information received from other environmental and biological monitoring sources into marine mammal recommendations to the AMT. The team will also work with federal, state and local partners to increase capacity, public awareness, and

education opportunities on dolphins within Barataria Bay and may provide training opportunities for partners throughout the state.

The DRT anticipates using a tailored version of the CETACEAN platform being developed in partnership with the International Ocean Observing System under the Open Ocean TIG for data intake, management, integration, and synthesis. NOAA will ensure that this system should be compatible with the data management practices outlined in Section 6.

3.7.3.20. Eastern Oysters (Crassostrea virginica)

- Rationale: Document oyster population dynamics and abundance to assess the status and trends of the resource within the project area. The distribution of oysters within an estuary is largely a function of salinity, freshwater input, depth, and substrate (Melancon et al., 1998), although sedimentation, coastal disturbances and overharvesting also control their distribution (Oyster Technical Task Force, 2012). Storm surge and wave action can also result in the destruction of oyster reefs, killing of spat and juvenile oysters, or displacement of oysters onto habitats that cannot support them (Banks et al., 2007).

- Schedule: Planned for both pre-operations and post-construction monitoring. LDWF samples at varying frequencies depending on the methodology and the time of year:
    - Dredge:
        - Monthly, except for July
        - LDWF may also sample weekly in April and May in order to adaptively manage the oyster fishery
    - 1-m^2 quadrat:
        - Coast-wide annually between late June and early July
        - In the Barataria and Pontchartrain Basins only, twice annually in May-June and September-October

- Locations: 34 existing locations shown in Figure 3.7-9.

- Methodology: The LDWF oyster-sampling plan uses square meter plots and dredge sampling to assess oyster density, abundance, and mortality. CPRA proposes to continue that monitoring at the current sampling spatial and temporal density (see Banks et al. 2016).

- Parties Responsible for Data Collection: LDWF.

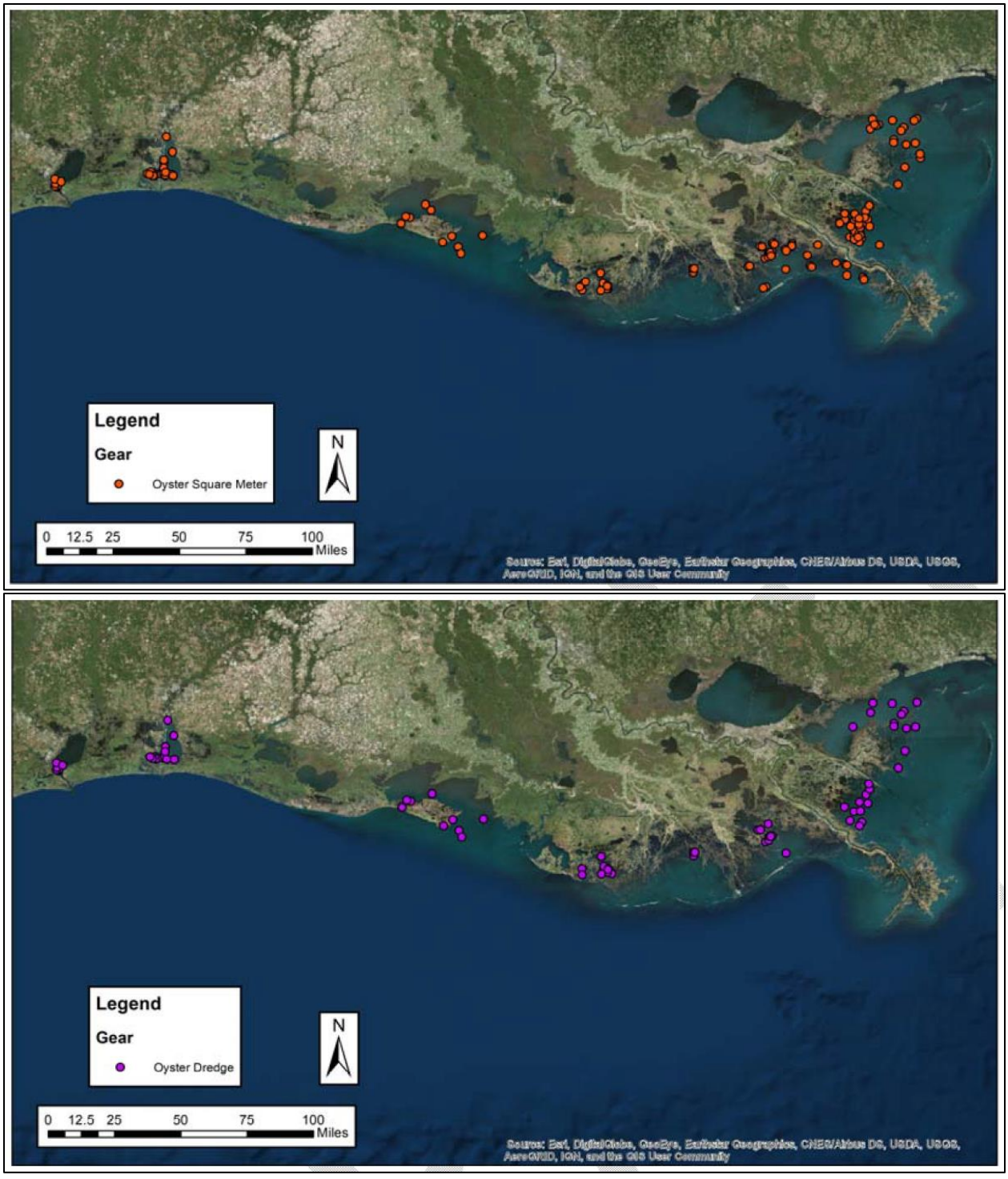


Figure 3.7-9. Existing LDWF locations for oyster density sampling along the Louisiana coast. Shown are locations for square-meter (top) and dredge sampling (bottom). Figures from CPRA & LDWF 2019.

3.7.3.21. Wildlife

- Rationale: Document changes in selected wildlife abundance within the project area. The data will support estimations of *Aquatic resource and terrestrial wildlife utilization of created/restored habitat (3.7.3.22).* The following wildlife species are priorities for Project monitoring, as there were identified in DWH Trustees (2016) as having been injured during the 2010 spill, were the subject of Project-effects estimation of habitat suitability (via the use of HSIs) or were otherwise identified as priorities for continued monitoring by Project partners.
    - *Alligator mississippiensis* (American alligator),
    - *Anas carolinensis* (green-winged teal),
    - *Anas fulvigula* (mottled duck),
    - *Mareca strepera* (gadwall), and
    - *Pelecanus occidentalis* (brown pelican.

- Schedule: Planned for both pre-operations and post-construction monitoring. Schedule varies by species; see Methodology below for details.

- Locations: Survey locations for the species listed above will be consistent with existing LDWF aerial surveys paths.

- Methodology:
    - LDWF conducts annual aerial surveys coast-wide to estimate the number of waterfowl (Figure 3.7-10). The survey consists of 27 north-south transect lines from the Gulf northward to U.S. Highway 90 that are one-quarter mile in width and vary in length from 8 to 48 miles. Survey lines are spaced at 7.5-mile intervals in the southwest and at 15 miles in the southeast resulting in 3% and 1.5% sampling rates in the two areas, respectively. A fixed-wing aircraft is used for this inventory from an altitude of 125 feet at approximately 100 mph. The number of ducks and type of waterfowl species are recorded by habitat type on each survey line. The AMT will rely on the continuation of those data-collection efforts, and will consult with LDWF staff to determine reasonable approaches to estimate those relevant population estimates for the PIA.
    - LDWF conducts nesting surveys for brown pelicans. The AMT will rely on the continuation of those data-collection efforts, and will consult with LDWF staff to determine reasonable approaches to estimate those relevant population estimates for the PIA.
    - LDWF also conducts annual aerial surveys coast-wide to estimate the number of alligator nests, for purposes of setting the annual limits for the taking of eggs in support of the alligator farming industry. The AMT will rely on the continuation of those data-collection efforts, and will consult with LDWF staff to determine reasonable approaches to estimate those relevant population estimates for the PIA.

- Parties Responsible for Data Collection: LDWF.

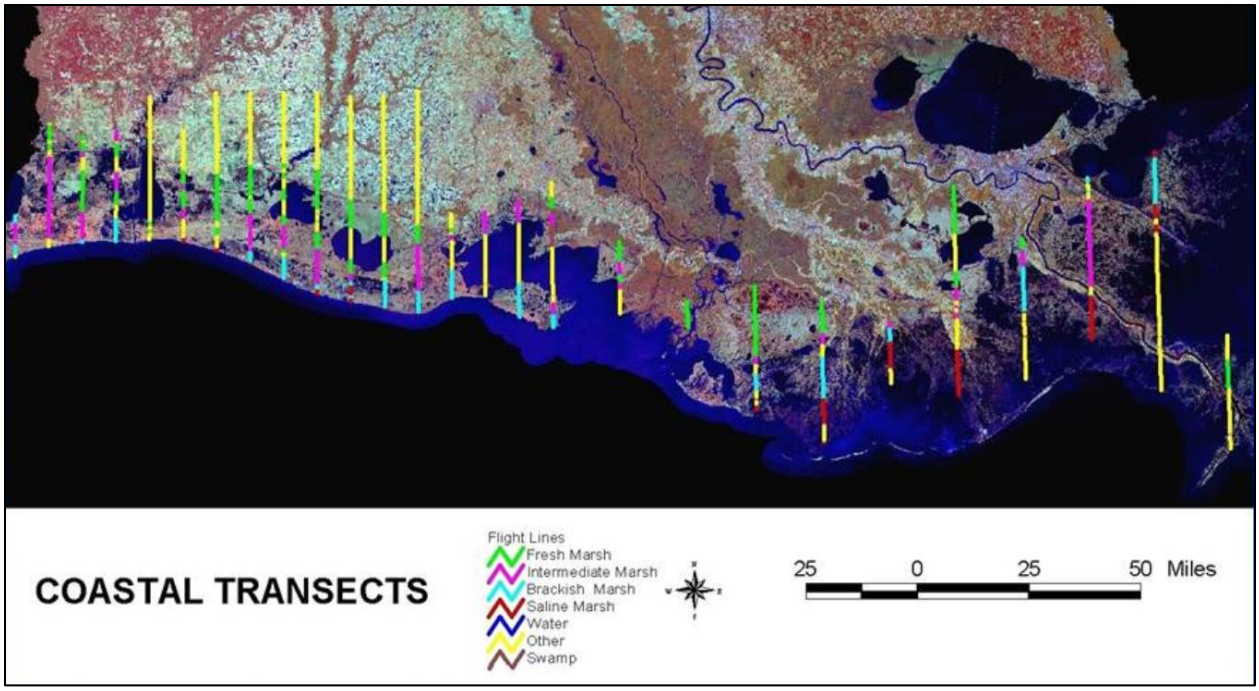


Figure 3.7-10. Locations of coastal transects flown by LDWF for waterfowl population estimations. Transects are shown in relation to marsh type from 2001 (see Linscombe and Hartley (2011). Figure courtesy of LDWF.

3.7.3.22. Aquatic resource and terrestrial wildlife utilization of created/restored habitat

- Rationale: Estimate utilization of created or restored habitat by aquatic resources and terrestrial wildlife. The DWH PDARP (DWH Trustees 2016) discussed several fish and wildlife species that served as indicators of injury to the coastal vegetated marsh ecosystem caused by the 2010 spill (though it is noted that these were not the only species for which Deepwater Horizon injuries were documented):
    - *Fundulus grandis* (Gulf killifish),
    - *Cyprinodon variegatus* (sheepshead minnow),
    - *Palaemonetes pugio (*grass shrimp)
    - *Callinectes sapidus* (blue crab)
    - *Littorina irrorata* (marsh periwinkle), and
    - *Uca longisignalis* (Gulf marsh fiddler crab).

- Schedule: Planned to occur once pre-operations and every five years post-construction.

- Locations: Will include a mix of existing marsh sites within the PIA and newly-created marshes in the PDDA, and in two additional wetland areas (a conventionally restored wetland and an unrestored wetland) as described in Section 4.1.3, for purposes of assessing the relative ecosystem function of different marsh restoration treatments.

- Methodology:
    - Entrapment gears will be used to sample nekton such as *Gulf killifish and* grass shrimp in the tidal creeks, marsh and at the marsh edge.
    - Data from *Nekton (Fish and Shellfish) Species Abundance and Composition/Assemblage* (3.7.3.18), *Eastern Oysters* (3.8.3.20), and *Wildlife* (3.7.3.21) surveys will be combined

with data collection at historically-occurring emergent wetlands within the Project Influence Area and newly-created emergent wetlands in the Project delta development area to provide an estimate of wildlife utilization.
    - *Gulf marsh fiddler crabs* will be surveyed non-destructively, through either burrow counts or visual counts of individual crabs (see discussion in Miller (no date)).
    - Marsh periwinkles will be sampled through visual counts.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.23. Contaminants in Fish, Shellfish, and Wildlife

- Rationale: Document 1) presence of Contaminants of Concern (COCs) on fish and wildlife resources within the Project Influence Area and 2) potential risks to human health and wildlife from consuming fish and shellfish from the Project Influence Area. Many of the soluble organic contaminants in the Mississippi River (e.g., hexachlorobenzene and polychlorinated biphenyls are associated with the suspended sediment fractions that contain the most organic carbon. Contaminants can bioaccumulate in organisms, and higher trophic levels exhibit higher concentrations (biomagnification).

- Schedule: One pre-operations sampling event to establish baseline concentrations of COCs in sediment, fish, and shellfish in the Project Influence Area. Initial post-operations fish and shellfish sampling schedules will be informed by baseline results of COCs found in the sediment of the Project Influence Area. For example, elevated levels of certain contaminants in baseline samples (e.g., mercury) may necessitate more frequent sampling. The periodic post-operational sampling of fish and shellfish will begin after sufficient time for potential contaminants to accumulate (2 to 5 years). The frequency, intensity, and potential expansion of subsequent periodic sampling (e.g., 2 to 5 years, or later) will be predicated upon the type and level of contaminants detected in tissue and/or sediment.

- Locations: Within the outfall area and the Mississippi River.

- Methodology:
    - CPRA, in coordination with the US Fish & Wildlife Service (USFWS), will develop
        - A list of contaminants to be analyzed, taken from the most recent EPA Priority Pollutants list (40 CFR Part 423 Appendix A) and relevant to Mississippi River water quality; and
        - A list of fish and shellfish to sample for the selected contaminants. Recommended species and analytes are detailed in USEPA (2000). A bottom-dwelling species of finfish will be included in all sampling events due to proximity with sediments.
    - Expansion of sampling to local nesting bald eagles (e.g., fecal and blood samples analyzed for the same contaminants) would also be predicated upon the type and level of contaminants detected.
    - Sediments will be sampled once pre-operations. Post-operations sampling may be added after sufficient time for potential contaminants to accumulate.
    - Analytical results will be shared with USFWS and LDWF. Based upon results and in consultation with USFWS and LDWF, the MAM plan may be modified as appropriate.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.3.24. Socio-economic Data

At this time, CPRA is proposing to rely on the Human Dimensions data collection in Barataria Basin outlined in the SWAMP implementation plan (Hijuelos and Hemmerling, 2016; https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=11464). To summarize the proposed information outlined in Table C:1 therein, the categories (*in italics*) and variables proposed by Hijuelos and Hemmerling (2016) are listed in Table 3.7-6. The Multi-year Project Synthesis Reporting (5.2.3) will summarize these data for interested parties.

- Parties Responsible for Data Collection: Most of these parameters are collected and archived by the US Census Bureau or other federal agencies. CPRA or its contractor will obtain and summarize the federal data to be considered as part of the 5-year synthesis (Section 5.2.3).

Table 3.7-6. Socio-economic parameters and data respositories. See Hijuelos and Hemmerling (2016) Table C:1 for additional details.

Category/Parameter	Currently Collected By	Data Availability
Population and Demographics		
Number of Households	Census Bureau	https://data.census.gov/cedsci/
Total Population	Census Bureau	https://data.census.gov/cedsci/
Race and Ethnicity	Census Bureau	https://data.census.gov/cedsci/
Housing and Community Characteristics		
Residential Stability	Census Bureau	https://data.census.gov/cedsci/
Home Ownership	Census Bureau	https://data.census.gov/cedsci/
Residential Occupancy Rates	Census Bureau	https://data.census.gov/cedsci/
Property Values	Census Bureau	https://data.census.gov/cedsci/
Economy and Employment		
Economic Development	Bureau of Economic Analysis	https://apps.bea.gov/itable/index.cfm
Income Levels	Bureau of Labor Statistics	https://beta.bls.gov/dataQuery/find?removeAll=1
Poverty Rates	Census Bureau	https://www.census.gov/library/publications/2021/demo/p60-273.html#:~:text=The%20official%20poverty%20rate%20in,and%20Table%20B%2D4).
Unemployment Levels	Bureau of Labor Statistics	https://beta.bls.gov/dataQuery/find?removeAll=1

Table 3.7-6 (*continued)*. Socio-economic parameters and data respositories.

Category/Parameter	Currently Collected By	Data Availability
Ecosystem Dependency		
Natural Resource Extraction (agriculture and forestry, fisheries landings, oil & gas production)	Several including US Department of Agriculture (USDA), US Department of Energy, Bureau of Land Management, Federal Emergency Management Agency (FEMA), USGS; USDA Census of Agriculture ZIP code agricultural yield data; Louisiana State University AgCenter parish agricultural totals; LDWF trip ticket zone fisheries landings data; LDNR oil and gas production data	https://www.ers.usda.gov/about-ers/partnerships/strengthening-statistics-through-the-icars/natural-resources-datasets/
Cultural and Traditional Uses of Natural Resources	Louisiana Division of Archaeology, State Division of Historical Preservation, LDWF, LDNR; additional sampling surveys needed	
Natural Resource-based Employment (agriculture, forestry, fishing and hunting, and oil & gas):	Bureau of Labor Statistics; 5-year American Community Survey block group estimates of employment in agriculture, forestry, fishing and hunting, and oil and gas extraction	https://www.bls.gov/iag/tgs/iag10.htm#workforce
Tourism, Commercial and Recreational Use of Natural Resources (e.g., number of recreational fishing and hunting licenses, number of recreational trips to the area)	Louisiana Wildlife and Fisheries; additional sampling surveys needed	https://www.wlf.louisiana.gov/page/wma-gis-data-download
Residential Properties Protection		
Residential Risk Reduction	FEMA digital flood maps	https://www.fema.gov/about/openfema/data-sets#hazard
Households Receiving Structural Protection	FEMA; USACE levee locations	https://www.fema.gov/about/openfema/data-sets#hazard
Residential Properties Receiving Nonstructural Protection	FEMA; Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) mitigated structures data	https://www.fema.gov/about/openfema/data-sets#hazard
Critical Infrastructure and Essential Services Protection		
Risk Reduction for Critical Facilities	NOAA; FEMA's Hazus Multi-Hazard tool data; GOHSEP Severe Repetitive Loss Data	https://coast.noaa.gov/digitalcoast/data/criticalfacilities.html
Miles of Levees Created and Maintained	USACE	https://levees.sec.usace.army.mil/
Number of Critical Facilities Protected by Levees	USACE	https://levees.sec.usace.army.mil/
Public and Commercial Properties Receiving Nonstructural Protection	Regional Planning Commission; GOHSEP mitigated structures data	

3.7.4. Compliance Monitoring

The purpose of compliance monitoring is to document the ability of those managing the Project to meet permitting requirements.

3.7.4.1. National Historic Preservation Act, Section 106 Monitoring Requirements

- Rationale: In compliance with Stipulation X. Monitoring Plan of the Programmatic Agreement among USACE, the State Historic Preservation Officer, the Advisory Council on Historic Preservation, and CPRA, CPRA will monitor the effects of the diversion on archaeological sites within the Operations Impact Area of Potential Effect.

- Schedule: Planned to occur once pre-operations and annually, after the cessation of operational flows and return to base flow, for the first fifteen years after the onset of Project operations.

- Locations: Documented historical sites in the Project Influence Area.

- Methodology: CPRA will use a team of Secretary of the Interior Qualified Archaeologists to conduct an annual one-day reconnaissance of the Operations Area of Potential Effect (APE)/PIA by boat. The first reconnaissance visit will occur within three months before the first operation of the MBSD and will document current conditions prior to operation for later, post-operation comparison. This reconnaissance team will take photographs and document visible changes to the landscape within the Operations APE/PIA, including in proximity to the National Register of Historic Places (NRHP) properties (16JE2, 16JE3, 16JE11, 16JE147, and 16JE237), with the particular attention to any evidence of previously undiscovered cultural resources and the appearance of human remains at known archaeological sites. If an apparent cultural resource is/are located by the reconnaissance team, CPRA will notify all Consulting Parties within 24 hours pursuant to Stipulation VIII.B.1 of the Programmatic Agreement. If apparent Human Remains are found, the provisions of Stipulation IX of the Programmatic Agreement will be followed. CPRA will comply with the Louisiana Unmarked Human Burial Sites Preservation Act (La. R.S. 8:671 et seq.). CPRA will notify local law enforcement and the Louisiana Division of Archaeology (LDOA), within the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, by telephone to assess the nature and age of the human skeletal remains within 24 hours of the discovery of unmarked human remains and will accompany local law enforcement during all field investigations.

- Parties Responsible for Data Collection
    - CPRA
    - Contracted team of Secretary of the Interior Qualified Archaeologists

3.7.4.2. Sea Turtles (Green, Kemps Ridley, Loggerhead) Fishery-related Take

- Rationale: The National Marine Fisheries Service's (NMFS) Biological Opinion Reasonable and Prudent Measure (RPM) 1 requires monitoring and reporting of LDWF collected annual brown shrimp fishing trip ticket data for area 211 to determine if shrimp fishing activity over a 3-year running average is within the range considered in the consultation.

- Schedule: Annually.

- Locations: Area 211, which covers most of the lower Barataria Basin and nearshore waters where increased sea turtle interactions resulting from relocation of shrimping activity are most likely to occur.

- Methodology: The level of fishing activity (number of brown shrimp fishing trips) that will occur in the lower basin (area 211) will be reported based on data collected by LDWF. The annual brown shrimp trip ticket data for area 211, along with the 3-year running average of brown shrimp fishing trips in area 211, will be reported to NMFS Protected Resources Division (PRD).

- Parties Responsible for Data Collection: CPRA contractor will request and synthesize the trip ticket data collected by LDWF.

3.7.4.3. Sea Turtles (Green, Kemps Ridley, Loggerhead) Habitat change-related Take

- Rationale: The Delft3D-based alternatives modeling outlined in the FEIS provided estimates of projected salinity conditions at various locations throughout the basin under FWOP and FWP scenarios. Staff from the NMFS Southeast Regional Office used those modeling outputs as a basis for drafting the Biological Opinion on the effect of the proposed Mid-Barataria Sediment Diversion Project on sea turtles in the Barataria Basin. The NMFS Biological Opinion RPM 2 requires the inclusion of a monitoring component in this Plan that establishes measurable triggers to determine if seasonal salinity conditions under actual project operations are within the expected range projected by the Delft 3D based model, to confirm that the level of take analyzed and authorized in the Biological Opinion is not exceeded.

- Schedule: CPRA and the NMFS Southeast Regional Office (SERO) will fully develop the monitoring plan prior to commencement of operations and will implement the plan prior to or immediately following commencement of operations. The monitoring plan will be integrated into this MAM Plan.

- Locations: Lower Barataria Basin.

- Methodology: The actual salinity levels occurring in the action area will be monitored as a surrogate for the level of sea turtle exclusion and harm occurring in the action area. See methods described under *3.7.3.8. Salinity in Barataria Basin Surface Waters*. CPRA and NMFS SERO and Southeast Fisheries Science Center (SEFSC) will implement a monitoring program and analytical design that establishes measurable triggers that will indicate when salinity conditions have exceeded the levels anticipated and analyzed in the Biological Opinion. An annual report of the data and analytical output from this monitoring shall be sent to NMFS.

- Parties Responsible for Data Collection:
    - Salinity at select monitoring stations: USGS and/or CPRA contractor.
    - Sea turtle location: TBD.

3.7.4.4. Sea Turtles (Green, Kemps Ridley, Loggerhead) Use and Abundance

- Rationale: There is a scarcity of information on sea turtle activity and use of the action area. The NMFS Biological Opinion RPM 3 requires the inclusion of a monitoring plan targeting sea turtle abundance, distribution, health, and habitat use within the Barataria Basin.

  Schedule: 3 years of field work pre-operations, 3 years of field work immediately post-construction, and 1 year of data analysis.

- Locations: Turtle monitoring and tagging field work will be conducted in selected areas of the lower Barataria Basin, from the area below the proposed outfall, down to and including the passes and inlets around the barrier islands and the Gulf-side shallow water habitat adjacent to the barrier islands at the southern end of Barataria Bay.

- Methodology: CPRA and NMFS SEFSC will develop and implement a monitoring plan approved by PRD, targeting sea turtle abundance, distribution, health, and habitat use within the Barataria Basin. Data collected will be used to analyze habitat use in relation to physical and biological habitat characteristics and salinity level parameters. Once finalized, the monitoring plan will be integrated into this MAM Plan.

  The field work will include trawl vessel surveys, satellite tag deployment, health assessment, and data analysis including the following:
  - Transect surveys - Direct capture of sea turtles using otter trawl and skimmer trawl vessels using standardized seasonal 30-minute transects during spring, summer, and autumn of each year to obtain a statistically appropriate sample size in the action area. Turtles will be captured using skimmer trawls in shallow areas (<10ft), focusing on salt marsh habitat where we expect to find smaller juvenile sea turtles, and larger otter trawl vessels using paired otter trawls in depths > 10 ft. Appropriate scientific research and collection permits will be required for these activities.
  - Health assessments -Turtles captured in trawl surveys will be measured, weighed, tagged with flipper and passive integrated transponder tags, tissue sampled (for genetic analysis and stable isotopes), and blood sampled (for blood chemistry analyses). Environmental data (salinity, water temperature, etc.) will be collected in conjunction with sea turtle capture efforts. Turtles will be released at or near the capture site.
  - Satellite Tagging – Up to 240 turtles (target of 40 per year, with selection based on appropriate size and condition) captured in the trawl surveys will be satellite tagged to monitor location, dive behavior, salinity, and temperature. Salinity sensor-equipped satellite tags will be used on a portion of these turtles to better understand habitat use patterns relative to salinity regimes and if shifts in salinity affect behavior.
  - Annual and seasonal estimates of relative abundance will be generated from the trawl data at the conclusion of each year's sampling.

  The data analysis and modeling will include the following:
  - Estimate habitat use by overlaying our satellite tracking data on available benthic habitat geospatial data, as well as salinity information collected by the satellite tags. Additionally, data from any current in-water environmental monitoring stations could be used to provide additional supplemental environmental data. In addition, we plan to coordinate with other research groups, such as benthic researchers studying lower trophic level organisms to provide abundance and species composition data for key prey organisms to further understand habitat use and sea turtle distribution.

- Complete development of a predictive model for sea turtle species habitat use and distribution in relation to physical and biological habitat characteristics and salinity level parameters. The model can be used to assess the overlap of sea turtle distribution with known and emerging threats to prioritize the type and location of restoration activities and to evaluate their effectiveness.

Due to uncertainties related to sea turtle activity and use of the study area, monitoring results and efficacy, and extrinsic factors (e.g., hydrologic conditions), monitoring activities will be adaptively managed. A team consisting of up to 3 state (CPRA) and 3 federal (NMFS SEFSC, NMFS PRD, and NOAA Restoration Center) representatives (along with any technical experts invited by these entities) will meet at least once a year to review progress and results of the monitoring activities. The USACE may also participate on this team if they wish. This team may make recommendations on any necessary changes to the monitoring and tagging activities, locations, timing, or level of effort, based on current information and monitoring/tagging results to date. Any proposed changes to the sea turtle monitoring activities must be approved by NMFS PRD before implementation.

- Parties Responsible for Data Collection:
  - Salinity at select monitoring stations: USGS and/or CPRA or its contractor.
  - Sea turtle location: CPRA or NOAA contractor.

3.7.4.5. Pallid Sturgeon

Project operation poses the risk of entrainment of all life stages of pallid sturgeon present in the area near the structure. Therefore, the USFWS Biological Opinion Terms and Conditions require the inclusion of a monitoring component in this Plan to confirm that the level of incidental take analyzed and authorized in the Biological Opinion is not exceeded, a condition that might require the re-initiation of formal consultations between USFWS and CPRA. CPRA has agreed to jointly develop a monitoring plan for pallid sturgeon with USFWS if, and if so after, the USACE awards a Project permit. That plan will be completed prior to construction and will detail schedule, locations, methodology and parties responsible for data collection. The monitoring plan will be approved by USFWS and integrated into this MAM Plan before construction of the cofferdam begins.

3.7.4.6. Bald Eagle Nests and Wading Bird Colonies

CPRA has agreed to jointly develop a monitoring plan for bald eagles and wading bird colonies in the vicinity of the Project during construction with USFWS. That plan will provide in part that if a bald eagle nest is within or adjacent to the proposed project area during construction, CPRA will follow the bald and golden eagle guidelines found on-line at https://www.fws.gov/library/collections/bald-and-golden-eagle-management to determine whether disturbance will occur and/or an incidental take permit is needed. That plan will further detail schedule, locations, methodology and parties responsible for data collection. Once finalized, the monitoring plan will be integrated into this MAM Plan.

3.7.5. Variables Associated with the Mitigation and Stewardship Plan

This section describes monitoring parameters that will inform or evaluate actions associated with the

separate Mitigation and Stewardship Plan. These parameters are not expected to directly inform Adaptive Management Actions undertaken as part of the MAM Plan.

3.7.5.1. Fecal Coliform

- Rationale: This dataset will inform actions described in the Aquatic/Fisheries Impact of the Mitigation and Stewardship Plan (Section 6.3.3) related to re-establishment of oyster reefs within Public Seed Grounds.

- Schedule: Pre-operations and post-operations, monthly

- Locations: Hackberry Bay Seed Reservation and Lower Barataria Basin

- Methodology: Monthly boat-based water sample collection at 165 established LDH sampling stations (Figure 3.7-11). Water samples undergo fecal coliform testing per methods established for the state laboratory (IDEXX 2000 - 5 step decimal dilution method using Most Probable Number/100mL) and results analysis (applying the geometric mean, 90% tile and percentage greater than 43).

- Parties Responsible for Data Collection:
    - Empirical data collection: LDH
    - Data synthesis: CPRA contractor.

3.7.5.2. Effectiveness of Investment in Vessel/Facility Improvements in the Finfish and Shrimp Fisheries

- Rationale: These datasets will help to evaluate the success of mitigation actions described in the Aquatic/Fisheries Impact of the Mitigation and Stewardship Plan (Section 6.3.3) related to investments in improvements to dockside facilities and vessels (such as refrigeration or gear improvements) and acquisition of new vessels for the finfish and shrimp fisheries.

- Schedule: Annually, pre-operations and post-construction, for 5 years following completion of Project investment in vessel/facility improvements.

- Locations: Within the Barataria Estuary (BA-0153 Area of Analysis in Figure 3.7-11)

- Methodology: Use LDWF LA Creel and/or Trip Ticket data for landings by weight for finfish, brown shrimp, and white shrimp from within the Barataria Estuary. Evaluate changes for fishers that received grants related to the Project's Stewardship and Mitigation Plan.

- Parties Responsible for Data Collection:
    - Empirical data collection: LDWF
    - Data synthesis: CPRA staff or contractor.

3.7.5.3. Effectiveness of Marketing Support for the Oyster, Finfish, and Shrimp Fisheries

CPRA will develop a protocol to monitor and evaluate the success of mitigation actions described in the

Aquatic/Fisheries Impact of the Mitigation and Stewardship Plan (Section 6.3.3) related to additional marketing for the oyster, finfish, and shrimp fisheries. Once finalized, the monitoring protocol, including schedule, locations, and methodology, will be integrated into this MAM Plan.

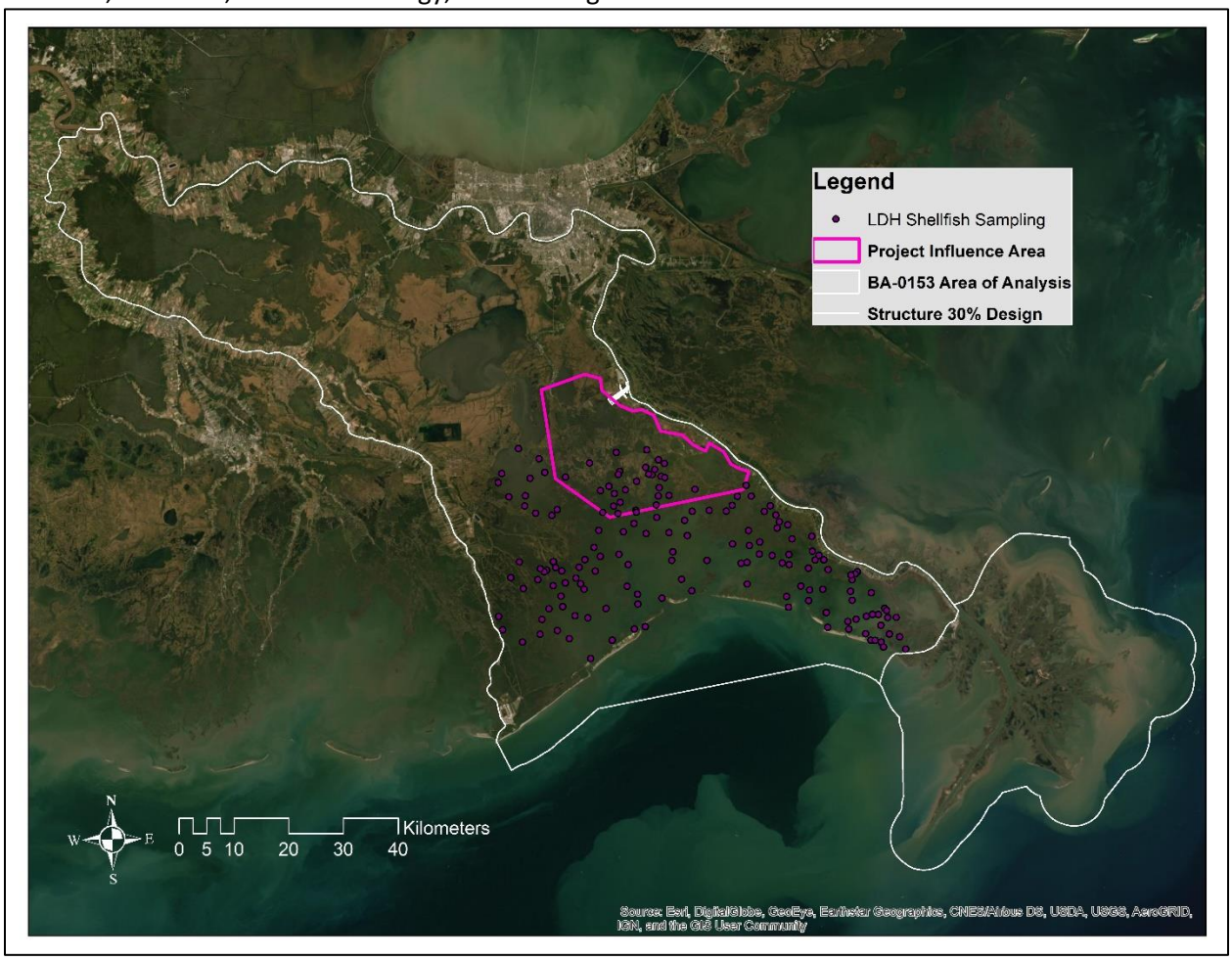


Figure 3.7-11. Louisiana Department of Health (LDH) shellfish sampling stations in the Barataria Basin.

3.7.5.4. Effectiveness of Workforce and Business Training for Commercial Fishing Industries

- Rationale: Evaluate the success of mitigation actions described in the Aquatic/Fisheries Impact of the Mitigation and Stewardship Plan (Section 6.3.3) related to investments in workforce and business training within various sectors of the commercial fishing industry.

- Schedule: Annually, pre-operations and post-construction, for 10 years following completion of Project investment in training.

- Locations: Within the Barataria Estuary (BA-0153 Area of Analysis in Figure 3.7-11)

- Methodology:
    - Compare annual income of commercial fishing industry participants before and after receiving Project support for workforce training to transition into new employment or for business training to enhance revenue within current employment.

- For commercial fishers who are part of an identified community with environmental justice concerns that may be disproportionately impacted by the Project, compare number and income before and after being targeted by the Project outreach plan, to include the number of applicants assisted, the number of applications completed, the number of grants awarded to applicants, and the percentage of program resources that are utilized.

- Parties Responsible for Data Collection: CPRA contractor.

3.7.5.5. Effectiveness of Environmental Justice Mitigation Measures

- Rationale: These datasets will help to evaluate the success of mitigation actions described in the Environmental Justice section of the Mitigation and Stewardship Plan (Section 6.3.8) related to outreach and engagement to identified communities with environmental justice concerns that may be disproportionately impacted by the Project. Programs will include startup grants, workforce training, shrimping vessel and gear improvement grants, enhancing public and private oyster seed grounds, alternative oyster culture, and overall fisheries workforce and business training.

- Schedule: Annually, pre-operations and post-construction, for 10 years following completion of Project investments.

- Locations: Within the targeted Environmental Justice populations.

- Methodology: For commercial fishers who are part of an identified community with environmental justice concerns that may be disproportionately impacted by the Project, compare income before and after implementation of the Project mitigation and stewardship programs; the number of applicants assisted; the number of applications completed; the number of grants awarded to applicants; and the percentage of program resources that are utilized.

- Parties Responsible for Data Collection: CPRA contractor.

Page intentionally left blank

4. EVALUATION AND PROJECT-LEVEL DECISIONS FOR CONDUCTING MANAGEMENT ACTIONS

Evaluation in the context of the Project MAM Plan refers to the consideration of data collected from the monitoring protocols outlined in Section 2. Those data will inform future Project management decisions aimed at improving Project effectiveness and limiting ecological and/or human impacts when possible.

This section describes the general types and anticipated frequency of evaluations that will ultimately inform management actions, such as operations refinements and outfall management measures, changes to monitoring protocols, and refinements to modeling assumptions. Table 4-1 outlines the general classes of evaluations that correspond to the Project objectives that are described in detail in Section 1.

Table 4-1. A description of how evaluation will support the fundamental and secondary objectives.

Types of Monitoring (Section)	**Fulfills:**	**Overarching Questions Linking Evaluation to Decision-making**
Effectiveness (Section 3.6)	Fundamental Project Objectives (1,2,3)	How can the components of the Project (intake, channel, outfall transition) and/or operation strategies be optimized for sediment delivery between the river and basin? What measures are available? Is the pace or magnitude of wetland habitat creation and sustainability meeting expectations, within natural constraints?
Compliance (Section 3.8)	Resource management and permit conditions	How can Project components and/or operations be optimized to balance Project objectives and impacts?

Decisions on Project management actions, including the development and amendment of annual Operations Plans, will be made based on evaluation of the Project monitoring data. The basis for initiation of Project operations is outlined in Section 4.2 of the OMRR&R main report. The OMT will work with the AMT and other adaptive management partners to decide on continuation, alteration or discontinuation of operations (and subsequent amendments to the Annual Operations Plans) and/or the need for outfall management actions or other management responses during individual structure openings (events) and on annual and multi-year cycles as outlined in Section 5. An overview of the process of assessing and evaluating new and existing information to inform project management decisions is illustrated in Figure 4-1, which is Step 8 of the Project Adaptive Management cycle (Figure 1.1-1).

It is important to note that while Project alternatives modeling informs expectation of biophysical responses to Project operations, it isn't possible to know for certain prior to the onset of Project operations what the monitoring data will show, and thus what specific changes in Project operations or outfall management actions will be necessary. Outfall management actions, such as spoil bank gapping or construction of water-directing features, may be considered in the future as potential adaptive management actions, based on assessment of project performance and monitoring data and recommendations of the Project Adaptive Management Team to the Project Operations Management Team. Consideration of those actions would likely require NEPA evaluation of potential environmental impacts prior to implementation, as summarized in *Mitigation Measures Environmental Analysis* in this FEIS Appendix.

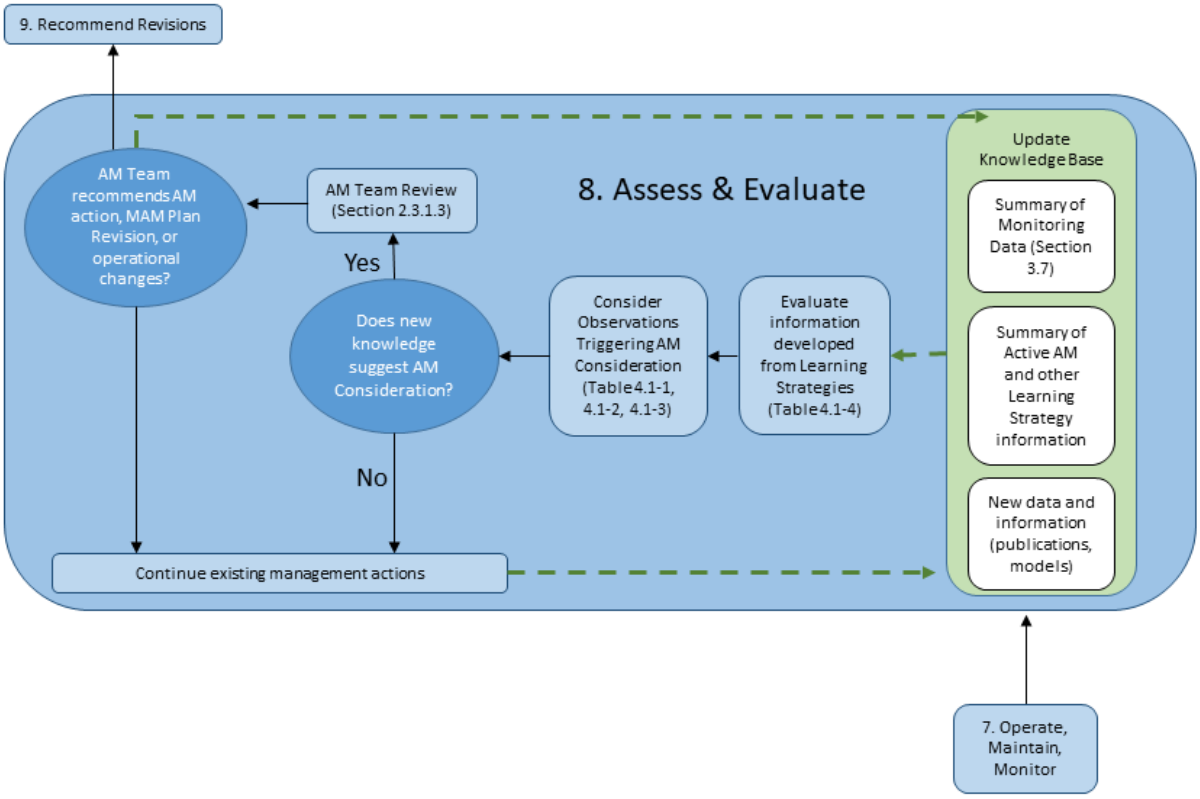


Figure 4-1. New and existing data are evaluated to reduce uncertainties and inform Project management decisions in Step 8 of the Project Adaptive Management cycle (Figure 1.1-1).

In the initial drafting of this section the focus has been to provide some considerations of the response to the Project Effectiveness data (Table 4-1), especially the efficiency by which the Project captures sediment from the MR and transports that sediment through the conveyance channel and into the Project receiving basin. CPRA expects these data will underpin the immediate needs and opportunities for adaptive management decision making. Evaluation of Project effectiveness in meeting Project objectives is described in Section 4.1. For critical uncertainties related to changes of existing conditions in response to the Project, a learning strategy to address each uncertainty is identified in Table 4.1-4.

To date, CPRA and LA TIG partners have proposed categorizing the monitoring parameters and evaluations into four categories. These categories reflect how the monitoring data will be evaluated, and whether the data evaluations would warrant or trigger considerations of some type of adaptive management action such as a change in operations or the implementation of outfall management. Those four categories are:

- Range: Data for these parameters will be evaluated with the goal of maintaining observations within a range of values based on documented historical and/or current variability, as well as scientific understandings of the parameter. Adaptive management actions will be considered if values were observed outside the range for a particular parameter.
- Presence/Absence: Data for these parameters will be evaluated in the binary of parameter occurrence or absence. Adaptive management actions will be considered if values occurred in the undesirable half of the binary (i.e., absent when presence is desired, or vice-versa).

- Trend: Data for these parameters will be evaluated as a progression of values in time and space. Adaptive management actions will be considered if the expected or desired trend (at least in part informed by Project alternative numerical modeling) does not occur or reverses from historical patterns.
- Context: Data for these parameters will be collected and analyzed due to broader interests in the values and trends. However, at this point, we do not anticipate data observations for these parameters triggering any considerations of adaptive management actions.

Initial categorization of each monitored parameter described in Section 3 is outlined in the tables below, with an emphasis on the term "initial." Consistent with the idea of Project adaptive management, it is plausible that there may be changes in categorization of monitored parameters over time, as additional observations are made and data collected.

The authors also acknowledge that these bins may be artificially discrete. For example, a parameter might be assigned to be evaluated within a Range of values, but repeated observations of a Trend of values increasing unabated towards the maximum "acceptable" value within that Range might realistically trigger adaptive management considerations before values are observed exceeding that maximum.

4.1. Evaluation of Project Effectiveness Monitoring Data

There will be extensive monitoring of the Mississippi River, conveyance structure and Barataria Basin to inform Project effectiveness and document natural and human community response, as outlined in Section 3. Evaluation and decision making should be tempered by expected and empirical outcomes and the disparate timescales over which meaningful and discernable trends are exhibited by the resource or landscape. For example, the hydrologic impacts of the Project on basin habitats will be sudden and widespread; however, the emergence of new land area or plant community changes may experience various lag effects. There should be caution against premature evaluations on processes that require an accumulation of interacting processes over time; such an approach avoids cross-scale issues common to some large-scale restoration projects (Walters 1997). It is envisioned that peer review and collaborative analysis approaches will converge on accepted time scales for certain resource evaluations, especially as they pertain to further constraining an operation regime designed to meet the primary Project objectives.

4.1.1. Evaluation of Monitoring Data in Support of Project Objective 1: Deliver Freshwater, Sediment, and Nutrients to Barataria Bay through a Large-Scale Sediment Diversion from the Mississippi River

The overt, empirical basis for Project structure operations, at least in the initial years, will be continuous monitoring of *Mississippi River water discharge* (3.7.1.1.1). Additionally, early in Project operations, *Mississippi River suspended sediment concentrations* (3.7.1.1.2), and *Sediment concentrations in the flows conveyed into Barataria Basin* (3.7.1.1.9) will be collected and analyzed immediately, as they will provide the technical rationale for confirmation and potential changes in operations to optimize *Sediment:water in the flows conveyed into Barataria basin* (Section 3.7.1.2.2).

Longer-term plans for the specific time intervals to conduct evaluations have not been determined. Measurements and surveys of each operational event could occur at higher frequencies during early operations, for example, to evaluate the sediment transport performance of all the conveyance features. As learning increases, the evaluations may shift from event-based to periodic (e.g., annual) intervals to inform operation decisions. However, it is not possible in advance of Project operations to predict how quickly the Project Implementation Teams (Section 2.2) will learn from each operational event. A performance metric such as *Sediment: water in the flows conveyed into Barataria basin* (Section 3.7.1.2.2) may initially be studied on multiple events within a year, but as river discharge and sediment availability relationships improve, evaluations may be limited to the water year.

Equally important is the determination of the extent to which Project operational flows are leading to changes in *Topography/bathymetry of the Project outfall area* (3.7.1.1.7), especially erosion of the native soils and sediments in the outfall area. Erosion may exceed deposition at some specific locations, especially immediately after operations commence. The Project Implementation Teams will need to make those assessments during and after distinct operational flow events, determine whether erosion and deposition patterns are within or exceed expectations, and, after evaluating other relevant context variables such as *Water velocities at multiple locations in the Project Influence Area* (3.7.2.1.1), whether these changes warrant immediate adaptive management of operations, which could include adjustment of the timing or extent that the Project structure is opened between operational and base flows, within permitted ranges (see Table 4.1-1).

The focus of this monitoring will be outside of the immediate Project Outfall Area. For areas most proximal to the discharge of the Project, numerical modeling has projected the scouring of some existing marsh and subaqueous water bottoms. This phenomenon is necessary for the Project flows to build the distributary network in the receiving area needed to distribute freshwater, nutrients and sediments into the Basin. Table 4.1-1 identifies "outfall management actions" as an example of a potential adaptive management action in response to observations of excessive water velocities. Examples of outfall management actions, based on experience with management of the Caernarvon and Davis Pond Freshwater Diversion Projects, could include spoil bank gapping to increase dispersal of diverted water, or, conversely, construction of water control structures to focus diverted water dispersal to targeted areas and/or restrict dispersal to more vulnerable areas of the Barataria Basin. Those or other outfall management actions could be recommended by the AMT to the OMT in response to observed data for other parameters listed in Tables 4.1-2 and 4.1-3, depending on specific future observations.

4.1.2. Evaluation of Monitoring Data in Support of Project Objective 2: Reconnect and Re-establish Sustainable Deltaic Processes between the MR and the Barataria Basin

The parameters listed in Table 4.1-2 and Section 3.7.2 are proposed to support Objective 2 by informing how the Project would reconnect the Mississippi River to the Barataria Basin and re-establish delta building in the Basin. Objective 2 is explicitly centered on the movement of water and sediment through the Basin and the response of soil-building processes; specifically, the repeated addition of riverine mineral sediments to Basin wetland soils and the resulting increase in marsh soil surface elevation that help those marshes be sustainable intertidal habitats in the face of relative SLR.

Project alternatives modeling has projected that *Frequency, depth and duration of inundation at multiple locations on the marsh in the Project Influence Area* (3.7.2.1.2) will increase during Project operations. The Project partners will monitor this parameter to determine if, and if so the extent to

which, Project operations will result in inundation patterns that are limiting subaerial wetlands in the PIA. This limitation, if present, could result from excessive water levels physically inundating wetland surfaces, and/or the imposition of an inundation stress on emergent wetland vegetation. Currently the available science informing what inundation patterns are either optimal for or detrimental to marsh vegetation growth is inexact and hinders establishing firm limits. As a result, no explicit thresholds in inundation have been established *a priori*, and instead the intention is to monitor this parameter to see whether an increasing trend in inundation results over time from Project operations. While the Project Operations and Adaptive Management Teams await scientific advances and Project-specific data to inform eventual thresholds on optimal versus detrimental inundation to specific plant species, a consistent increase in inundation would be more broadly recognized as undesirable.

The hydrologic flows resulting from Project operations are ultimately what will transport the mineral sediments in diverted Mississippi River flows (Objective 1) into the Barataria Basin and distribute those sediments into open waterbodies and onto the marsh surface. The two remaining parameters proposed as adaptive management triggers in Table 4.1-2 reflect the fate and effect of those sediments.

Most central to the overall intention of the Project, and thus the determination of Project success and effects, is the effect of diverted freshwater, nutrients and sediments on the *Marsh surface elevation change rate in the Project Influence Area* (3.7.2.1.9), as measured at CRMS-*Wetlands* sites. The Project is intended to create and sustain emergent marshes in the Basin indirectly by stimulating plant growth that will contribute organic matter to the marsh soil profile, and by directly transporting mineral sediments onto the marsh surface and into the soil profile. Both of these processes would be manifested by increases in marsh surface elevation over time, with sustainability defined as rates of increase exceeding local estimates of RSLR and thus sustaining subaerial emergent marsh. Observations of declines in marsh surface elevation, especially at CRMS-*Wetlands* sites that currently demonstrate other elevation change patterns, would suggest either limitations in diverted material flows to the marsh or that Project operations are imposing other stresses on the wetlands.

Similarly, calculations of *Sediment dispersal and retention on the emergent marsh surface in the Project Influence Area* (3.7.2.2.1) will elucidate Project success by determining patterns of mineral sediment distribution onto the surface, and into the soil matrix, of the wetlands in the PIA. This parameter will be important for the Project Operations Management Team and Adaptive Management Team to monitor because unlike the well-recognized benefits of filling erosional open water bottoms with sediment and establishing new emergent wetlands, the available science suggests that there is a "Goldilocks" optimum to the benefits of dispersed sediments to intact marshes. Too few sediments transported to the marsh surface may not stimulate plant growth and maintain *Marsh surface elevation change rate in the Project Influence Area*, while too great a sediment delivery can impose lethal physical stresses to the native vegetation and lead to mineral lenses in the soil profile that hinder future marsh growth. The CPRA Executive Team, OMT and AMT will have to evaluate the observational data and, for example, decide if outfall management options that would limit short-term sediment deposition (to best achieve those "Goldilocks" rates and/or magnitudes) would negatively impact longer-term Project goals.

CPRA has proposed that a number of soil development parameters be relegated for now as Context variables; i.e., parameters for which data will be collected, but which at this time are not being identified as representing overt triggers for adaptive management consideration (see Section 4.2). As proposed, if there are issues noted with the soil-related triggers above, these parameters will be more fully investigated to determine why issues were identified.

Adaptive management actions to improve Project performance as measured by these parameters could include outfall management actions; maintenance dredging; or adjustment of the timing or extent that the Project structure is opened between operational and base flows, within permitted ranges (see Table 4.1-2).

4.1.3. Evaluation of Monitoring Data in Support of Project Objective 3: Create, restore, and sustain wetlands and associated ecosystem services

If the processes represented by the monitoring parameters designated in support of Objective 2 represent the secondary effects on Barataria Basin hydrology and soils of diverted Mississippi River freshwater, nutrients and sediments, then Objective 3, and the parameters intended to support the evaluations of meeting Objective 3 (Section 3.7.3) and the needs for adaptive management actions (Table 4.1-3), are the tertiary effects of the diverted flows, and are the primary goal of and need for this project. The proposed Objective 3 parameters are specifically concerned with the actual development of new wetlands, and restoration and sustenance of existing wetlands, resulting from sediment dispersal into the Basin, changes in water quality, and the response of living resources (plant, animal and human) to the diverted freshwater, nutrients and sediments.

As defined by Objective 3, *Land and water extent/Area of new delta formation* (3.7.3.1) and *Emergent wetland area* (3.7.3.2) will be priority parameters for mid-term consideration. These two parameters specifically follow the Objective 2 observations of dispersal of materials by the Project, and whether those material flows are resulting in new or sustained emergent wetlands within the Basin. This report has discussed earlier why the projections of wetland loss and gain from numerical modeling are inappropriate as temporal benchmarks of Project performance. However, the modeling can provide an order-of-magnitude estimate of what land gain and loss could be expected if the Project were to be operated over a particular time period under conditions (river discharge, operational frequency, sediment content, etc.) similar to those modeled. Those evaluations cannot be made *a priori*, and so will need to wait on both actual operations and the land/water data availability. That said, land building or land-loss that is anomalous to the model's order-of-magnitude projections will trigger closer looks at other variables (e.g., those described under Objective 2) that might provide an explanation for why.

To quantify the restoration benefits of the marsh that develops in the diversion outfall area, a Before-After-Control-Impact study will be established. Ecosystem function in the created marsh will be compared to the pre-construction existing condition using the following datasets: *Land and water extent* (3.7.3.1), *Emergent wetland area* (3.7.3.2), *Vegetation Cover, Abundance, and* Height (3.7.3.3), *Emergent and submerged vegetation community type* (3.7.3.5), *Emergent vegetation biomass in the Project area* (3.7.3.6), *Topography/bathymetry of the Project delta development area* (3.7.1.1.7), *Lower trophic level organisms* (3.7.3.16), *Nekton species abundance and composition/assemblage* (3.7.3.18), and *Aquatic resource and terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22).

To compare the wetland function of a marsh built by a sediment diversion to that of a marsh built by conventional wetland restoration (marsh creation from dredged sediments), a study will be established to compare three types of wetland treatments. MAM partners will develop the experimental design for the study once the study goals and objectives are finalized. Assessment will rely heavily on the data collection that was otherwise established for this Project, planned coast-wide LiDAR surveys, existing CRMS-*Wetlands* stations (for unrestored marsh), and pre- and post-construction sampling from a conventionally-restored marsh. Wetland function will be evaluated using the same parameters listed in the paragraph above.

Regarding water quality parameters, the adaptive management focus will be on the response of *Dissolved oxygen* (3.7.3.7) and *Salinity* (3.7.3.8), as these are expected to drive many of the biological responses described below in the Basin, as well as fundamentally defining the ability of Project operations to still retain a functional estuary, from a *Salinity* standpoint. On that latter point, while Project alternatives numerical modeling does project that salinities will freshen substantially during Project operations beyond base flows, the same modeling projects a rapid return to a full range of estuarine salinities in the Basin once base flows are reinstated. Observations of freshwater salinities or hypoxic conditions that persist throughout the Basin even after Project operations return to base flow would trigger adaptive management considerations (see Table 4.1-3 for details).

Concerns have been expressed about the potential for Project operations to result in the development of phytoplankton blooms, and especially HCABs. The Project partners propose to capture these possible changes by systematically monitoring *Chlorophyll a* (3.7.3.9) using *in situ* sondes, remote sensing, and other relevant data; by identifying *Phytoplankton species composition* (3.7.3.10) both monthly and when *Chlorophyll a* (3.7.3.9) or other datasets warrant it; and by testing HCAB toxins both in water samples with a presence of cyanobacterial and/or eukaryotic algal species associated with harmful algal blooms, and in fish tissue.

The proposal described above for a Presence/Absence approach to evaluating *Salinity* data is similar to the proposal for evaluating a number of living resources; namely, *Submerged aquatic vegetation area* (3.7.3.4), *Emergent and submerged vegetation community type* (3.7.3.5), *Nekton species abundance and composition/assemblage* (3.7.3.18), and *Aquatic resource and terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22). The reason for this proposal is the same as described earlier as well. We expect, from the results of the Project alternatives numerical modeling, that Project operations will result in some persistent and some temporary changes in the salinity structure of the estuary, including localized salinity decreases (especially closer to the Project outfall). Living resource distributions are expected to likewise change, at least in so far as that described by the Basin-wide Model (for vegetation) and model outputs for fish and wildlife. No adaptive management considerations are proposed in the event that there are not persistent and large-scale changes in estuarine species distributions throughout the Basin as a whole; i.e., that Project operations do not result in major and widespread Basin-wide losses of estuarine plants and animals. Explicit in this proposal is the idea that localized estuarine species losses where salinities decrease would not trigger AM considerations.

The project may cause a change in the occurrence of invasive species. The new or increased occurrence of invasive nekton species (*Nekton species abundance and composition/assemblage* (3.7.3.18)) or invasive aquatic invertebrate or algal species (*Aquatic Invasive (Algae and Invertebrate) Species* (3.7.3.17)) would trigger an adaptive management action to control species that are deemed as a threat to ecosystem function. The new or increased occurrence of invasive vegetation species (*Emergent and submerged vegetation community type* (3.7.3.5)) would be noted as a sign of changing conditions, and would provide context, but would not trigger an adaptive management action.

The exception to this Presence/Absence consideration of living resources data would be for consideration of *Emergent vegetation biomass in the Project Influence Area* (3.7.3.6), measured at the existing and proposed CRMS-*Wetlands* stations. It is uncertain how exactly emergent plant biomass will respond to the environmental changes resulting from Project operations. As mentioned earlier, numerical modeling projects localized increases in *Marsh surface elevation change rate in the Project*

Influence Area (3.7.2.1.9) during Project operations. Similar to the data evaluation for that parameter (described in section 4.1.2), repeated, consistent year-over-year decreases in emergent plant biomass would trigger data evaluation.

To evaluate changes in the Barataria Basin food web, multiple datasets will be used. Changes in community assemblage over time will be clarified through *Nekton species abundance and composition/assemblage* (3.7.3.18) and in *Lower Trophic Level Organisms* (Section 3.7.3.16). Questions about changes in the biodiversity of the aquatic food web, the food web links, and the benthic: pelagic ratios (biomass and productivity, including interannual and seasonal variability) over time will be explored through the use of ecosystem models refined and run as described in Section 1.5 and by incorporating additional information collected as described in *Lower Trophic Level Organisms* (Section 3.7.3.16) *Nekton species abundance and composition/assemblage* (3.7.3.18), and *Aquatic resource and terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22). Refined models will also be used to qualify the ecosystem benefits of the Project; test and understand ongoing and potential future changes resulting from management actions to existing conditions; statistically relate environmental condition variability to food web responses; improve predictive capabilities. Adaptive management actions to improve Project performance as measured by these parameters could include outfall management actions; adjustment of the timing or extent that the Project structure is opened between operational and base flows, within permitted ranges; invasive species control; or changes in sampling frequency or intensity; and refinement of Learning Strategies to reduce Critical Uncertainties (see Tables 4.1-3 and 4.1-4).

4.2. Evaluation of Context Variables

Comprehensive evaluation of all monitored parameters is anticipated to occur at every five years during the preparation of the Multi-year Project Synthesis Reporting (5.2.3). Some of these variables will be monitored due to substantial interest in changes in value, but we do not anticipate the data serving as triggers for adaptive management at this time (although consistent with the idea of adaptive management, those parameter classifications/considerations could change in the future); and are thus classified as Context variables. Other variables listed below are not proposed in themselves as potential triggers for adaptive management, but may contribute to calculations of other variables that are presented above as adaptive management triggers.

However, it is not that these parameters would not inform adaptive management considerations. In fact, when observations of the more actionable parameters described in Section 4.1 trigger adaptive management consideration, it is entirely likely that related or contributing parameter data will also be analyzed to help inform decision making on the best course of action. For instance, if consideration of an adaptive management action is triggered based on observations of *Sediment dispersal and retention on the emergent marsh surface in the Project Influence Area* (3.7.2.2.2) below the desired range of values, the Adaptive Management Team would likely examine *Soil mineral matter density* (3.7.2.2.3) or *Rate of accretion above feldspar marker horizons* (3.7.2.1.7) to help inform why dispersal may be insufficient.

Parameters proposed for classification as Context variables are

- Mississippi River nutrient concentrations (3.7.1.1.3),
- Sedimentology of the Alliance South sand bar (3.7.1.1.5),
- River bathymetry at and around the Project structure inlet (3.7.1.1.6),
- Water volume conveyed into Barataria Basin (3.7.1.1.8),
- Sediment concentrations in the flows conveyed into Barataria Basin (3.7.1.1.9),
- Mississippi River sediment load (3.7.1.2.1),
- Sediment volume conveyed into Barataria Basin (3.7.1.2.3),
- Nutrient loads conveyed into Barataria Basin (3.7.1.2.4),
- Water velocities at multiple locations in the Barataria Basin (3.7.2.1.1),
- Soil bulk density (3.7.2.1.3),
- Loss of soil organic matter on ignition (3.7.2.1.4),
- Soil mineral matter grain size (3.7.2.1.5),
- Soil total nutrients (3.7.2.1.6),
- Rate of accretion above feldspar marker horizons (3.7.2.1.7),
- Soil strength (3.7.2.1.8),
- Soil organic matter density (3.7.2.2.2),
- Soil mineral matter density (3.7.2.2.3),
- Vegetation Cover, Abundance, and Height (3.7.3.3),
- Nutrient constituents in Barataria surface waters (3.7.3.12),
- Temperature of Barataria surface waters (3.7.3.13),
- Turbidity of Barataria surface waters (3.7.3.14),
- Total suspended solids in Barataria surface waters (3.7.3.15),
- Lower Trophic Level Organisms (3.7.3.16)
- Wildlife (3.7.3.21), and
- Socio-economic data (3.7.3.23).

4.3. Evaluation of Compliance Monitoring Data

This placeholder exists for descriptions of the evaluation of compliance data identified in Section 3.7.4. If the Project permit is approved and issued identifying those requirements, the corresponding details will be developed accordingly.

Page intentionally left blank

Table 4.1-1. Parameters monitored to ensure Project Objective 1 (Delivery of freshwater, sediment, and nutrients), proposed frequency of evaluation, categorization of parameter evaluation, and criteria that would trigger consideration of undertaking adaptive management action.

Parameter/Calculation	Frequency of Evaluation or Data Collection	Category	Observations Triggering Adaptive Management Consideration	Examples of Potential Adaptive Management Actions
Mississippi River water discharge (3.7.1.1.1)	Pre-operations: Continuous Post-construction: Continuous	Range	MR discharges less than 450,000 cfs would constrain operations to a base flow of up to 5,000 cfs, dependent on head differential between MR and basin. MR discharges 450,000 – 1,000,000 cfs would result in operational flows, also dependent on head differential between MR and basin. MR discharge greater than 1,000,000 cfs would constrain operational flows to maximum 75,000 cfs Outside that, irregular discharge patterns beyond those observed in the historical record (e.g., persistent high or low discharges outside expected seasonal patterns) would trigger consideration of flow alterations.	Adjust the extent that the Project structure is opened between operational and base flows, within permitted ranges.
Mississippi River suspended sediment concentrations (3.7.1.1.2)	Pre-operations: Continuous Post-construction: Continuous	Context/ Range	Initial considerations as a Context variable may be amended in the future to a Range variable, with learning following some period of data collection. As Range, decline of concentrations below expected for a particular *Mississippi River water discharge* (3.7.1.1.1)	None in the short term while this is considered a Context variable.
Bathymetry of the Alliance South sand bar (3.7.1.1.4)	Pre-operations: Annually Post-construction: before/after each Project operational event for first five years, every two years thereafter	Range	Excessive magnitude or rate of erosion in bar bathymetry would trigger consideration of adaptive management. Numerical criteria are pending continued high-resolution modeling outcomes by the PDT.	To be determined.
Topography/bathymetry of the Project Delta Development Area (3.7.1.1.7)	Pre-operations: Once prior to onset of operations Post-construction: before/after each Project operational event for first five years, every five years thereafter	Trend/Range	Year-to-year observations of a magnitude or rate of erosion of the Project outfall area, compared to model projections as order-of-magnitude expectations. Deposition in the Project outfall area without the development of a deltaic distributary network, compared to model projections as order-of-magnitude expectations.	Conduct maintenance dredging of the canals to address impacts from the Project. Implement outfall management measures to limit the loss of sediments to the canals. Implement outfall management measures to increase the deposition of sediments in shallow open water and onto the surface of intertidal wetlands
Sediment:water in the flows conveyed into Barataria Basin (3.7.1.2.2)	Post-construction: Biweekly during operational events, quarterly during base flows	Range	Persistent (greater than 5 year) sediment:water below initial operations values; declines in sediment:water through time during operational events and base flows. Numerical criteria are pending continued high-resolution modeling outcomes by the PDT.	With learning gained from monitoring, and if possible, adjust timing of Project operational flows in relation to river discharge and suspended sediment concentration. Optimize project to reduce freshwater inflows to the Basin while maintaining the efficacy of the Project consistent with goals and objectives.
Nutrient loads conveyed into Barataria Basin (3.7.1.2.4)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Context	None in the short term while this is considered a Context variable.	None in the short term while this is considered a Context variable.

Table 4.1-2. Parameters monitored to ensure Project Objective 2 (Reconnect and Re-establish Deltaic Processes), proposed frequency of evaluation, categorization of parameter evaluation, and criteria that would trigger adaptive management action.

Parameter/Calculation	Frequency of Evaluation	Category	Observations Triggering Adaptive Management Consideration	Examples of Potential Adaptive Management Actions
Frequency, depth and duration of inundation of marsh at locations in the Project Influence Area (3.7.2.1.2)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Trend	Persistent (greater than 5-year) trend of increasing frequency of inundation would trigger consideration of adaptive management if data and learning could lead to identification of a threshold. No explicit threshold value has been identified at this time. Potential for a revision of the parameter to be binned as Range if data and learning allow.	Adjust the timing or extent that the Project structure is opened between operational and base flows, within permitted ranges. Outfall management actions
Marsh surface elevation change rate in the Project Influence Area (3.7.2.1.9)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Trend	A decline in marsh surface elevation that exceeds the projected rate (considering RSLR) within the Project Influence Area would trigger consideration of adaptive management	Outfall management actions
Sediment dispersal and retention on the emergent marsh surface in the Project Influence Area (3.7.2.2.1)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Presence/ Absence	Absence of sediment dispersal onto marsh surface, or substantially lower values than modeling results as order-of-magnitude expectations. Values would be based on high-resolution design modeling, which is still ongoing.	Outfall management actions

Table 4.1-3. Parameters monitored to ensure Project Objective 3 (Create, restore, and sustain wetlands and associated ecosystem services), proposed frequency of evaluation, categorization of parameter evaluation, and criteria that would trigger adaptive management action.

Parameter/Calculation	Frequency of Evaluation or Data Collection	Category	Observations Triggering Adaptive Management Consideration	Examples of Potential Adaptive Management Actions
Land and water extent / Area of new delta formation in the Project Influence Area (3.7.3.1)	Pre-operations: Once prior to onset of operations Post-construction: Every three years after the onset of Project operations	Trend	Land building that does not occur after a reasonable amount of time, using the Delft Basin-wide Project modeling as an order-of-magnitude projection (e.g., if no land gain after five years IF the project operated during the first decade as proposed in response to environmental drivers).	Outfall management actions
Emergent wetland area (3.7.3.2)	Pre-operations: Once prior to onset of operations Post-construction: Every three years after the onset of Project operations	Trend	Repeated observations of loss of existing and lack of creation of new emergent wetlands from the Project Influence Area, using the Delft Basin-wide Project modeling as an order-of-magnitude projection (e.g., if no land gain after five years IF the project operated during the first decade as proposed in response to environmental drivers).	Outfall management actions
Submerged aquatic vegetation area (3.7.3.4)	Limited analysis annually; comprehensive analysis every five years after the onset of Project operations	Presence/ Absence	Repeated observations of a complete loss of submerged aquatic vegetation from the Barataria Basin	Outfall management actions
Emergent and submerged vegetation community type (3.7.3.5)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Presence/ Absence	A persistent (greater than five-year) shift in vegetation communities to a fully freshwater + intermediate character of the Barataria Basin	Outfall management actions
Emergent vegetation biomass in the Project Influence Area (3.7.3.6)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Trend	Reductions in emergent vegetation biomass in the Project Influence Area over a five-year period (dependent on Project operations) that suggests excessive inundation or other imposed stresses on the vegetation.	Outfall and operational adaptive management actions;
Dissolved Oxygen in Barataria Surface Waters (3.7.3.7)	Pre-operations: Continuous (sondes); monthly (discrete water sampling) Post-construction: Continuous (sondes); monthly (discrete water sampling); Comprehensive analysis every five years after the onset of Project operations	Range	Changes in oxygen within a "normoxic" range (4-14 mg/L) would be viewed as acceptable Development of hypoxic conditions (dO_2 < 4 mg/L) that persist throughout the Basin for more than 3 months after Project operations return to base flow, as a result of Project operations in areas currently and historically normoxic.	Outfall management actions
Salinity in Barataria Surface Waters (3.7.3.8)	Pre-operations: Continuous (sondes); monthly (discrete water sampling) Post-construction: Continuous (sondes); monthly (discrete water sampling); Comprehensive analysis every five years after the onset of Project operations	Presence/ Absence	Observations of freshwater salinities that persist throughout the Basin for more than 3 months after Project operations return to base flow would trigger adaptive management considerations.	Outfall management actions
Chlorophyll *a* in Barataria Surface Waters (3.7.3.9)	Pre-operations: Continuous (sondes), daily (remote sensing), monthly (discrete water sampling) Post-construction: Continuous (sondes), daily (remote sensing), monthly (discrete water sampling)	Trend	Increase in chlorophyll concentrations suggestive of a cyanobacterial bloom with a moderate probability of acute health effects (in-water samples with > 10 µg L^{-1} per World Health Organization 2003, or remotely sensed cyanobacterial index of >100,000 cells L^{-1} per WHO 1999) would trigger follow-up discrete sampling for *Phytoplankton species composition (3.7.3.10*) and *Harmful algal bloom toxins* (3.7.3.11)	Outfall and operational adaptive management actions;

Table 4.1-3 (*continued*). Parameters monitored to ensure Project Objective 3 (Create, restore, and sustain wetlands and associated ecosystem services), proposed frequency of evaluation, categorization of parameter evaluation, and criteria that would trigger adaptive management action.

Parameter/Calculation	Frequency of Evaluation	Category	Observations Triggering Adaptive Management Consideration	Adaptive Management Actions to Consider
Phytoplankton species composition in Barataria Surface Waters (3.7.3.10)	Pre-operations: Monthly (discrete sampling) Post-construction: Monthly (discrete sampling) and as needed	Presence/ Absence	Presence of cyanobacterial and/or eukaryotic algal species associated with harmful algal blooms would trigger analysis of discrete samples from 3.7.3.10 for *Harmful algal bloom toxins* (3.7.3.11) ($\geq$ 5000 cells L^{-1} for *K. brevis* (LDHH guidelines) or $\geq$ 1,000 cells L^{-1} for *Pseudo-nitzschia* spp. (GOMA 2014) or $\geq$ 1,000 cells L^{-1} for *Dinophysis* spp. (GOMA 2014) or $\geq$ 20 cells L^{-1} for cyanobacteria (World Health Organization 2003)	Outfall and operational adaptive management actions.
Harmful Cyanobacterial/Algal bloom Toxins in Barataria Surface Waters (3.7.3.11)	Pre-operations: Monthly (discrete sampling) Post-construction: Monthly and as-needed sampling; analysis as needed based on Phytoplankton species composition (3.7.3.10)	Presence/ Absence	Presence of cyanobacterial and/or eukaryotic algal bloom toxins could trigger consideration of a receiving basin adaptive management action. Thresholds related to harvesting closures: 20MU/100g brevetoxins ((or > 1.6 ppm in clams, > 1.8 ppm in oysters using NSP ELISA) or $\geq$ 20 ppm Domoic Acid or $\geq$ 0.16 ppm Okadaic Acid or $\geq$ 0.16 ppm Dinophysis toxins or > 80 µg Saxitoxin eq./100 g (per GOMA 2014 and FDA National Shellfish Sanitation Program)) Thresholds related to recreational water advisories: > 8 ppm Total Microcystins (EPA 2019; note: > 24 ppm Microcystin-LR per WHO 2020) or > 15 ppm Cylindrospermopsin (EPA 2019; note: > 6 ppm per WHO 2020) or > 60 ppm Anatoxin-a (WHO 2020) or > 30 ppm Saxitoxin (WHO 2020)	Outfall and operational adaptive management actions; shellfish harvesting closures; recreational water advisories.
Aquatic Invasive (Algae and Invertebrate) Species (3.7.3.17)	Pre-operations: Once Post-construction: Once per five years	Presence/ Absence	The new or increased presence of aquatic invasive species could trigger an adaptive management action to address species viewed as an ecosystem threat.	If presence of aquatic invasive species is deemed a threat to ecosystem function, control or eradication measures may be initiated.
Nekton (Fish and Shellfish) Species Abundance and Composition/Assemblage (3.7.3.18)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Presence/ Absence	-Measuring a persistent basin-wide decline in abundance over five years for an estuarine assemblage could trigger an adaptive management action (NOT a change in community assemblage or location-specific shift from marine to freshwater character of the assemblage). The new or increased presence of aquatic invasive species could trigger an adaptive management action to address species viewed as an ecosystem threat. Sufficient project monitoring indicates that freshwater inflows to the Basin may be reduced while still maintaining the efficacy of the Project consistent with goals and objectives.	Outfall management actions If presence of aquatic invasive species is threat to ecosystem function, control or eradication measures may be initiated.
Bottlenose Dolphins (*Tursiops truncatus*) (3.7.3.19)	Pre-operations: Varies over 5-year period Post-construction: Periodically, with annual analysis	Trend, Range	1. Increase in average stranding rate above the pre-operation level (for example, mean plus 2 standard deviations) or increase in the proportion of cases with cause of illness/death determined to be low salinity exposure 2. Increase in mortality in specific regions, decrease in dolphin body condition, or increase in prevalence of skin lesions 3. Increase in morbidity or mortality 4. Shift in prey base and decrease in dolphin body condition 5. Increase in dolphin stranding rates; prevalence of adverse health effects; dolphin movements; qualified personnel and resources available for response/intervention (e.g., stranding network capacity); impacts from disasters; and/or habitat/water quality. Other indicators are TBD. See discussion in Section 3.7.3.19.	1. Increase in Marine Mammal Stranding Network effort, analyses, and response 2. Increase in visual health assessment sampling frequency, possibly combined with stranding response active surveillance 3. Increase in biopsy frequency or implementation 4. Bioenergetics study 5. Operational modifications

Table 4.1-3 (*continued*). Parameters monitored to ensure Project Objective 3 (Create, restore, and sustain wetlands and associated ecosystem services), proposed frequency of evaluation, categorization of parameter evaluation, and criteria that would trigger adaptive management action.

Parameter/Calculation	Frequency of Evaluation	Category	Observations Triggering Adaptive Management Consideration	Adaptive Management Actions to Consider
Eastern Oysters (*Crassostrea virginica*) (3.7.3.20)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Range	Persistent decline in parameter values over three consecutive years that suggests the loss of a viable population in the Basin or current seed grounds would trigger additional analyses of the relationship between operations, freshwater, sediment and nutrient loads and oyster density, abundance and mortality to inform mitigation strategy actions Persistent decline over the five-year comprehensive analysis period could trigger consideration of actions outlined in the mitigation strategy, such as relocation of seed grounds to more environmentally-suitable areas within the Basin or establishment of brood-stock reefs to address larval supply. Observations that Project operations result in hydrodynamic barriers to larval dispersion	Analysis of project operations and resulting conditions across the basin.
Aquatic resource and terrestrial wildlife utilization of habitat in the Project Influence Area (3.7.3.22)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Trend	Measuring a persistent decline in aquatic resource and/or terrestrial wildlife utilization of habitat in the Project Influence Area.	Outfall management actions
Contaminants in Fish, Shellfish, and Wildlife (3.7.3.24)	Will be determined by CPRA in consultation with USFWS pending the Project permit record of decision by USACE.	Range	Measuring a level outside of the acceptable range for any one EPA Priority Pollutant or Contaminant of Concern	Increase frequency and/or intensity, and potential expansion of sampling

Table 4.1-4. A learning strategy has been identified to address each uncertainty in responses of environmental resources to project inputs. Reducing these uncertainties will help to refine Project Adaptive Management. Other uncertainties that will not directly affect adaptive management decisions, such as quantifying restoration benefits, are listed in Section 10. The "Reference" column provides sources of additional information including this MAM Plan, the Project Phase II Restoration Plan, and the Diversion Expert Panel reports #1-7 (CPRA 2014/2015/2016).

Uncertainty	Reference	Purpose of Learning Goal	Learning Strategy
Effect of inundation patterns on subaerial wetlands in the Project Influence Area.	MAM Plan 4.1.2	Inform thresholds for *Frequency, depth and duration of inundation at multiple locations on the marsh in the Project Influence Area* (3.7.2.1.2) / Objective 2 evaluation	Determine whether limitation results from excessive water levels physically inundating wetland surfaces, and/or the imposition of an inundation stress on emergent wetland vegetation.
Optimum dispersal of sediments to intact marshes	MAM Plan 4.1.2	Weigh the costs and benefits of observed short-term sediment depositional patterns to the long-term goals of the Project	Evaluate *Sediment dispersal and retention on the emergent marsh surface in the Project Influence Area* (3.7.2.2.1) to determine patterns of mineral sediment distribution onto, and into the soil matrix of, the wetlands in the Project Influence Area.
Marsh surface capture of sediment	MAM Plan 4.1.2	Inform observations of *Marsh surface elevation change rate in the Project Influence Area* (3.7.2.1.9)	Identify cause, possibly including limitations in diverted material flows to the marsh, or Project operations stresses on the wetlands. Evaluate related parameters, including *Sediment dispersal and retention on the emergent marsh surface in the Project Influence Area* (3.7.2.2.2), *Soil mineral matter density* (3.7.2.2.3), *Rate of accretion above feldspar marker horizons* (3.7.2.1.7), and vegetation parameters.
Project order-of-magnitude land building or land loss under future conditions (river discharge, operational frequency, sediment content)	MAM Plan 4.1.3	*Inform creation of trigger for Land and water extent/Area of new delta formation* (3.7.3.1) and *Emergent wetland area* (3.7.3.2)	Input post-operations conditions into model over time period of interest.
Ongoing and potential future changes resulting from management actions to existing conditions	MAM Plan 1.4 and 4.1.3	Adaptive management of project	Refine and run ecosystem models (Section 1.5).
Ability to reduce freshwater inflows to the Basin while maintaining the efficacy of the Project consistent with goals and objectives	MAM Plan 3.6, 3.8, 4.1.3	Optimize project to balance Project objectives and impacts; reduce freshwater influence on resources including Nekton (Fish and Shellfish) Species Abundance and Composition/Assemblage (3.7.3.18) and Bottlenose Dolphins (*Tursiops truncatus*) (3.7.3.19)	Input post-operations conditions into Delft Basin-wide model every 5 years post-operation; evaluate related parameters, including *Sediment:water in the flows conveyed into Barataria Basin* (3.7.1.2.2), *Topography/bathymetry of the Project Delta Development Area* (3.7.1.1.7), and *Marsh surface elevation change rate in the Project Influence Area* (3.7.2.1.9).
Limits of vegetation growth at very low elevation marshes	TWIG 2016b	Land building in low elevation marshes	Prioritize model refinement to focus on vegetation species or communities that are most likely to influence land building
Indicators of Harmful Algal Bloom Toxins from *Pseudo-nitzschia* and *Dinophysis* cell counts	MAM Plan 4.1.3	Inform thresholds for follow-up analysis for *Pseudo-nitzschia* and *Dinophysis* as part of Phytoplankton species composition in Barataria Surface Waters (3.7.3.10) analysis and associated Harmful algal bloom toxins in Barataria Surface Waters (3.7.3.11)	Evaluate pre-operations and post-construction relationship between impacts on aquatic resources or human health, and combinations of cell counts and environmental conditions known to trigger toxin production in P *Pseudo-nitzschia* and *Dinophysis*.
Correlation of changes in distribution and productivity of juvenile and adult fishery species to far-field changes in salinity and temperature	TWIG 2014a	Adaptive management of project	Salinity (3.7.3.8), Temperature of Barataria Surface Waters (3.7.3.13.), Nekton species abundance and composition/assemblage (3.7.3.18)

5. MONITORING AND ADAPTIVE MANAGEMENT SCHEDULE

5.1. Project Monitoring Schedule 1

5.1.1. Pre-operational Monitoring

The Pre-operations Monitoring Plan introduced in Section 3 are currently being planned as up to a five-year effort (no less than three), to establish a robust baseline condition within the Project receiving area and the larger Barataria Basin during Project construction. Critical in that baseline monitoring will also be clarifying spatial variability in the data, as well as inherent temporal trends in the data that might refine considerations of when to undertake adaptive management action.

5.1.2. Post-operational Monitoring

Given the intended 50-year life of the Project that guided Project E&D, at least some of the attributes outlined in Section 3 will be collected for that entire time. However, the planned length of monitoring for all attributes will ultimately depend on evaluation of the early datasets for responsiveness and variability.

5.2. Timeline of Adaptive Management Decision-Making and Implementation

The overall timeline of adaptive management will include activities that take place during individual structure openings (events), annually, as well as activities occurring on a five-year planning cycle that will more comprehensively consider and integrate data across a longer cycle. Periods for evaluation of whether each adaptive management trigger has been met vary by parameter; see section 4 for details.

5.2.1. Event Timeline

Evaluation and decision-making at the level of individual structure openings will occur as discussed in Section 4. Decisions made during individual events will be memorialized in the annual and multi-year reporting described below.

5.2.2. Annual Timeline

Figure 5.2-1 proposes two categories of actions that will occur on an annual basis. The top of the figure illustrates a more expedited consideration of a limited set of operations performance data from the Water Year (WY) operations that ends on September 30, to provide CPRA with a rapid summary of the past year's Project operations and to support annual State funding requests for continued operations during the upcoming State Fiscal Year. In contrast, the bottom of the figure illustrates the consideration of a more comprehensive set of WY operations data that underpins the development of annual Operations, Maintenance and Monitoring (OM&M) Reports and the formal Operations Plan. Both sets of actions center on the annual management of the Project by the Operations Management Team and continuous collection of the data outlined in Section 3.

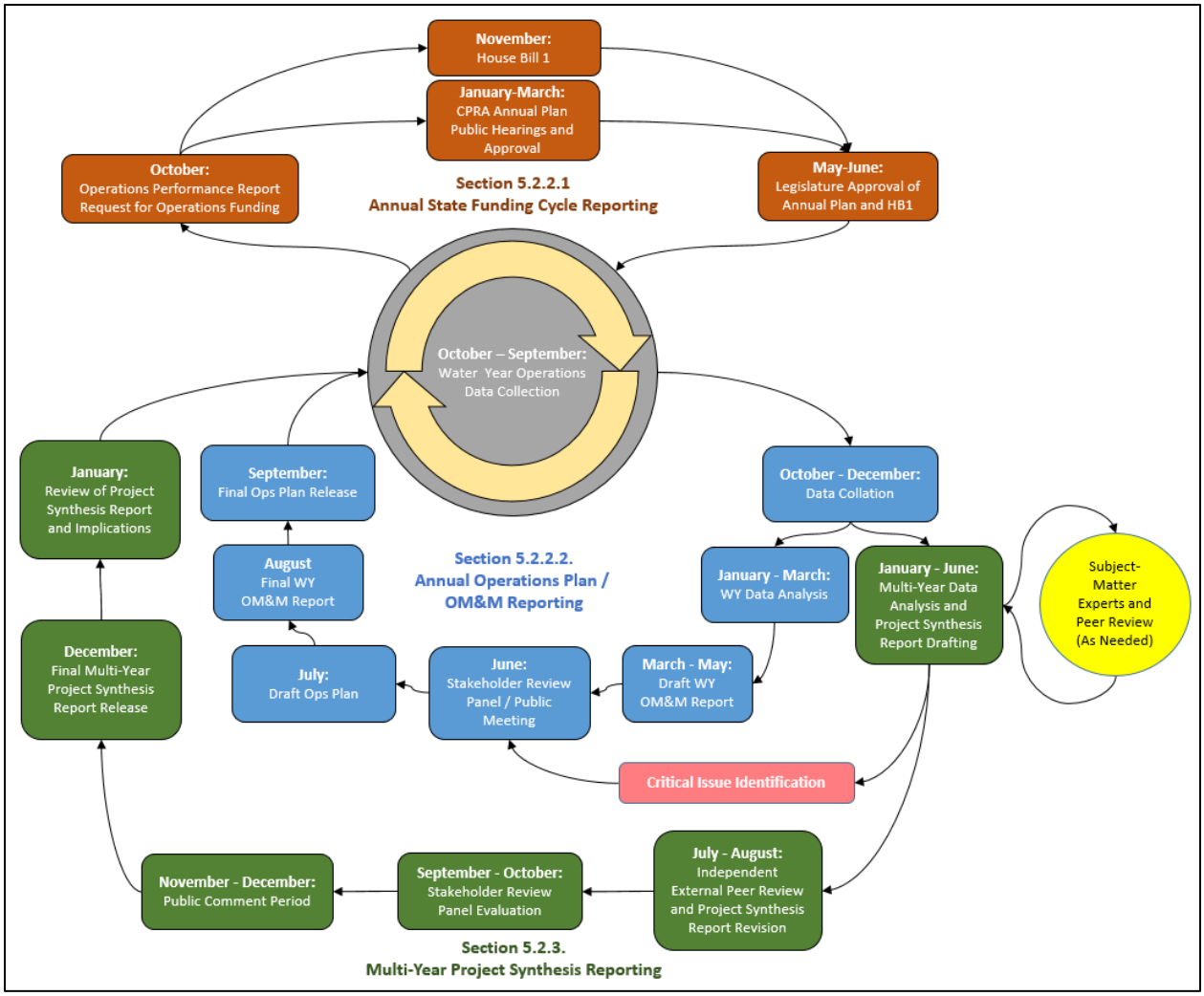


Figure 5.2-1. Idealized timeline of Annual Cycle Adaptive Management Activities discussed in Section 5.2.2 and the Multi-year Project data evaluations discussed in Section 5.2.3. The steps illustrated in the orange boxes are discussed in Section 5.2.2.1. The steps illustrated in the blue boxes are discussed in Section 5.2.2.2. The steps illustrated in the green boxes are discussed in Section 5.2.3.

5.2.2.1. State Funding Cycle Reporting

- October
  - Immediately following the end of the WY, the Data Management Team (DMT) and OMT will work to develop an Operations Performance Report to underpin upcoming State Fiscal Year funding requests.
- November
  - CPRA will submit the upcoming State Fiscal Year project operations funding request to the State's Division of Administration for inclusion in the draft of House Bill 1.
- January - March
  - The upcoming State Fiscal Year Project operations funding request will be included in the draft of CPRA's Annual Plan, which CPRA submits annually for a 3 year-budget outlook. Typically, CPRA releases the draft Annual Plan for public comment in January for the upcoming fiscal year, with CPRA Board vote for approval of the Annual Plan

occurring during the last Board meeting prior to the beginning of the annual Session of the Legislature. Following approval by the Board, CPRA submits the Annual Plan to the Legislature for consideration.

- May-June
    - Typically, the Legislature votes on both House Bill 1 and the CPRA Annual Plan late in the annual Legislative session. Both bills must pass the Legislature to appropriate Project operational funds in the next State Fiscal Year starting on July 1.

5.2.2.2. Annual Operations Plan / OM&M Reporting

The following idealized annual timeline may be adjusted to allow the Annual Operations Plan to be included in CPRA's Annual Plan and aligned with the State's funding cycle.

- October to December, Year
    - Data collection will largely follow a WY schedule, but due to the nature of some data collection/analysis, the WY data inventory will likely not be complete until the end of the calendar year.
- January – March
    - Analysis of the WY data, along with relevant external data collection and publications, by the Data Management Team
- March – June
    - Preparation of the draft WY OM&M Report, including progress towards reducing identified Critical Uncertainties to address Learning Strategies and recommendations from the Adaptive Management Team for Adaptive Management actions, MAM Plan revisions, and operational changes.
- June-July: Stakeholder Review Panel / Public Meeting
    - CPRA will present the draft Operations Plan for the upcoming year, to gather input for possible incorporation into that plan, and to consider possible items to be evaluated and or addressed in an OM&M or Adaptive Management report.
    - CPRA will solicit comments, perspectives, and insights from stakeholders and the public on the information contained within the draft OM&M report and the proposed annual Operations Plan for the upcoming WY.
    - CPRA may convene additional meetings throughout the year as deemed appropriate and/or necessary.
    -
- August
    - Completion and release of previous WY OM&M Report, prior to the release of the draft operations plan. WY Project data will be uploaded to the Diver data server (Section 6).
- September: Final Operations Plan
    - Completion and public release of the upcoming WY Operations Plan, prior to October implementation.

5.2.3. Multi-year Project Synthesis Reporting

In addition to the annual timeline of adaptive management activities, additional review and comprehensive synthesis of monitoring data and evaluation of management options will occur at five-year intervals, allowing for the consideration and evaluation of multiple years of monitoring data and to

assess processes on a longer time scale. It will also describe progress towards reducing identified Critical Uncertainties to address Learning Strategies, and recommendations from the Adaptive Management Team for Adaptive Management actions, MAM Plan revisions, and operational changes.

The comprehensive data syntheses will be based on multiple years-worth of Project Effectiveness evaluations (Section 4) and other data. The syntheses will be developed consistent with processes used to conduct other comprehensive data reviews.

5.2.3.1. October-December: Data Collation

The DMT will collate multi-year data in the last quarter of the Calendar Year following the end of a particular WY, with the same rationale as described in Section 5.2.2.2 above.

5.2.3.2. January-June: Data Analysis and Project Synthesis Report Drafting

The AMT will lead the analysis of the multi-year datasets and the drafting of the Multi-year MAM Report, in coordination with the OMT. Given the nature of the data, CPRA expects to conduct analyses using a mix of AMT members directly and outside contractors as needed. Note that any serious issues initially identified during this analysis/synthesis could be addressed by the AMT and PMT outside of the rest of the review and communication process below, and brought to the attention of the Stakeholder Review Panel during their June meeting (5.2.2.2).

5.2.3.3. July-August: External Peer Review and Revision

The AMT will coordinate an external peer review of the draft Multi-year MAM Report. The Team will develop the protocols for the external review in coordination with the Stakeholder Review Panel to ensure an objective process. This draft schedule assumes a 45-day review of the draft report, after which the AMT and any relevant contractors will revise the report based on the reviews received.

5.2.3.4. September-October: Stakeholder Review Panel Evaluation

The AMT will work with the OMT to present the revised draft Multi-year MAM Report to the Stakeholder Review Panel and solicit a review and comments from the Panel. CPRA will conduct this presentation as an in-person meeting or a web seminar with the Panel members. The Panel will have four weeks to review the report, after which time the AMT and its contractors will revise the document into a final draft report based on the reviews received.

5.2.3.5. November-December: Public Comment Period

The AMT will coordinate with the OMT to make the revised draft Multi-year MAM Report available for a 30-day public comment period on the final draft report, after which the Adaptive Management Team and any relevant contractors will revise the report based on the reviews received. CPRA will then publicly release the final report.

5.2.3.6. January: Review of Project Synthesis Report Implications

The AMT and OMT will review the Multi-year MAM Report for implications to Project operations and/or additional management actions. Recommendations based on that review will be made to the CPRA Executive Team, and if adopted will be discussed at the next Stakeholder Review Meeting.

Page intentionally left blank

6. DATA MANAGEMENT

6.1. Data Description

Data collected as part of this Project will occur via site visits, field surveys, *in situ* continuous recorder devices, and remote sensing. As discussion in Section 3, data types include hydrologic (e.g., water level, water velocity), bathymetric/topographic (e.g., land/water area, elevations, accretion), geotechnical (e.g., soil characteristics), geophysical (e.g., sidescan sonar), chemical (e.g., salinity, water quality), biological (e.g., fish, invertebrates, wildlife, vegetation), and geospatial (e.g., vector, raster, aerial and satellite imagery). A substantial amount of data will be collected via existing programs, including those coordinated by CPRA (e.g., CRMS, BICM, SWAMP) as well as other agencies (e.g., LDWF, LDEQ, USGS, NOAA). Additional data collection will occur from targeted project-specific monitoring and research. The timing and frequency of data collection varies by parameter, ranging from continuous sampling (e.g., water level), to biannual or annual (e.g., biological surveys), to every few years (e.g., land change).

To the extent practicable, data collection will follow relevant standard operating procedures (SOPs). These include, but are not limited to

- A Standard Operating Procedures Manual for the CRMS – *Wetlands* (Folse et al., 2020).
- Standard Operating Procedures for Geo-scientific Data Management, Louisiana Sand Resources Database (Khalil et al., 2016)
- A Contractor's Guide to the Standards of Practice for CPRA Contractors Performing GPS Surveys and Determining GPS Derived Orthometric Heights within the Louisiana Coastal Zone (CPRA, 2016)
- Coast-wide and Barataria Basin Monitoring Plans for Louisiana's SWAMP (Hijuelos and Hemmerling, 2015)

Electronic data files will follow the file naming convention used by CPRA's Coastal Information Management System (CIMS) as outlined in Appendix 4 of Khalil et al. (2016). Metadata will be developed for project data, and to the extent practicable will follow Federal Geographic Data Committee and International Organization for Standardization standards.

6.2. Data Review and Clearance

All data collected as part of the Project will undergo proper QA/QC, review, and clearance procedures consistent with the guidelines developed by the NRDA Cross-TIG Monitoring and Adaptive Management work group (https://www.gulfspillrestoration.noaa.gov/project?id=71). CPRA's DMT will be responsible for data stewardship following CPRA's documented policies, SOPs, data conventions, and QA/QC procedures (e.g., Folse et al., 2020; Khalil et al., 2015; CPRA, 2016; CPRA, 2017). Data integrity will be checked with detailed and complex QA/QC software routines prior to input into the database, and additional automated routines when input into the database. CPRA staff and contractors who collect and input data into the database may also provide feedback on data quality and software routines to the DMT. Following data QA/QC, CPRA will give the other TIG members time to review the data before publishing on a public site.

6.3. Data Storage and Accessibility

CPRA will provide an online information dashboard to keep the public informed of diversion operations and monitoring results, including real-time data where available (e.g., turbidity, river stage, velocity, and water quality).

All data collected and analyzed as part of this project will be stored on either CPRA's CIMS website (https://cims.coastal.louisiana.gov/default.aspx) and/or the NOAA's Data Integration, Visualization, Exploration, and Reporting (DIVER) tool. CPRA will submit Project data to CIMS and/or DIVER as soon as possible and no more than one year from when data are collected. NOAA will provide a link to CIMS in the DIVER Restoration Portal.

CIMS is the official repository for environmental, modeling, and monitoring data for restoration projects undertaken by the state, as well as programmatic data collected by CRMS and BICM. CIMS combines a network of webpages hosted by CPRA, a GIS database, and a relational tabular database into one public-facing, GIS-integrated system capable of data visualizations and data delivery. Data preservation of the CIMS database/application suite is largely done through regular tape back-up and/or cloud storage for disaster recovery and continuation of service. All data and documents in the CIMS database/application suite are publicly available will continue to be available in perpetuity and/or for the life of the agency.

DIVER serves as the public NOAA repository for data related to the DWH Trustees' NRDA efforts. To provide additional context to the NRDA data, the site also includes historical (pre-2010) contaminant chemistry data for the onshore area of the Gulf of Mexico, as well as contaminant chemistry data collected during the response efforts and by the responsible party, British Petroleum. These data are available to the public and are accessed through a query and mapping interface called DIVER Explorer. Categories of Trustee NRDA data in DIVER include:

- photographs of the emergency response, the oiled animals, plants, fish, and beaches;
- telemetry information collected from remote sensing devices such as transmitter data from animal monitoring;
- field observations such as notes about the condition of animals found in the spill and extent of oiling in marshes;
- instrument data such as water temperatures and salinity collected during the spill; and
- sample results of laboratory analysis on tissue, sediment, oil, and water.

CPRA and NOAA are discussing ways to establish links between the two systems (e.g., ways to point to NRDA project data stored in each system) so CIMS users can easily find relevant data stored in DIVER and vice versa.

6.4. Data Sharing

Preliminary datasets (e.g., data that have not yet been subject to QA/QC or do not have complete metadata) will be accessible to Project participants and partners through non-public repositories (e.g., DWH SharePoint) as they become available. Fully QA/QC'ed data will be made publicly available, in accordance with the Federal Open Data Policy, through either the CIMS Data Portal (https://cims.coastal.louisiana.gov/) and/or the DIVER Explorer (https://www.diver.orr.noaa.gov) within one year of data collection. In the event of a public records request related to data and information on a

project that is not already publicly available, the Trustee to whom the request is addressed will provide notice, and an opportunity to comment or object, to the other LA TIG Trustees prior to releasing any project data that is the subject of the request.

Any data that is protected from public disclosure under federal and state law (e.g., personally identifiable information under the Privacy Act or observer information collected under Magnuson–Stevens Fishery Conservation and Management Act will not be publicly distributed.

Page intentionally left blank

7. REPORTING

7.1. DIVER Restoration Portal Reporting

Once finalized, this MAM Plan will be uploaded to the DIVER Restoration Portal and made publicly available through the DIVER Explorer https://www.diver.orr.noaa.gov/) and Trustee Council website (https://www.gulfspillrestoration.noaa.gov/). CPRA will also upload future revisions of the MAM Plan to the DIVER Restoration Portal following development and approval by the LA TIG, following discussions between CPRA and the TIG about the magnitudes of Plan amendments that would warrant reposting.

MAM activities and corresponding documents will be reported annually in the DIVER Restoration Portal. This will include information on the monitoring parameters, performance criteria (if applicable), monitoring duration and frequency, etc.

7.2. Mid-Basin Sediment Diversion Project Annual Operations Plans

The basis of Project operations is the main OMRR&R Plan, and the Annual Operations Plan is its yearly implementation. Information and lessons learned from the previous year will be considered when adjusting the operations plan for each upcoming year. Draft Annual Operations Plans will be presented to the Stakeholder Review Panel and at public meetings to solicit comments, perspectives, and insights. Following any revisions, the plan will be finalized for approval by the CPRA Executive Director.

7.3. Annual Operations Performance Reports

The Project DMT will develop Annual Operations Performance Reports to underpin CPRA's annual Project operations funding requests to the CPRA Board and the Louisiana Legislature. These reports will be limited to a summary of the Project Effectiveness monitoring data available in October of any Calendar Year, immediately following the end of a WY. Once developed, these reports will be posted onto CPRA's CIMS website, as well as uploaded to the DIVER Explorer and Trustee Council websites.

7.4. Annual Operations, Maintenance & Monitoring Reports

Annual OM&M Reports of Water Year Project Effectiveness and Status & Trends Data will be developed by the Operations Management Team that provides data collection results, attribute outcomes, operations information, maintenance updates, recommendations for monitoring, additional project features, lessons learned, etc. from the previous year's operations. As described in Section 5.2.2, these reports will provide a summary of the monitoring data collected during the WY regarding Project Operations and river and basin responses. Some descriptive and initial statistical analyses will be conducted on the WY data. However, more robust analyses will be relegated to the Multi-Year Report described below. Once developed, CPRA will post these reports the CIMS website, as well as upload them to the DIVER Explorer and Trustee Council websites.

7.5. Multi-year Monitoring and Adaptive Management Reports

Multi-year Monitoring and Adaptive Management Reports will be developed as described in Section 5.2.3 to provide a comprehensive analysis of Project Effectiveness and Status & Trends Data during the duration of the project. To the extent practicable, the interim and final MAM reports will be consistent with the MAM report template in the Deepwater Horizon TIG MAM Manual. Once developed, CPRA will post these reports the CIMS website, as well as upload them to the DIVER Explorer and Trustee Council websites.

7.6. Compliance Reporting

7.6.1. National Historic Preservation Act Annual Report

A report documenting the results of the annual reconnaissance survey, developed by CPRA, will be provided to all Consulting Parties within 30 days after completion of the survey. CPRA shall share annual survey results only after USACE New Orleans District (CEMVN) has been allowed to review proposed language and redact any specific location data for the historic properties or new findings or other sensitive data under applicable law and regulations.

7.6.2. US Fish & Wildlife Service Coordination Act Annual Report

CPRA's responsibilities with regards to the US Fish & Wildlife Service (USFWS) Coordination Act require the development and communication of an annual report outlining data specific to USFWS trust resources in the Barataria Basin. CPRA intends for that report to represent a subset of, but otherwise largely mirror the level of analysis in, the Annual OM&M Reports (7.4). The final format, content, and review process for this report will be developed by CPRA and USFWS.

7.6.3. Louisiana Trustee Implementation Group Annual Report

CPRA will develop an annual report to the LA TIG outlining data specific to NRDA trust resources in the Barataria Basin. CPRA intends for that report to represent a subset of, but otherwise largely mirror the level of analysis in, the Annual OM&M Reports (7.4). The final format, content, and review process for this report will be developed by CPRA and the LA TIG.

8. REFERENCES

Ainsworth, C., D. Brady, and K. Rose. 2018. How to use CASM and EwE in their Current Forms for Assessing Ecological Responses to the Mid-Barataria Diversion. Mini-report from the Expert Advisory Panel. 9 pages.

Allison, M., Chen, Q.J., Couvillion, B., Freeman, A., Leadon, M., McCorquodale, A., Meselhe, E., Ramatchandirane, C., Reed, D., and White, E. 2017. 2017 Coastal Master Plan: Model Improvement Plan, Attachment C3-2: Marsh Edge Erosion. Version Final. p 51. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

Banks, P., Beck, S., Chapiesky, K., & Isaacs, J. 2016. Louisiana Oyster Fishery Management Plan. *Louisiana Department of Wildlife and Fisheries, Office of Fisheries.*

Banks, P., Berrigan, M., Choudhury, A., Craig, L., Diaz, D., Kern, F., King, J., Marshall, M., Robinson, L., Steimle, F., Takacs, R., & Wikfors, G. 2007. Status review of the Eastern Oyster (*Crassostrea virginica*) (No. NOAA Technical Memo NMFS F/SPO-88) (p.105). Report to the National Marine Fisheries Service.

Barth, B. 2019. Mid-Barataria Sediment Diversion Program: Progress Update – CPRA Board. Presentation to the CPRA Board, 20 March 2019. https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=22775.

Biedenharn, D.S., C.R. Thorne, and C.W. Watson. 2006. Wash load / bed material load concept in regional sediment management. 2006. Proceedings of the Eighth Federal Interagency Sedimentation Conference (8thFISC), April 2—6, 2006, Reno, NV, USA: 483-490.

Blum, M.D. and H.H. Roberts. 2009. Drowning of the Mississippi River Delta due to insufficient sediment supply and global sea-level rise. Nature Geoscience DOI: 10.1038/NGEO553.

Booth, J.G., Miller, R.L., McKee, B.A., & Leathers, R.A. 2000. Wind-induced bottom sediment resuspension in a microtidal coastal environment. *Continental Shelf Research*, 20(7), 785–806.

Boyer, J.N., Kelble, C.R., Ortner, P.B., & Rudnick, D.T. 2009. Phytoplankton bloom status: Chlorophyll *a* biomass as an indicator of water quality condition in the southern estuaries of Florida, USA. *Ecological Indicators*, 9(6), S56–S67.

Brown, G., C. Callegan, R. Heath, L. Hubbard, C. Little, P. Luong, K. Martin, P. McKinney, D. Perky, F. Pinkard, T. Pratt, J. Sharp, and M. Tubman. 2009. West Bay Sediment Diversion Effects: ERDC Workplan Report – DRAFT. U.S. Army Corps of Engineers / Engineer Research and Development Center / Coastal and Hydraulics Laboratory. 263 pages.

Chesney, E.J., Baltz, D.M., & Thomas, R.G. 2000. Louisiana estuarine and coastal fisheries and habitats: perspectives from a fish's eye view. *Ecological Applications*, 10(2), 350–366.

Coastal Protection and Restoration Authority (CPRA). 2011. Myrtle Grove delta building diversion modeling effort in support of the LCA medium diversion at Myrtle Grove with dedicated dredging project. Data collection, preliminary design and modeling initiative. 96 p +Appendices.

CPRA. 2016. A Contractor's Guide to the Standards of Practice: For CPRA Contractors Performing GPS Surveys and Determining GPS Derived Orthometric Heights within the Louisiana Coastal Zone. Coastal Protection and Restoration Authority of Louisiana. Baton Rouge, LA. January. Available. https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=18503.

CPRA. 2017. Coastal Information Monitoring System (CIMS) Data Descriptions. Coastal Protection and Restoration Authority of Louisiana. Baton Rouge, LA. May. Available: https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=11505.

CPRA and LDWF. 2019. Scope of Services: The Coastwide Fish and Shellfish Monitoring Program, FY 2019. 40 pages.

CPRA and U.S. Army Corps of Engineers. 2010. Conceptual Ecological Model. Annex 1 of Appendix I: Monitoring and Adaptive Management Plan, of the Louisiana Coastal Area (LCA) Ecosystem Restoration Study Volume VI of VI: Finial Integrated Feasibility Study and Supplemental Environmental Impact Statement for the Medium Diversion at White Ditch, Plaquemines Parish, Louisiana. 18 pp. https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=1633

CPRA and U.S. Army Corps of Engineers. 2011. Conceptual Ecological Model. Louisiana Coastal Area (LCA) Medium Diversion at Myrtle Grove with Dedicated Dredging. 25 p.

Coleman, D.J., A.S. Kolker, and K.H. Johanneson. 2016. Submarine groundwater discharge and alkaline earth element dynamics in a deltaic coastal setting. *Hydrology Research* **48**: 1169-1175.

Conner, W.H. and J.W. Day, Jr. eds. 1987. The ecology of Barataria Basin, Louisiana: an estuarine profile. U.S. Fish and Wildl. Bio. Rep. 85(7.13). 165 pp.

Couvillion, B.R., Barras, J.A., Steyer, G.D., Sleavin, W., Fischer, M., Beck, H., Trahan, N., Griffin, B., & Heckman, D. 2011. Land area change in coastal Louisiana from 1932 to 2010. U.S. Geological Survey Scientific Investigations. Map 3164, scale 1:265,000, 12 p. pamphlet.

Couvillion, B.R., Beck, Holly, Schoolmaster, Donald, and Fischer, Michelle. 2017. Land area change in coastal Louisiana 1932 to 2016: U.S. Geological Survey Scientific Investigations Map 3381. Available at: https://doi.org/10.3133/sim3381. Accessed December, 2017.

Danielson, J.J., Poppenga, S.K., Brock, J.C., Evans, G.A., Tyler, D.J., Gesch, D.B., Thatcher, C.A., and Barras, J.A., 2016, Topobathymetric Elevation Model Development using a New Methodology: Coastal National Elevation Database: Journal of Coastal Research, p. 75–89, doi: 10.2112/SI76-008.

Day, J.W., G.P. Shaffer, L.D. Britsch, D.J. Reed, S.R. Hawes, and D. Cahoon. 2000. Pattern and process of land loss in the Mississippi Delta: A spatial and temporal analysis of wetland habitat change. Estuaries 23:425-438.

Day, J.W., J. Agoobla, C. Zhongyuan, C. D'Elia, D.L. Forbes, L. Giosan, P. Kemp, C. Kuenzer, R.R. Lane, R. Ramachandran, J. Syvitski, A. Yanez-Acranciba. 2016. Approaches of defining deltaic sustainability in the 21st century. Estuarine, Coastal and Shelf Science 183: 275-291.

Day J.W., Jr., D.F. Boesch, E.J. Clairain, G.P. Kemp, S.B. Laska, W.J. Mitsch, K. Orth, H. Mashriqui, D.J. Reed, L. Shabman, C.A. Simenstad, B.J. Streever, R.R. Twilley, C.C. Watson, J.T. Wells, and D.F. Whigman. 2007. Restoration of the Mississippi Delta: Lessons from Hurricanes Katrina and Rita. Science 315, 1679-1684.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH Trustees). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS). Retrieved from http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH Trustees. 2016. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Originally approved May 4, 2016; revised November 15, 2016.

DWH Trustees. 2017. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December.

Dokka, R.K. 2011. The role of deep processes in late 20th century subsidence of New Orleans and coastal areas of southern Louisiana and Mississippi. *Journal of Geophysical Research* 116: B06403, DOI:10.1029/2010JB008008.

Environmental Protection Agency (EPA). 2019. Recommendations for Cyanobacteria and Cyanotoxin Monitoring in Recreational Waters. EPA 823-R-19-001. Office of Water. https://www.epa.gov/sites/default/files/2019-09/documents/recommend-cyano-rec-water-2019-update.pdf

Fagherazzi, S., & Wiberg, P.L. 2009. Importance of wind conditions, fetch, and water levels on wave-generated shear stresses in shallow intertidal basins. *Journal of Geophysical Research* 114: F03022, doi:10.1029/2008JF001139.

Fischenich, J.C. 2008. The Application of Conceptual Models to Ecosystem Restoration. ERDC TN-EMRRP-EBA-01. U.S. Army Corps of Engineers, Engineer Research & Development Center, Environmental Laboratory, Vicksburg, MS. 23 pp.

Folse, T. M., McGinnis, T. E., Sharp, L. A., West, J. L., Hymel, M. K., Troutman, J. P., Weifenbach, D., Boshart, W. M., Rodrigue, L. B., Richardi, D. C., Wood, W. B., & Miller, C. M., Robinson, E. M., Freeman, A. M., & Stagg, C. L. (2020). 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. 260 pp.

Gulf of Mexico Alliance (GOMA). 2014. Resource Guide for Harmful Algal Bloom Toxin Sampling and Analysis. White Paper from the Gulf of Mexico Alliance Water Quality Priority Issue Team Harmful Algal Blooms Workgroup. 45 pp. http://gulfofmexicoalliance.org/documents/pits/wq/goma_hab_toxin_resource_guide.pdf

Graham, S.A., and I.A. Mendelssohn. 2014. Coastal wetland stability maintained through counterbalancing accretionary responses to chronic nutrient enrichment. *Ecology* **95**: 3271–3283.

Handley, L.R., C.M. Lockwood, K. Spear, M. Finkbeiner, and J. Kenworthy. 2018. Gulf-wide Seagrass Monitoring and Needs Assessment Workshop: Report for the Gulf of Mexico Alliance, September 2018. 89 pages. https://gulfofmexicoalliance.org/wp-content/uploads/2019/01/Handley-et-al-2018-GOMAA-Seagrass-Workshop-Report.pdf

Hatton, R.S., R.D. DeLaune, and W.H. Patrick, Jr. 1983. Sedimentation, accretion, and subsidence in marshes of Barataria Basin, Louisiana. *Limnology and Oceanography* **28**: 494-502.

Hijima, M.P., Z. Shen, T.E. Törnqvist, and B. Mauz. 2017. Late Holocene evolution of a coupled, mud-dominated delta plain - chenier plain system, coastal Louisiana, USA. *Earth Surface Dynamics* **5**: 689-710.

Hijuelos, A.C. & Hemmerling, S.A. 2016. Coast Wide and Basin Wide Monitoring Plans for Louisiana's System-Wide Assessment and Monitoring Program (SWAMP), Version III. The Water Institute of the Gulf. Prepared for and funded by the Coastal Protection and Restoration Authority (CPRA) under Task Order 6, Contract No. 2503-12-58. Baton Rouge, LA.

Jafari, N., Brian Harris, Jack Cadigan, John Day, Charles Sasser, G. Paul Kemp, Cathleen Wigand, Angelina Freeman, Leigh Anne Sharp, James Pahl, Gary Shaffer, Guerry Holm, and Robert Lane. 2019. Wetland Soil Strength with emphasis on the impact of nutrients, sediments, and sea level rise. *Estuarine, Coastal and Shelf Science* 229: 106394.

Kemp, W.M., Sampou, P.A., Garber, J., Tuttle, J., & Boynton, W.R. 1992. Seasonal depletion of oxygen from bottom waters of Chesapeake Bay: roles of benthic and planktonic respiration and physical exchange processes. *Marine Ecology Progress Series, 85*, 137–152.

Khalil, S.M., E. Haywood, and B. Forrest. 2016. Standard Operating Procedures for Geo-scientific Data Management, Louisiana Sand Resources Database (LASARD). Coastal Protection and Restoration Authority of Louisiana (CPRA). June. Available: https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=12362.

Kindinger, J.L., Buster, N.A., Flocks, J.G., Bernier, J.C., and Kulp, M.A. 2013 Louisiana Barrier Island Comprehensive Monitoring (BICM) Program Summary Report: Data and Analyses 2006 through 2010: U.S. Geological Survey Open-File Report 2013–1083, 86 p.

Knaus, R.M., & Cahoon, D.R. 1990. Improved cryogenic coring device for measuring soil accretion and bulk density. *Journal of Sedimentary Petrology* 60: 622-623.

Li, C., J. R. White, C. Chen, H. Lin, E. Weeks, K. Galvan, and S. Bargu. 2011. Summertime tidal flushing of Barataria Bay: Transports of water and suspended sediments. *Journal of Geophysical Research* **116**: C04009, doi:10.1029/2010JC006566.

Linscombe, R.G., and Hartley, S.B. 2011. Analysis of Change in Marsh Types of Coastal Louisiana, 1978–2001. U.S. Geological Survey Open-File Report 2010-1282. 52 p.

Livingston, R. 1988. Inadequacy of species-level designations for ecological studies of coastal migratory fishes. *Environmental Biology of Fishes* ***22*****(3):** 225–234.

Lopez, J., T. Henkel, A. Moshoglanis, A. Baker, E. Boyd, E. Hillmann, and D. Baker. 2014. Evolution of Mardi Gras Pass within the Bohemia Spillway of the Mississippi Delta in Southeast Louisiana: March 2012 through December 2013. Lake Pontchartrain Basin Foundation. 92 pages.

Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTF). 2018. The 2018 Evaluation Report to the U.S. Congress on the Effectiveness of Coastal Wetlands, Planning, Protection and Restoration Act Projects. 28 pages.

Louisiana Department of Wildlife and Fisheries (LDWF). 2015. Barataria Basin: lake history & management issues. Office of Fisheries – Inland Fisheries Section. 45 p.

LDWF. 2018. Marine Fisheries Section Independent Sampling Activities Field Manual. 49 pages.

Madden, C.J., J.W. Day, Jr., and J.M. Randall. 1988. Freshwater and marine coupling in estuaries of the Mississippi River deltaic plain. Limnology and Oceanography 33: 982–1004.

Martin, S.B., K. Samek., N.L. Pace, C. Kelble, and S. Giordano. 2018. Selecting Ecological Indicators for Ecosystem Assessment of Barataria Basin. A poster at State of the Coast 2018.

Meade, R.H. and J.A. Moody. 2009. Causes of the decline of suspended-sediment discharge in the Mississippi River system, 1940-2007. Hydrologial Processes 24, 35-49. DOI: 10.1002/hyp.7477.

Melancon, E., Soniat, T.M., Cheramie, V., Dugas, R.J., Barras, J., & Lagarde, M. (1998). Oyster Resource Zones of the Barataria and Terrebonne Estuaries of Louisiana. *Journal of Shellfish Research*, 17(4-5), 1143–1148.

Meselhe, E.M, White, E.D., and Wang, Y. 2017. *2017 Coastal Master Plan: Attachment C3-24: Integrated Compartment Model Uncertainty Analysis.* 68p. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

Meselhe, E.A. and K.M. Sadid. 2015. Louisiana Coastal Area Program – Mississippi River Hydrodynamic and Delta Management Study. Multidimensional Modeling: Local Applications of Delft 3-D model. March 2015.

Michel J, Owens EH, Zengel S, Graham A, Nixon Z, Allard T, et al. (2013) Extent and Degree of Shoreline Oiling: *Deepwater Horizon* Oil Spill, Gulf of Mexico, USA. PLoS ONE 8(6): e65087. https://doi.org/10.1371/journal.pone.0065087

Minello, T.J., Able, K.W., Weinstein, M.P., & Hays, C.G. (2003). Salt marshes as nurseries for nekton: testing hypotheses on density, growth and survival through meta-analysis*. Marine Ecology Progress Series*, 246, 39–59.

Morton, R.A., J.C. Bernier, J.A. Barras. 2006. Evidence of regional subsidence and associated interior wetland loss by hydrocarbon production, Gulf Coast region, USA. Environmental Geology 50: 261–274 DOI 10.1007/s00254-006-0207-3.

Nelson, D.W.& Sommers, L.E. (1996). Total Carbon, Organic Carbon, and Organic Matter. In: Methods of Soil Analysis, Part 2, 2nd ed., A.L. Page et al., Ed. Agronomy. 9:961-1010. Am. Soc. of Agron., Inc. Madison, WI

Nuttle, W.K, F.H. Sklar, A.B. Owens, M. Inoue, D. Justic, W. Kim, E. Melancon, J. Pahl, D. Reed, K. Rose, M. Schexnayder, G. Steyer, J. Visser and R. Twilley. 2008. Conceptual Ecological Model for River Diversions into Barataria Basin, Louisiana, Chapter 7. In, R.R. Twilley (ed.), Coastal Louisiana Ecosystem Assessment & Restoration (CLEAR) Program: A tool to support coastal restoration. Volume IV. Final Report to Department of Natural Resources, Coastal Restoration Division, Baton Rouge, LA. Contract No. 2512-06-02.

Nyman, J.A., R.D. DeLaune, and W.H. Patrick Jr. 1990. Wetland soil formation in the rapidly subsiding Mississippi River Deltaic Plain: mineral and organic matter relationships. *Estuarine, Coastal & Shelf Science* **31**: 57-69.

Oberg, K.A., S.E. Morlock, and W.S. Caldwell. 2005. Quality-Assurance Plan for Discharge Measurements Using Acoustic Doppler Current Profilers. U.S. Geological Survey Scientific Investigations Report 2005-5183. 46 pages.

Odum, W.E. 1988. Comparative Ecology of Tidal Freshwater and Salt Marshes. *Annual Review of Ecology and Systematics* **19**: *147–176*.

Oyster Technical Task Force. (2012). The Oyster Fishery of the Gulf of Mexico, United States: A Fisheries Management Plan. (S.J. Vanderkooy, Ed.). Ocean Springs, MS: Gulf States Marine Fisheries Commission.

Pahl, J. 2017. 2017 Coastal Master Plan: Attachment C-2: Eustatic Sea Level Rise. Version Final. p. 23. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority. Ramirez & Allison, 2013

Pennings, S.C., Grant, M.B., & Bertness, M.D. (2005). Plant Zonation in Low-Latitude Salt Marshes: Disentangling the Roles of Flooding, Salinity and Competition. *Journal of Ecology*, 93(1), 159–167.

Poormahdi, S., S.A. Graham, and I.A. Mendelssohn. 2018. Wetland Plant Community Responses to the Interactive Effects of Simulated Nutrient and Sediment Loading: Implications for Coastal Restoration Using Mississippi River Diversions. Estuaries and Coasts 41:1679–1698 https://doi.org/10.1007/s12237-018-0390-y

Ramirez, M.T., and M.A. Allison. 2013. Suspension of bed material over sand bars in the Lower Mississippi River and its implications of Mississippi delta environmental restoration. *Journal of Geophysical Research: Earth Surface* **118:** 1085-1104.

Rangoonwala, A.., C.E. Jones, and E. Ramsey III. 2016. Wetland shoreline recession in the Mississippi River Delta from petroleum oiling and cyclonic storms. *Geophysical Research Letters* **43**: 11,652-11,660.

Raynie, R.C. 2017. CPRA's Adaptive Management Program: Overview. Coastal Protection and Restoration Authority, Baton Rouge, LA. 33pp.

Reddy, K.R., D'Angelo, E.M., & Harris, W.G. (2000). Biogeochemistry of Wetlands. In M.E. Sumner, Handbook of Soil Science, pp. G89– 119. Boca Raton, FL: CRC Press.

Reed, D. J., E. M. Swenson, and J. G. Gosselink. 1995. Status and trends of hydrologic modification, reduction in sediment availability, and habitat loss/modification in the Barataria-Terrebonne estuarine system. Barataria-Terrebonne National Estuary Program, Publication #20.

Reed, D. and B. Yuill. 2017. 2017 Coastal Master Plan: Attachment C2-2: Subsidence. Version Final. p. 15. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

Roman, C.T., Raposa, K.B., Adamowicz, S.C., James-Pirri, M., and J.G. Catena. 2002. Quantifying vegetation and nekton response to tidal restoration of a New England salt marsh. Restoration Ecology 10(3): 450-460.

Smith, J.E., S.J. Bentley, G.A. Snedden and C. White. 2015. What role do hurricanes play in sediment delivery to subsiding river deltas? *Scientific Reports* **5**: 17582.

Turner, R.E. 1997. Wetland loss in the northern Gulf of Mexico: Multiple working hypotheses. Estuaries, 20, 1–13.

Silliman, B.R., J. van de Koppel, M.W. McCoy, J. Diller, G.N. Kasozi, K. Earl, P.N. Adams, and A.R. Zimmerman. Marsh degradation and resilience after oiling. *Proceedings of the National Academy of Sciences* **109**: 11234-11239; DOI:10.1073/pnas.1204922109

Smith, P.E., Orvos, D.R., and J. Cairns. 1993. Impact assessment using the before-after-control-impact (BACI) model: concerns and comments. Canadian Journal of Fisheries and Aquatic Sciences 50:627-637.

Snedden, G. 2019. Patterning emergent marsh vegetation assemblages in coastal Louisiaina, USA, with unsupervised neural networks. *Applied Vegetation Science* **22**: 213-229.

Stagg, C.L., M.M. Baustian, C.L. Perry, T.J. Carruthers and C.T. Hall. Direct and indirect controls on organic matter decomposition in four coastal wetland communities along a landscape salinity gradient. *Journal of Ecology* **106**: 655—670.

Stewart-Oaten, A. 2003. On rejection rates of paired intervention analysis: comment. Ecology 84:2795-2799.

Stewart-Oaten, A., J. R. Bence, and C. W. Osenberg. 1992. Assessing effects of unreplicated perturbations: no simple solutions. Ecology 73:1396-1404.

Stewart-Oaten, A., W. W. Murdoch, and K. R. Parker. 1986. Environmental Impact Assessment: "pseudoreplication" in time? Ecology 67:929-940.

Steyer, G.D., (2010), U.S. Geological Survey Fact Sheet. Coastwide Reference Monitoring System (CRMS) 2010-3018, 2 p.

Steyer, G.D., Sasser, C. E., Visser, J. M., Swensen, E. M., Nyman, J. A., & Raynie, R.C. (2003). A Proposed Coast-Wide Reference Monitoring System for Evaluating Wetland Restoration Trajectories in Louisiana. *Environmental Monitoring and Assessment* 81:107-117.

Steyer, G.D., Twilley, R.R., & Raynie, R.C. (2006). An Integrated Monitoring Approach Using Multiple Reference Sites to Assess Sustainable Restoration in Coastal Louisiana. Pages 326 – 333. Monitoring Science and Technology Symposium: Unifying Knowledge for Sustainability in the Western Hemisphere. 2004 September 20-24, Denver, CO. Proceedings RMRS-P-42CD, Fort Collins, CO, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 990 p.

Thatcher, C.A., Brock, J.C., Danielson, J.J., Poppenga, S.K., Gesch, D.B., Palaseanu-Lovejoy, M.E., Barras, J.A., Evans, G.A., and Gibbs, A.E., 2016, Creating a Coastal National Elevation Database (CoNED) for Science and Conservation Applications: Journal of Coastal Research, p. 64–74, doi: 10.2112/SI76-007.

Tonelli, M., Fagherazzi, S., & Petti, M. (2010). Modeling wave impact on salt marsh boundaries. *Journal of Geophysical Research*, 115(C9).

Turner, R.E., Swenson, E.M., Milan, C.S., and Lee, J.M. 2019. Spatial variations in Chlorophyll *a*, C, N, and P in a Louisiana estuary from 1994 to 2016. Hydrobiologia 834, 131–144. https://doi.org/10.1007/s10750-019-3918-7

Turner, R.E., G. McClenachan, and A.W. Tweel. 2016. Islands in the oil: Quantifying salt marsh shoreline erosion after the Deepwater Horizon oiling. *Marine Pollution Bulletin* **10**: 316-232.

Turner, R.E., & Rabalais, N.N. (1991). Changes in Mississippi River water quality this century. *BioScience*, 41(3), 140–147.

Tweel, A.W., and R.E. Turner. 2012. Landscape-scale analysis of wetland sediment deposition from four tropical cyclone events. PLoS ONE 7(11): e50528. doi:10.1371/journal.pone.0050528

U.S. Army Corps of Engineers. (1993). Methods of Measuring Sedimentation Rates in Bottomland Hardwoods. US Army Corps of Engineers Waterways Experiment Station. WRP Technical Note SDCP-4.1. Vicksburg, MS. 7 pp.

United States Environmental Protection Agency (USEPA). 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 1 Fish Sampling and Analysis. Third Edition. Washington DC: Office of Science and Technology, Office of Water. EPA 823-B-00-007. https://www.epa.gov/sites/default/files/2015-06/documents/volume1.pdf

Underwood, A. J. 1992. Beyond BACI: the detection of environmental impacts on populations in the real, but variable, world. J. Exp. Mar. Biol. Ecol. 161:145-178.

Valiela, I. (1995). Marine Ecological Processes (Second Edition). New York: Springer Science & Business Media.

The Water Institute of the Gulf (TWIG). 2014a. Expert Panel on Diversion Planning and Implementation. Report #1. https://thewaterinstitute.org/assets/docs/reports/2_25_2014_Diversion-Expert-Panel-Report-1.pdf.

TWIG. 2014b. Expert Panel on Diversion Planning and Implementation. Report #2. https://thewaterinstitute.org/assets/docs/reports/6_18_2014_Diversion-Expert-Panel-Report-2.pdf.

TWIG. 2015a. Expert Panel on Diversion Planning and Implementation. Report #3. https://thewaterinstitute.org/assets/docs/reports/1_21_2015_Diversion-Expert-Panel-Report-3.pdf.

TWIG. 2015b. Expert Panel on Diversion Planning and Implementation. Reports #4. https://thewaterinstitute.org/assets/docs/reports/03_24_2015_Diversion-Expert-Panel-Report-4.pdf.

TWIG. 2015c. Expert Panel on Diversion Planning and Implementation. Report #5. https://thewaterinstitute.org/assets/docs/reports/9_16_2015_Diversion-Expert-Panel-Report-5.pdf.

TWIG. 2016a. Expert Panel on Diversion Planning and Implementation. Report #6. https://thewaterinstitute.org/assets/docs/reports/1_12_2016_Diversion-Expert-Panel-Report-6.pdf.

TWIG. 2016b. Expert Panel on Diversion Planning and Implementation. Report #7. https://thewaterinstitute.org/assets/docs/reports/10_19_2016_Diversion-Expert-Panel-Report-7.pdf.

TWIG. 2019. Monitoring Plans for Louisiana's System-Wide Assessment and Monitoring Program (SWAMP), Version IV. Prepared for and funded by the Coastal Protection and Restoration Authority (CPRA) under Task Order 6, Contract No. 2503-12-58. Baton Rouge, LA. 235 pages.

TWIG. 2020. Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations. Prepared for the Coastal Protection and Restoration Authority (CPRA) and the Louisiana Trustee Implementation Group (LA TIG), funded by the LA TIG. Task Order 50.2, Contract No. 2503-12-58 Baton Rouge, LA. 202 pp.

West, J., Blanchet, H., Marx, J., & Powers, J.E., (2016). Update Assessment of Blue Crab in Louisiana Waters 2016 Report. Office of Fisheries, Louisiana Department of Wildlife and Fisheries

Wynne, T., A. Meredith, T. Briggs, W. Litaker, and R. Stumpf 2018. Harmful Algal Bloom Forecasting Branch Ocean Color Satellite Imagery Processing Guidelines. NOAA Technical Memorandum NOS NCCOS 252. Silver Spring, MD.48 pp. doi:10.25923/twc0-f025. https://repository.library.noaa.gov/view/noaa/20270

Wood, W.B., Shaffer, G.P., Visser, J.M., Krauss, K.W., Piazza, S.C., Sharp, L.A. & Cretini, K.F., (2017). Forested Floristic Quality Index: An Assessment Tool for Forested Wetland Habitats Using the Quality and Quantity of Woody Vegetation at Coastwide Reference Monitoring System (CRMS) Vegetation Monitoring Stations (No. 2017-1002). US Geological Survey.

Wood, W.B., Visser, J.M., Piazza, S.C., Sharp, L.A., Hundy, L.C., & McGinnis, T.E. (2015). Coastwide Reference Monitoring System (CRMS) Vegetation Volume Index—An assessment tool for marsh habitat focused on the three-dimensional structure at CRMS vegetation monitoring stations. U.S. Geological Survey Open-File Report 2015–1206, 14 p.

World Health Organization (WHO). 1999. Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management. Ed: I. Chorus and J. Bartram. 400 pp. https://www.who.int/water_sanitation_health/resourcesquality/toxcyanbegin.pdf

World Health Organization (WHO). 2020. Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management. Second edition. Ed: I. Chorus and M. Welker. 859 pp. https://www.who.int/publications/m/item/toxic-cyanobacteria-in-water---second-editionYuill, B., D. Lavoie, and D.J. Reed. 2009. Understanding subsidence processes in coastal Louisiana. Journal of Coastal Research, SI54:23-36.

Zedler, J.B. 2005. Ecological restoration: guidance from theory. San Francisco Estuary and Watershed Science 3(2):1-31.

Zimmerman, R.J., Minello, T.J., & Rozas, L.P. (2000). Salt marsh linkages to productivity of penaeid shrimps and blue crabs in the northern Gulf of Mexico. In M.P. Weinstein & D.A. Kreeger (Eds.), Concepts and Controversies in Tidal Marsh Ecology, pp. 293– 314. Dordrecht, The Netherlands: Kluwer Academic Publishers.

9. MONITORING AND ADAPTIVE MANAGEMENT BUDGET

The adaptive management component of a MAM strategy makes long-term budget estimating of a MAM budget difficult, given decisions that will be made throughout Project operations of continued need for collection of data on specific parameters. To match the analyses conducted in support of the Project EIS, however, the budget (Table 9-1) below projects out MAM costs through both a five-year pre-operations (baseline) period and 50 years post-construction (Project operations). Final MAM budget estimates are subject to further conversation between CPRA and the LA TIG agencies.

Table 9-1. Initial estimated costs for Project monitoring and adaptive management during the 5-years pre-operations and either 20 years (NRDA) or 50 years (Other) post-construction. Cost estimates shown are limited to estimated contractual costs for the empirical data collection items outlined in Section 3.

Time Period / Data Collection Area	**Initial Proposed Funding Source**		
	NRDA	**Other**	**Total**
Pre-operations (Baseline)	$29,160,124	$0	$29,160,124
Post-construction (Operations)	$119,577,350	$40,167,600	$159,744,950
Total (Pre + Post)	$148,737,474	$40,167,600	$188,905,074

Page intentionally left blank

10. INVENTORY OF PROJECT-RELATED DISCRETE/APERIODIC STUDIES

Table 10-1. A learning strategy has been identified to address uncertainties in responses of environmental resources to project inputs. In contrast to the uncertainties listed in Table 4.1-4, reducing the uncertainties in this table is not critical to the Adaptive Management cycle for this Project. The "Reference" column lists the source that identified the uncertainty (this MAM Plan, the Project Phase II Restoration Plan, and the Diversion Expert Panel reports #1-7 (CPRA 2014/2015/2016)).

Uncertainty	Reference	Purpose of Learning Goal	Learning Strategy
Ecosystem function in the created marsh (project outfall area) compared to pre-construction existing condition in the same area.	MAM Plan 4.1.3; Diversion Expert Panel Report #1	Quantify restoration benefits (Objective 3)	Compare pre-construction and 5-year post-operations values for *Land and water extent* (3.7.3.1), *Emergent wetland area* (3.7.3.2), *Vegetation Cover, Abundance, and Height* (3.7.3.3), *Emergent and submerged vegetation community type* (3.7.3.5), *Emergent vegetation biomass in the Project area* (3.7.3.6), *Topography/bathymetry of the Project delta development area* (3.7.1.1.7), *Lower trophic level organisms* (3.7.3.16), *Nekton species abundance and composition/assemblage* (3.7.3.18), and *Aquatic resource and terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22). Use an ecosystem model ensemble approach (spatially articulate and including trophic interactions) to increase confidence in conclusions.
Comparative wetland function of three types of wetland treatments: marsh built by this sediment diversion; a marsh built by conventional wetland restoration (marsh creation from dredged sediments); and unrestored marsh (CRMS-Wetlands stations).	MAM Plan 4.1.3	Quantify restoration benefits (Objective 3)	Develop experimental design and evaluate wetland function including *Topography/bathymetry of the Project Influence Area* (3.7.1.1.7) and *Aquatic resource and terrestrial wildlife utilization of created/restored habitat* (3.7.3.22)

Table 10-1 (*continued*). A learning strategy has been identified to address uncertainties in responses of environmental resources to project inputs (*continued*).

Uncertainty	Reference	Purpose of Learning Goal	Learning Strategy
Will the Project help to reduce the size, shape, or severity of the Gulf hypoxic zone by filtering some of the Mississippi River nutrients that would otherwise reach Gulf waters?	Restoration Plan 3.2.1.6.5	Quantify restoration benefits (Objective 3)	Evaluate *Dissolved Oxygen* (3.7.3.7) and data from the nearshore Gulf of Mexico (e.g. www.gulfhypoxia.net), *Nutrient loads conveyed into Barataria Basin* (3.7.1.2.4), and *Nutrient constituents in Barataria Surface Waters* (3.7.3.12).
Changes in the Barataria basin community assemblage, biodiversity of the aquatic food web, the food web links, and the benthic: pelagic ratios (biomass and productivity, including interannual and seasonal variability) over time.	MAM Plan 4.1.3	Quantify restoration benefits (Objective 3)	Refine and run ecosystem models (Section 1.5) and evaluate additional parameters: *Lower Trophic Level Organisms* (Section 3.7.3.16), *Nekton species abundance and composition/assemblage* (3.7.3.18), and *Aquatic resource and terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22).
Statistical relationship of environmental condition variability to food web changes	MAM Plan 4.1.3	Quantify restoration benefits (Objective 3)	Refine and run ecosystem models (Section 1.5).

Table 10-1 (*continued*). A learning strategy has been identified to address uncertainties in responses of environmental resources to project inputs (*continued*).

Uncertainty	Reference	Purpose of Learning Goal	Learning Strategy
Nutrient influence on soil strength and efficacy of land building; Effects of nutrients on floating marsh and emergent marsh soil strength, organic accretion rates, shallow rooting, increased rate of microbial decomposition of soil organic materials, and/or growth alterations to emergent vegetation	TWIG 2014a, TWIG 2015b; MAM Plan 1.4.3, 3.7.1.1.3	Quantify restoration benefits (Objective 3)	Evaluate *Topography/bathymetry of the Project Influence Area* (3.7.1.1.7), *Nutrient loads conveyed into Barataria Basin* (3.7.1.2.4), *Soil organic matter content* (3.7.2.1.4), *Soil total nutrients* (3.7.2.1.6), Soil strength (3.7.2.1.8), *Marsh surface elevation change rate in the Project Influence Area* (3.7.2.1.9), *Land and water extent / Area of new delta formation in the Project Influence Area (3.7.3.1)*, *Emergent wetland area* (3.7.3.2.), *Vegetation Cover, Abundance, and Height* (3.7.3.3), *Emergent and submerged vegetation community type* (3.7.3.5), *Emergent vegetation biomass in the Project area* (3.7.3.6), *Nutrient constituents in Barataria Surface Waters* (3.7.3.12). Establish marsh experiments in controlled environments and in greenhouses. Consider data and publications from other Barataria Basin diversion studies.
Can nutrients be effectively filtered by vegetation and sediment in receiving basins, or will nutrient delivery exceed the needs of primary producers and lead to local and far-field algal bloom?	TWIG 2014a, MAM Plan 3.7.1.1.3	Effect of excess nutrients on water quality	Evaluate *Nutrient loads conveyed into Barataria Basin* (3.7.1.2.4), phytoplankton blooms (3.7.3.9), harmful algal blooms (3.7.3.10), dissolved oxygen (3.7.3.7). May require supplemental data collection (beyond the scope of this MAM Plan).
How will rates of nutrient and toxin assimilation change following Project Operations?	TWIG 2014a	Effects of nutrients on HCABs, toxins, and associated implications for ecosystem effects and human health	Phytoplankton Species Composition (including Harmful Cyanobacterial/Algal Bloom Species) (3.7.3.10), Harmful Cyanobacterial/Algal Bloom Toxins 3.7.3.11). May require supplemental data collection (beyond the scope of this MAM Plan).

Table 10-1 (*continued*). A learning strategy has been identified to address uncertainties in responses of environmental resources to project inputs (*continued*).

Uncertainty	Reference	Purpose of Learning Goal	Learning Strategy
Effects on SAV coverage related to dispersal opportunities (expansion) and reduced salinity and suspended sediments (shifts in composition)	TWIG 2014a	Quantify restoration benefits (Objective 3)	*Submerged aquatic vegetation area* (3.7.3.4), *Emergent and submerged vegetation community type* (3.7.3.5), *Salinity* (3.7.3.8), *Turbidity of Barataria Surface Waters* (3.7.3.14)
Recruitment potential of emergent marsh species in newly formed deltaic sediments, and colonization in receiving basins that are relatively isolated and degrading vs in vegetated basins with ample propagule sources	TWIG 2014a	Quantify restoration benefits (Objective 3)	Emergent wetland area (3.7.3.2.), Vegetation Cover, Abundance, and Height (3.7.3.3), Emergent and submerged vegetation community type (3.7.3.5), Emergent vegetation biomass in the Project area (3.7.3.6). May require supplemental data collection (beyond the scope of this MAM Plan).
Relationship of social factors to diversion performance and operations (e.g., sediment volumes affected by runoff throughout the watershed; future navigation needs related to economic activity)	TWIG 2014a	Socioeconomic influences on Project performance	Explicitly link social outcome analysis to biophysical models. Incorporate the role of upstream social and economic factors, including other diversions and restoration projects, into diversion project performance assessment.

Table 10-1 (*continued*). A learning strategy has been identified to address uncertainties in responses of environmental resources to project inputs (*continued*).

Uncertainty	Reference	Purpose of Learning Goal	Learning Strategy
Correlation of socioeconomic changes and biophysical changes, such as character of natural resources (e.g., land mass, water quality, flood risks, species abundance) and social resources (e.g., fishing, hunting, navigation, agriculture, community structure, property value).	TWIG 2014a, 2016b	Socioeconomic response to biophysical changes	Ecosystem Services analysis approach to link policy and management interventions to changed biophysical outcomes and then corresponding changes in social impacts, expressed as human health, financial, employment, and community welfare outcomes. Evaluate changes in community demographics; results of retail/service and housing market analyses; demand for public services; changes in employment and income levels; and changes in the aesthetic quality of the community.

Page intentionally left blank

11. PROJECT ADAPTIVE MANAGEMENT DECISION LOG AND CATALOG OF UPDATES TO THE MONITORING AND ADAPTIVE MANAGEMENT PLAN

This section will be populated through time as this Plan is updated.

R3: Mitigation Summary Table

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Best Management Practices (BMPs) (Mitigation Plan Section 6.1)			
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Stormwater Pollution Prevention Plan (SWPPP), Spill Prevention, Control, and Countermeasure (SPCC) Plan (CPRA BMPs Section 1.IV.F and Section 2.III.B)	▪ Hazardous, toxic, and radioactive waste assessment ▪ Aquatic resources ▪ Marine mammals ▪ Public health & safety ▪ Surface water and coastal processes ▪ Wetland resources and WOTUS	ADDRESSED IN EIS: These plans are designed to avoid and minimize adverse impacts on the environment and these measures are integral components of the alternatives considered in the EIS, so their effects have already been addressed within the environmental impact analysis. (See EIS Section 4.1, 4.5, 4.9, 4.10, 4.20, 4.25.)
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs *(based on ESA RPMs, below)*	Fish Removal Plan Development for cofferdam and diversion structure for pallid sturgeon (ESA Protection Measures)	▪ Aquatic resources ▪ T&E species	See discussion under ESA measures, below.
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs *(based on ESA RPMs, below)*	Manatee protection measures to avoid and minimize potential impacts associated with in-water work (FWCA recommendation #11; ESA Protection Measures)	▪ Marine mammals ▪ T&E species	See discussion under ESA measures, below.
Mitigation and Stewardship Plan	Environmental inspections (CPRA BMPs Section 1.II.A-N and Section 2.II.A-I)	▪ Aquatic Resources ▪ Wetland resources and WOTUS	NEGLIGIBLE: Environmental impacts from inspection activities would be negligible.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Avoidance and Minimization Measures – BMPs			
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Preconstruction planning (CPRA BMPs Section 1.III.A-D)	▪ Surface water and sediment quality ▪ Wetland resources and WOTUS ▪ Land-based transportation ▪ HTRW	NEGLIGIBLE: There are no environmental impacts inherent in developing a plan. Any activities resulting from these planning efforts would be within the scope of the alternatives and environmental impacts considered in the EIS.
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Preconstruction planning – waste disposal plan (CPRA BMPs Section 2.III.A)	▪ Wetland resources and WOTUS	NEGLIGIBLE: There are no environmental impacts inherent in developing a plan. Any activities resulting from these planning efforts would be within the scope of the alternatives and environmental impacts considered in the EIS.
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Preconstruction planning – disposal of excavated materials for beneficial use (CPRA BMPs Section 2.III.C)	▪ Wetland resources and WOTUS ▪ HTRW	NEGLIGIBLE: There are no environmental impacts inherent in developing a plan. Any activities resulting from these planning efforts would be within the scope of the alternatives and environmental impacts considered in the EIS.
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Pile Driving Plan (CPRA BMPs Section 3.V.B)	▪ Terrestrial wildlife and habitat ▪ Aquatic resources	NEGLIGIBLE: There are no environmental impacts inherent in developing a plan. Any activities resulting from these planning efforts would be within the scope of the alternatives and environmental impacts considered in the EIS.
Mitigation and Stewardship Plan	Construction activities (CPRA BMPs Section 1.IV.A-D)	▪ Geology and soils	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See discussion of construction impacts in EIS Chapter 4.)

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Avoidance and Minimization Measures – BMPs		▪ Surface water and coastal processes ▪ Land-based transportation	
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Construction – temporary erosion control (CPRA BMPs Section 1.IV.F)	▪ Geology and soils ▪ Terrestrial wildlife and habitat ▪ Land use and land cover ▪ Wetland resources and WOTUS	ADDRESSED IN EIS: This BMP is designed to avoid and minimize adverse impacts on the environment and is integrated into the alternatives considered in the EIS, so its effects have already been addressed within the environmental impact analysis. (See EIS 4.1, 4.5, 4.9, 4.10, 4.20, 4.25.)
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Construction – dust management (CPRA BMPs Section 1.IV.E)	▪ Air quality	ADDRESSED IN EIS: This BMP is designed to avoid and minimize adverse impacts on the environment and is integrated into the alternatives considered in the EIS, so its effects have already been addressed within the environmental impact analysis. (See EIS Sections 4.7.)
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Construction Close-Out (CPRA BMPs Section 1.V.A-B)	▪ Geology and soils ▪ Terrestrial wildlife and habitat ▪ Land use and land cover	YES: See R-4.
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Construction Close-Out: Soil compaction mitigation (CPRA BMPs Section 1.V.C)	▪ Geology and soils ▪ Terrestrial wildlife and habitat ▪ Land use and land cover	YES: See R-4.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Post-Construction Activities and Documentation (CPRA BMPs Section 1.VI.A-B)	▪ Geology and soils ▪ Terrestrial wildlife and habitat ▪ Land use and land cover	NEGLIGIBLE: Environmental impacts from monitoring, maintenance, and documentation would be negligible; any environmental effects from maintenance are addressed in EIS impact analysis. (See EIS Sections 2.8, 4.2, 4.6, 4.9, 4.18.)
Mitigation and Stewardship Plan Avoidance and Minimization Measures – BMPs	Vessel access (pre-construction planning and construction) (CPRA BMPs Section 2.III.D and Section 2.IV.C.ii)	▪ Geology and soils ▪ Surface water and coastal processes ▪ Wetland resources and WOTUS ▪ Aquatics ▪ Navigation	NEGLIGIBLE AND ADDRESSED IN EIS: Environmental impacts from inspection activities would be negligible; any environmental effects are addressed in EIS impact analysis. (See EIS Section 4.2, 4.4, 4.6, 4.10, 4.21.)
Mitigation Measures			
Wetland Mitigation and Stewardship (Section 6.2.1)			
Mitigation and Stewardship Plan – Compensatory wetland mitigation (Section 6.2.1)	Beneficial use placement and upland reuse (e.g. filling existing borrow pits) of excess soils and sediments	▪ Aquatic resources ▪ Geology and soils ▪ Terrestrial wildlife and habitat ▪ Land use and land cover ▪ Wetland resources and WOTUS ▪ HTRW	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2, 4.4, 4.6, 4.9, 4.10, 4.23, and 4.27.)
Navigation Mitigation and Stewardship (Section 6.3.1)			
Mitigation and Stewardship Plan Navigation	Adjust operations to reduce aggradation in Barataria waterway if needed	▪ Wetland resources and WOTUS ▪ Aquatic resources ▪ Aesthetics and visual resources ▪ Navigation	ADDRESSED IN EIS: Environmental effects within the scope of operations considered in the EIS (from No Action to max capacity of 150kcfs). (See EIS Sections 4.2 and 4.21.)

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation and Stewardship Plan Navigation	Conduct maintenance dredging of the canal to address aggradation in Barataria waterway, if needed	▪ Wetland resources and WOTUS ▪ Aquatic resources ▪ Aesthetics and visual resources ▪ Navigation ▪ Noise	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2, 4.7, 4.8, 4.12, 4.14, and 4.19 and 4.21.) See also R-4.
Mitigation and Stewardship Plan Navigation	Outfall management to limit the loss of sediments in Barataria waterway as needed	▪ Wetland resources and WOTUS ▪ Aquatic resources ▪ Aesthetics and visual resources ▪ Navigation ▪ Water quality ▪ Sediment quality	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2, 4.21, and 4.27.)
Mitigation and Stewardship Plan Navigation	Operational management to reduce aggradation in Wilkinson Canal as needed	▪ Wetland resources and WOTUS ▪ Aquatic resources ▪ Aesthetics and visual resources ▪ Navigation ▪ Water quality ▪ Sediment quality	ADDRESSED IN EIS: Environmental effects within the scope of operations considered in the EIS (from No Action to max capacity of 150kcfs).
Mitigation and Stewardship Plan Navigation	Maintenance dredging to address aggradation in Wilkinson Canal as needed	▪ Wetland resources and WOTUS ▪ Aquatic resources ▪ Aesthetics and visual resources ▪ Navigation ▪ Water quality ▪ Sediment quality	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.7, 4.8, 4.12, 4.13, 4.14, and 4.19.)
Mitigation and Stewardship Plan Navigation, Also Fisheries, and Recreation	Provide alternative boat access to Myrtle Grove and Woodpark communities	▪ Wetland resources and WOTUS ▪ Navigation ▪ Recreation and tourism ▪ Commercial fisheries ▪ Environmental justice	TO BE DETERMINED: Details regarding the location and scale of alternative boat access are not known at this time. Environmental analysis of the effects of alternative boat access may be tiered as appropriate, or the activity may be covered by other NEPA analyses.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation and Stewardship Plan Navigation	Coordinate the location of Mississippi River Aids to Navigation (ATONS) associated with the MBSD structure with the USCG	▪ Navigation	NEGLIGIBLE AND ADDRESSED IN EIS: Coordination with USGC would have no environmental impacts. ATONS placed following consultation would be subject to an existing USGC categorical exclusion.
Mitigation and Stewardship Plan Navigation	Notify the USCG via a Navigation Bulletin when the structure is started or stopped	▪ Navigation	NEGLIGIBLE: There would be no environmental impacts from providing this notification. The potential effects of Project construction on navigation in the Mississippi River are analyzed in the EIS (see Section 4.21)
Mitigation and Stewardship Plan Navigation	Monitor for boats, fisherman, and swimmers and provide alerts before raising/lowering the diversion gates	▪ Navigation ▪ Recreation and tourism ▪ Commercial fisheries	NEGLIGIBLE: There would negligible environmental impacts from these monitoring and alert activities. The alert could include intermittent, temporary horns, slights and/or audio messages near the diversion intake channel.
Storm Hazard, Flooding Mitigation and Stewardship (Section 6.3.2)			
Mitigation and Stewardship Plan Tidal flooding	Monitor and adaptively manage operations to address tidal flooding impacts	▪ Socioeconomic impacts ▪ Environmental justice ▪ Public health and safety	NEGLIGIBLE AND ADDRESSED IN EIS: Environmental impacts of monitoring activities are negligible. The potential effects of operational modifications under adaptive management are covered within the range of impacts analyzed in the EIS.
Mitigation Plan Tidal Flooding	Property rights acquisition (e.g., project servitude or fee acquisitions) of properties projected to be impacted by Project operations)	▪ Socioeconomic impacts ▪ Environmental justice ▪ Public health and safety	ADDRESSED IN EIS: Potential for acquisition of property rights to enable Project construction and operation is addressed in the EIS. (See EIS Section 2.8.) The acquisition of property or compensation of landowners for unavoidable tidal flooding impacts is an administrative action that has no inherent environmental impacts. The environmental effects of any subsequent actions, such as the demolition and removal of structures and/or utilities from acquired properties, would be addressed at that time. See Appendix R-4.
Mitigation and Stewardship Plan	Structural mitigation and infrastructure improvements (e.g., providing funding to property owners to elevate homes and	▪ Socioeconomic impacts ▪ Environmental justice ▪ Public health and safety	YES: The potential environmental impacts of these activities will be evaluated prior to implementation as part of any required permitting analysis. See Appendix R-4.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Tidal flooding	other structures (e.g., docks and boathouses) on private property; improving bulkheads; elevating public roadways; upgrading septic or sewerage treatment systems; and water control structures) to offset additional inundation due to Project operations		
Mitigation and Stewardship Plan Storm hazard and flooding	Interim risk reduction measures designed and built to provide the same level of risk reduction currently provided by the NOV-NFL and MR&T levee systems	▪ Socioeconomic impacts ▪ Environmental justice ▪ Public health and safety	ADDRESSED IN EIS: Environmental effects of interim risk reduction measures are addressed in the EIS. (See EIS Section 4.20.)
Fisheries Mitigation and Stewardship (Section 6.3.3)			
Mitigation and Stewardship Plan Potential impacts to oysters/oyster fishery	Establish new public seed grounds in Lower Barataria Basin (relocation of native cultch materials within areas or the provision of new cultch material to establish the oyster beds)	▪ Aquatic resources ▪ Commercial fisheries ▪ Socioeconomic ▪ Recreation and tourism	YES: See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to oysters/oyster fishery	Enhancement of public and private oyster grounds through the provision of cultch material (cultch or spat/shell)	▪ Aquatic resources ▪ Commercial fisheries ▪ Socioeconomic ▪ Recreation and tourism	YES: See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to oysters/oyster fishery	Create or enhance broodstock reefs to provide larval supply, as needed	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries ▪ Recreation and tourism	YES: See Appendix R-4.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation and Stewardship Plan Potential impacts to oysters/oyster fishery	Alternative Oyster Aquaculture (AOC), including: ▪ Introduction and Training ▪ Startup Assistance ▪ Hatchery Establishment ▪ Designated Use Areas	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries ▪ Recreation and tourism	YES: See Appendix R-4. NEGLIGIBLE: Environmental impacts from training activities would be negligible. Activities that are educational, informational, or advisory in nature, including training exercises and simulations, have no inherent environmental effects. Workforce and business training may lead to changes in fisheries engagement, but any resulting environmental effects would be addressed through existing fishery management and related regulatory mechanisms.
Mitigation and Stewardship Plan Potential impacts to oysters/oyster fishery	Marketing to support the oyster industry	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries ▪ Recreation and tourism	NEGLIGIBLE: Environmental impacts from marketing activities would be negligible. Activities like commercial marketing support have no inherent environmental effects. Targeted marketing efforts may support transition to new fisheries and changes in fishery engagement, but any resulting environmental effects would be addressed through existing management and related regulatory mechanisms. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Marketing to support the finfish industry (and transition to other species if abundance patterns change)	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries ▪ Recreation and tourism	NEGLIGIBLE: Environmental impacts from marketing activities would be negligible. Activities like commercial marketing support have no inherent environmental effects. Targeted marketing efforts may support transition to new fisheries and changes in fishery engagement, but any resulting environmental effects would be addressed through existing management and related regulatory mechanisms. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Marketing to support blue crab fishers	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries ▪ Recreation and tourism	NEGLIGIBLE: Environmental impacts from marketing activities would be negligible. Activities like commercial marketing support have no inherent environmental effects. Improved marketing may lead to increased fishery engagement, but any resulting environmental effects would be addressed through existing fishery management and related regulatory mechanisms. See Appendix R-4.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Gear funding to support crab fishers	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries	NEGLIGIBLE: No additional environmental analysis needed for grant program. Environmental impacts from grant program would be negligible. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Grant program to equip shrimp fishing vessels with refrigeration	▪ Socioeconomic ▪ Commercial fisheries ▪ Aquatic resources ▪ Water quality (possibility of refrigerant leakage) ▪ Air quality (extended vessel trip length)	NEGLIGIBLE: No additional environmental analysis needed for grant program. Environmental impacts from grant program would be negligible. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Marketing to support the Louisiana shrimp industry	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries ▪ Recreation and tourism	NEGLIGIBLE: Environmental impacts from marketing activities would be negligible. Activities like commercial marketing support have no inherent environmental effects. Improved marketing may lead to increased fishery engagement, but any resulting environmental effects would be addressed through existing fishery management and related regulatory mechanisms. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Assistance with federal considerations (assistance with review of Federal Shrimp Permit Moratorium)	▪ Socioeconomic ▪ Aquatic resources ▪ Commercial fisheries	NEGLIGIBLE: Assistance in engaging NOAA regarding Federal Shrimp Permit Moratorium would have no inherent environmental effects. To the extent NOAA implements changes to the Moratorium, NOAA will undertake environmental review as appropriate. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Workforce and business training for commercial fishers	▪ Socioeconomics ▪ Aquatic resources ▪ Commercial fisheries	NEGLIGIBLE: Environmental impacts from training activities would be negligible. Activities that are educational, informational, or advisory in nature, including training exercises and simulations, have no inherent environmental effects. Workforce and business training may lead to changes in fisheries engagement, but any resulting environmental effects

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
			would be addressed through existing fishery management and related regulatory mechanisms. See Appendix R-4.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Project Operational Considerations	▪ Socioeconomics ▪ Aquatic resources ▪ Commercial fisheries	NEGLIGIBLE: Monitoring and consultation with experts and fishers would have no appreciable environmental impacts. TO BE DETERMINED: Operational modifications that may be made in the future are unknown. To the extent operational changes are identified through this monitoring and consultation, such modifications may fall within the range of alternatives and environmental effects considered in the EIS. To the extent that modifications are outside the scope of the range of alternatives considered, these activities will be evaluated prior to implementation.
Mitigation and Stewardship Plan Potential impacts to commercial fishery	Enhanced resource sampling	▪ Socioeconomics ▪ Aquatic resources ▪ Commercial fisheries	NEGLIGIBLE: Environmental impacts from monitoring activities, including enhanced resource sampling, are expected to be negligible. See MAM Section below and Appendix R-4.
Environmental Justice Mitigation and Stewardship (Section 6.3.8)			
Mitigation and Stewardship Plan Measures to minimize and offset impacts to communities with environmental justice concerns	Engage with the community of Ironton during Project construction, including identifying a community liaison to receive and respond to concerns from Ironton community members regarding Project construction impacts, and develop and implement a Community Communications Plan	▪ Environmental justice	NEGLIGIBLE: Environmental impacts from community liaison and community communications/outreach activities would be negligible.
Mitigation and Stewardship Plan	Improved public access for recreational and subsistence fishing	▪ Recreation and tourism ▪ Commercial fisheries	YES: See Appendix R-4.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Measures to minimize and offset impacts to communities with environmental justice concerns; Also commercial and recreational fisheries		▪ Environmental justice	
Mitigation and Stewardship Plan Measures to minimize and offset impacts to communities with environmental justice concerns	Reserve a portion of each of the following mitigation and stewardship programs for individuals from identified environmental justice communities: startup grants, workforce training, shrimping vessel, and gear improvement grants, enhancing public and private oyster seed grounds, Alternative Oyster Culture, and overall fisheries workforce and business training	▪ Commercial fisheries ▪ Environmental justice	See Environmental Review identified above for each of the fisheries mitigation programs identified here (e.g., workforce and business training, marketing, gear improvements, etc.).
Mitigation and Stewardship Plan Measures to minimize and offset impacts to communities with environmental justice concerns	CPRA will engage an outreach coordinator to develop targeted outreach to communities with environmental justice concerns and to work with property owners and residents from those communities to provide information and facilitate participation in the mitigation and stewardship measures proposed to offset additional inundation due to Project operations	▪ Socioeconomics ▪ Environmental Justice ▪ Public Health and Safety	NEGLIGIBLE: Environmental impacts from direct outreach activities would be negligible.
Mitigation and Stewardship Plan	Implementation of special measures in Grand Bayou, including: • Resilient gardens	▪ Socioeconomics ▪ Environmental Justice ▪ Public Health and Safety	YES: additional environmental review, including any required consultations (e.g., ESA, EFH and NHPA Section 106) would be

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Measures to minimize and offset impacts to communities with environmental justice concerns	• Elevated community connecting walkways • Grand Bayou Canal backfilling and ridge restoration project		conducted a part of subsequent permitting and authorizations for each of these structural measures if required. See Appendix R-4.
NHPA Section 106 Mitigation and Stewardship (Section 6.3.9)			
Mitigation and Stewardship Plan NHPA Section 106	The NHPA 106 Programmatic Agreement includes an alternative mitigation plan that includes three basic products: • Peer-reviewed scholarly publication of an ethnohistoric overview regarding Tribes in the Barataria Basin and larger Mississippi River Delta region • Compilation of information intended to be available only to Tribes that may more specifically elucidate their Tribal history and become useful in future consultations • Public-facing components that may include a website or other accessible materials providing greater information to the public-at-large	▪ Cultural resources	NEGLIGIBLE: Compilation of information, publication of peer-reviewed scholarly ethnohistoric overview, and public-facing components such as a website have no inherent environmental effects.
ESA Protection Measures, Reasonable and Prudent Measures, and Terms and Conditions (Section 6.3.4)			

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
ESA	Development of sea turtle protection measures	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE AND ADDRESSED IN EIS: Protection plan development and implementation will reduce potential impacts to sea turtles and was analyzed in the EIS.
ESA	FWS RPM 1: Gate operation that would significantly increase or decrease the velocity through the structure should be implemented over several hours to allow fish sufficient time to migrate back to the river or swim away from the structure, and corresponding Terms and Conditions	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: No adverse impacts to the environment are expected as a result of ensuring that gate operation changes are implemented over several hours. Further, full opening and closure of the gates is anticipated to take several hours under planned Project operations, so this impact has been addressed within the impact analysis in the EIS.
ESA	FWS RPM 2: The CPRA and the USACE will coordinate with the Service to develop a Fish Monitoring and Removal Plan for pallid sturgeon. This plan will need to be completed and Service approved prior to the construction of the cofferdam; and corresponding Terms and Conditions	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: There are no environmental impacts inherent in developing a plan. Any activities resulting from these planning efforts may trigger supplemental environmental review; details regarding the outcome of such planning are not known at this time. Supplemental environmental review will be tiered as appropriate, or the activity may be covered by other NEPA analyses.
ESA	FWS RPM 3. Dredging (cutterhead/suction) in the Mississippi River would be conducted using dredge operational parameters coordinated with the Service; and corresponding Terms and Conditions	▪ Aquatic resources ▪ T&E species	YES: See Appendix R-4 for additional analysis for environmental impacts of dredging. Using the suggested operational parameters when dredging is conducted is not expected to have adverse environmental impacts.
ESA	FWS RPM 4: Ensure that the terms and conditions are accomplished and completed as detailed in the incidental take statement including the completion of reporting requirements; and corresponding Terms and Conditions	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: Only negligible adverse environmental impacts would be expected from responding to dead, injured, or sick individual of an endangered or threatened species. Similarly, there are no environmental impacts inherent in preparing the required report.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
ESA	FWS M&R 1- Monitoring of the diversion structure for the entrainment of pallid sturgeon should be conducted, once the diversion is in operation	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: Environmental impacts of monitoring activities are negligible.
ESA	FWS M&R 2- Prepare and submit monitoring report	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: There are no environmental impacts inherent in preparing the required report.
ESA	NOAA RPM 1: Monitoring Brown Shrimp Fishing Effort in the Action Area; and corresponding Terms and Conditions.	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: Environmental impacts of monitoring activities are negligible, and there are no impacts involved in preparing the required report.
ESA	NOAA RPM 2: Monitoring Salinity Conditions in the Lower Barataria Basin; and corresponding Terms and Conditions.	▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: Environmental impacts of monitoring activities are negligible.
ESA	NOAA RPM 3: Monitor Sea Turtle Habitat Use and Abundance in the Action Area; and corresponding Terms and Conditions.	▪ Aquatic resources ▪ T&E species	TO BE DETERMINED: When details of the Sea Turtle monitoring are finalized, proposed monitoring activities will be reviewed to determine if existing environmental review adequately has addressed activities (e.g., programmatic assessment of monitoring activities, etc.) or if additional environmental review is required.
Marine Mammals Mitigation and Stewardship (Bottlenose Dolphins) (Section 6.3.6)			
Bottlenose Dolphins	Bottlenose Dolphin mitigation including: ▪ Operational minimization measures as indicated by the MAM Plan ▪ Statewide stranding program funding ▪ Human interaction /anthropogenic stressor reduction ▪ Intervention Plan Contingency funding for Excess Strandings, Unusual	▪ Marine mammals	TO BE DETERMINED: Environmental impacts would be addressed through other NOAA review requirements, and/or will be consistent with measures covered under the NOAA (2009) *Final Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program*.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
	Mortality Events or Episodic Mortality Events		
Fish and Wildlife Coordination Act Conditions[1]			
FWCAR Recommendations	Within 5 years of the commencement of Project operations, CPRA or the LA TIG will provide $10,000,000 of additional funding for wetland preservation and restoration work in the Delta NWR and the PAL WMA to offset modeled acres of indirect wetland losses in those areas. This is in lieu of implementing FWCAR recommendation of construction of crevasse projects that may include terracing to offset the indirect loss of 926 acres on the Delta NWR and 37 acres on the Pass-A-Loutre (PAL) (Recommendation 1)	▪ Geology and soils ▪ Terrestrial wildlife and habitat ▪ Public lands ▪ Wetland resources and WOTUS	YES: The potential environmental impacts of these activities will be evaluated prior to implementation as part of any permitting analysis.
FWCAR Recommendations	Develop and maintain a basin-wide operations and basin monitoring data repository (Recommendation 3)	▪ Wetland resources and WOTUS ▪ Water quality	NEGLIGIBLE: Environmental impacts of creating and maintaining a data depository would be negligible.
FWCAR Recommendations	Pre- and post-construction sampling of fish and shellfish from the outfall area and the Mississippi River (Recommendation 4)	▪ Sediment and water quality ▪ Aquatic resources ▪ Terrestrial wildlife and habitat	NEGLIGIBLE: Environmental impacts of fish and shellfish sampling are expected to be negligible. For example, similar types of sampling to support monitoring have been deemed by NOAA to have direct, short-term, minor adverse impacts to living coastal and marine resources but

[1] FWCAR Recommendation 2 is included in the EFH measures. FWCAR Recommendations 5, 6, 7, 8 and 9 are all included in the MAM Plan. The portion of Recommendation 7 recommending beneficial reuse of dredged material is covered by the measure under Wetland Mitigation on beneficial use placement of excess soils and sediments. FWCAR Recommendations 10, 12 and 14 are included in the ESA measures. FWCAR Recommendations 11 and 13 are included in the BMPs.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
			also indirect, long-term, major beneficial impacts on such resources (NOAA, 2015).[2]
Essential Fish Habitat Conservation Recommendations (Section 6.3.7)			
Mitigation Plan and Stewardship Plan Essential Fish Habitat Conservation Recommendations	EFH Conservation Recommendations include: ▪ Develop Monitoring and Adaptive Management Plan ▪ Continue investment in ecosystem (e.g., EwE and CASM) and individual species models (e.g., HSI) development and refinement	▪ Essential Fish Habitat ▪ Aquatic Resources	See MAM section below for discussion of individual MAM elements and environmental review. NEGLIGIBLE: Continued investment and development of ecosystem and individual species models will not result in impacts to the resources not already analyzed and will further our understanding of the relationships between species and the habitats they rely on.
Monitoring and Adaptive Management (MAM)			
MAM Plan	Baseline (pre-construction) and Operations (post-construction) monitoring	▪ Addressed below by monitoring plan element	NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible. Affected resource categories by monitoring objective presented below.
MAM Plan – Objective #1	Freshwater and estuarine monitoring, including: ▪ Mississippi River discharge monitoring ▪ Mississippi River suspended sediment monitoring ▪ Mississippi River nutrient monitoring ▪ Alliance South sand bar bathymetry and sedimentology monitoring	▪ Wetland resources and WOTUS ▪ Water quality ▪ Sediment quality ▪ Aquatic resources ▪ T&E species	NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible. Discharge rates and sediment concentrations, and bathymetry and topography monitoring activities are generally conducted using remote gages and sensing equipment, satellite imagery, and/or in the course of ongoing sampling activities having minimal effects on the environment (e.g. vessel mounted depth sounders). Bathymetry monitoring may also involve the use of vessel mounted depth sounders. These types of activities have no or negligible effects on the environment.

[2] https://www.fisheries.noaa.gov/resource/document/restoration-center-programmatic-environmental-impact-statement

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
	▪ River bathymetry monitoring at around the Project inlet structure ▪ Topography/bathymetry monitoring at the Project delta development area ▪ Bathymetric monitoring of canals in the Project influence area		
MAM Plan – Objective #1	Freshwater and estuarine monitoring, including: ▪ Water volume conveyed into Barataria Basin ▪ Sediment concentrations conveyed in Barataria Basin inflows ▪ Mississippi River sediment load ▪ Nutrient loads conveyed in Barataria Basin inflows	▪ Wetland resources and WOTUS ▪ Water quality ▪ Sediment quality ▪ Aquatic resources ▪ Marine mammals ▪ T&E species	NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible. Discharge rates and sediment concentrations, flow velocity, and bathymetry and topography monitoring activities are generally conducted using remote gages and sensing equipment, satellite imagery, and/or in the course of ongoing sampling activities having minimal effects on the environment (e.g. vessel mounted depth sounders). Bathymetry monitoring may also involve the use of vessel mounted depth sounders. These types of activities have no or negligible effects on the environment.
MAM Plan – Objective #2	Deltaic processes monitoring between the Mississippi River and the Barataria Basin, including: ▪ Water velocities ▪ Frequency, depth, and duration of inundation ▪ Soil bulk density ▪ Soil organic matter content ▪ Soil mineral matter grain size ▪ Soil total nutrients ▪ Rate of accretion above feldspar marker horizons ▪ Soil strength ▪ Rate of marsh surface elevation change in the Project Influence Area	▪ Geology and soils ▪ Terrestrial and wildlife and habitat ▪ Land use and land cover ▪ Aquatic resources ▪ Wetland resources and WOTUS	NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible. Discharge rates, flow velocity, and bathymetry and topography monitoring activities are generally conducted using remote gages and sensing equipment, satellite imagery, and/or in the course of ongoing sampling activities having minimal effects on the environment (e.g. vessel mounted depth sounders). Soil density and composition sampling would involve the collection of field samples using hand equipment. Soil and water sample collection would have negligible effects on species and habitats in the project area.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
	▪ Sediment dispersal and retention on the emergent marsh surface ▪ Soil organic and mineral matter density		
MAM Plan – Objective #3	Land and water extent / Area of new delta formation in the Project Influence Area monitoring, including: ▪ Emergent wetland area ▪ Vegetation Cover, Abundance, and Height ▪ Submerged aquatic vegetation area ▪ Emergent and submerged vegetation community composition ▪ Emergent vegetation biomass in the Project area ▪ Dissolved oxygen, salinity, and chlorophyll a ▪ Phytoplankton Species Composition ▪ Harmful Cyanobacterial/Algal Bloom Toxins ▪ Nutrient constituents in Barataria Surface Waters ▪ Temperature of Barataria Surface Waters ▪ Total suspended solids and turbidity in Barataria Surface Waters ▪ Lower trophic level organisms ▪ Aquatic invasive (algae and invertebrate) species ▪ Nekton (fish and shellfish) species abundance and community composition	▪ Wetland resources and WOTUS ▪ Surface water and coastal processes ▪ Aquatic resources ▪ Marine mammals ▪ T&E species (direct and indirect) ▪ Navigation ▪ Commercial fisheries ▪ Geology and soils	NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible. Vegetation coverage would typically be monitored using a combination of satellite imagery, other remote sensing, and field survey methods. Water quality data may be collected using a combination of remote sensing (chlorophyl a) methods as described above, and field sampling activities. Water sample collection would have insignificant effects on species and habitats in the project area. Fish and wildlife surveys would typically involve both passive (e.g. direct observation, wildlife cameras) and active measures (e.g. traps and nets used for fish sampling). Monitoring plans would include BMPs to avoid unintended impacts on protected species and habitats. Therefore, while some individual organisms may be adversely affected by these measures, these effects would be negligible relative to baseline natural mortality and therefore negligible at population scales. Monitoring of bottle nose dolphins may include enhanced stranding response, drone- or boat-based survey, Capture-Mark-Recapture (CMR) surveys, tagging, biopsies, prey collection and analysis. Impact analysis requirements will depend on the nature of mitigation activity. Assessments/analysis likely covered by other NOAA review, and/or will be consistent with measures covered under the NOAA (2009) Final Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program.

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
	▪ Eastern Oysters (Crassostrea virginica) sampling/monitoring ▪ Wildlife presence/abundance (annual surveys) ▪ Aquatic and terrestrial species use of created/restored habitat ▪ Compliance monitoring		
MAM Plan – Compliance Monitoring	National Historic Preservation Act		NEGLIGIBLE: Cultural resources information would typically be collected through visual inspection or photography, and would have a negligible effect on the environment.
MAM Plan – Compliance Monitoring	Sea Turtles		NEGLIGIBLE: Sea turtles compliance monitoring will be conducted through level of fishing activity based on brown shrimp fishing trip tickets, salinity monitoring, field work including trawl vessel surveys, satellite tag deployment, health assessment. Monitoring the number of brown shrimp fishing trips in the project area is not expected to have any adverse environmental impacts. Monitoring salinity in the project area is not expected to have any adverse environmental impacts.
MAM Plan – Compliance Monitoring	Pallid Sturgeon		MAM Plan – Compliance Monitoring
MAM Plan – Compliance Monitoring	Bald Eagle Nests and Wading Birds		TO BE DETERMINED: Monitoring of bald eagle nests and wading bird colonies will be developed as part of a future monitoring plan. Similar types of monitoring have been deemed by NOAA to have direct, short-term, minor adverse impacts to living coastal and marine resources but also indirect, long-term, major beneficial impacts on such resources (NOAA, 2015). Identifying nesting birds to avoid adverse impacts during construction would be expected to have benefits impacts.
MAM Plan – Reporting	DIVER Restoration Portal Reporting	Not applicable	NEGLIGIBLE: Environmental impacts from planning and reporting activities would be negligible. Consistent with 33 C.F.R. 230.9(d), routine

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
MAM Plan – Reporting	Mid-Basin Sediment Diversion Project Annual Operations Plans		administrative actions such as program planning, preparation of operational plans and reports, and compliance reporting have no significant environmental effects.
MAM Plan – Reporting	Annual Operations Performance Reports		
MAM Plan – Reporting	Annual Operations, Maintenance & Monitoring Reports		
MAM Plan – Reporting	Multi-Year Monitoring and Adaptive Management Reports		
MAM Plan – Reporting	Compliance Reporting		
MAM Plan – Adaptive management for bathymetries of canals in the project influence area	▪ Conduct maintenance dredging of the canals to address impacts from the Project Implement outfall management measures to limit the loss of sediments to the canals ▪ Implement outfall management measures to increase the deposition of sediments in shallow open water and onto the surface of intertidal wetlands	▪ Wetland resources and WOTUS ▪ Aquatic resources ▪ Surface water and sediment quality ▪ Recreation and tourism ▪ Aesthetics and visual resources ▪ T&E Species ▪ Aquatic resources ▪ Marine mammals ▪ Terrestrial wildlife and habitat ▪ Socioeconomics ▪ Commercial fisheries ▪ Land use and land cover ▪ Recreation and tourism ▪ Public lands ▪ Navigation	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. Impacts within the scope of operations considered in the EIS across all relevant resource categories (from No Action to max capacity of 150kcfs).
MAM Plan – Adaptive management for Mississippi River water discharge; bathymetry of the Alliance South sand bar; etc.	Adjust the extent that the Project structure is opened between operational and base flows to maintain proposed operational and base flow discharges.		

Plan Element/Source	Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
MAM Plan – Adaptive management for sediment: water in the flows conveyed into Barataria Basin	Adjust timing of Project operational flows in relation to river discharge and suspended sediment concentration.		
MAM Plan – Adaptive Management for marsh, emergent wetlands, submerged and emergent vegetation	Outfall management actions	▪ T&E Species ▪ Aquatic resources ▪ WOTUS and wetland resources	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. Impacts within the scope of operations considered in the EIS across all relevant resource categories.
MAM Plan – Adaptive management for water quality	Outfall and operational adaptive management actions	▪ T&E Species ▪ Aquatic resources ▪ WOTUS and wetland resources ▪ Recreation & tourism	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. Impacts within the scope of operations considered in the EIS across all relevant resource categories.
MAM Plan - Adaptive management for eastern oysters, aquatic resource and terrestrial wildlife, etc.	Potential adaptive management actions for erosion in project influence area, increased inundation, absence of sediment dispersal, loss of wetlands, shifts in vegetation, increased algal blooms: Outfall management actions such as PDDA dredging or spoil bank gapping	▪ T&E Species ▪ Aquatic resources ▪ Recreation & tourism ▪ Navigation ▪ WOTUS and wetland resources	TO BE DETERMINED: Details of such actions are not currently available and will depend on the outcome of monitoring of project operations. If such activities are subsequently proposed, the potential environmental impacts will be evaluated prior to implementation as part of any permitting analysis (e.g. NWP 27: Aquatic restoration, enhancement, and establishment activities).
MAM Plan – Adaptive management for bottlenose dolphins	Enhanced stranding response, assessments, and analyses, mitigation	▪ T&E species ▪ Marine mammals	TO BE DETERMINED: Impact analysis requirements will depend on the nature of mitigation activity. Assessments/analysis likely covered by other NOAA review, and/or will be consistent with measures covered under the NOAA (2009) *Final Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program*.
MAM Plan – Adaptive management for bottlenose dolphins	Increase vessel and UAS based visual assessment along with a vessel based Photo ID survey following CMR track lines in the specific dolphin habitat	▪ Marine mammals	

Citation:
2015. NOAA. Final Programmatic Environmental Impact Statement for habitat restoration activities implemented throughout the coastal United States. NOAA Restoration Center. Available: https://www.fisheries.noaa.gov/resource/document/restoration-center-programmatic-environmental-impact-statement

R4: Mitigation Measures Environmental Analysis

APPENDIX R-4. MITIGATION AND STEWARDSHIP MEASURES: ENVIRONMENTAL ANALYSIS

1.0 Purpose

This document provides environmental review of mitigation and stewardship measures included in the Final Mitigation and Stewardship Plan (Mitigation Plan) and the Monitoring and Adaptive Management Plan (MAM Plan) for the Mid-Barataria Sediment Diversion (MBSD) Project (the Project), including best management practices (BMPs) used for Project construction and operation. Some of these measures may result in environmental impacts beyond those considered in the Environmental Impact Statement (EIS) and therefore may require additional environmental review to comply with the National Environmental Policy Act (NEPA). This environmental review considers the likelihood and significance of potential environmental impacts resulting from each measure, the extent to which these effects are or are not considered in the MBSD EIS, and, where applicable, summarizes any non-negligible environmental impacts that could potentially occur as a result of the implementation of each measure. Future analyses are outlined for instances where sufficient specificity of information (e.g., specific details about the measure and therefore its potential environmental effects) is currently lacking to complete the analysis at this time.

2.0 Analysis Summary

The mitigation and stewardship measures set forth in the Mitigation Plan, the MAM Plan, the Endangered Species Act (ESA) reasonable and prudent measures and terms and conditions, the Essential Fish Habitat (EFH) recommendations, and the Fish and Wildlife Coordination Act (FWCA) recommendations are summarized in Appendix R-3. The Table in Appendix R-3 identifies the relevant measure, the environmental resource categories potentially affected by the measure, and the environmental review requirement for each measure. The associated environmental review requirements fall into four categories (Appendix R-3):

- NO ENVIRONMENTAL IMPACT OR NEGLIGIBLE ENVIRONMENTAL IMPACT: Measures that have no environmental impacts or negligible environmental impacts and therefore do not require additional review.
- ADDRESSED IN EIS: Measures that fall within range of environmental impacts are fully considered in the EIS and therefore do not require additional review.
- ANALYSIS PROVIDED: Measures with definable environmental impacts addressed by the supplemental analysis provided in this document.
- ADDITIONAL ANALYSIS MAY BE REQUIRED IN THE FUTURE: Some measures include components that cannot be fully analyzed because the scope, scale, and/or location of the actions are not fully known at this time. For these measures, preliminary analyses are presented in this document and, if required, future environmental analyses will be conducted once relevant details become available.

The categories of measures in Appendix R-3 include:

- Pre-construction, construction and operational BMPs,
- Mitigation and stewardship measures for impacts to wetlands,

- Mitigation and stewardship measures for unavoidable impacts to navigation in the Mississippi River and Barataria Basin,
- Mitigation and stewardship measures for unavoidable impacts on oysters and commercial oyster fisheries,
- Mitigation and stewardship measures for unavoidable impacts on commercial brown shrimp, blue crab, and finfish fisheries,
- Mitigation and stewardship measures for unavoidable tidal flooding impacts,
- Mitigation and stewardship measures to address disproportionately high and adverse impacts on some communities with environmental justice concerns resulting from the identified unavoidable impacts to oyster and shrimp fisheries and tidal flooding impacts,
- Mitigation and stewardship measures for unavoidable impacts on bottlenose dolphins,
- Mitigation measures for unavoidable impacts to cultural resources (NHPA Section 106 consultation),
- A range of environmental monitoring and reporting activities to track project performance and inform adaptive management,
- Adaptive management measures to address specific environmental impacts should they occur,
- Reasonable and prudent measures and terms and conditions to minimize the impact of take of threatened and endangered species,
- EFH recommendations, and
- Fish and wildlife resource conservation recommendations.

The environmental effects of mitigation and stewardship measures for unavoidable impacts on the following resources are addressed below in Section 3 through Section 8, respectively: oysters and oyster fisheries; commercial brown shrimp, blue crab and finfish fisheries; environmental justice communities; tidal flooding; navigation; aquatic species; and bottlenose dolphins.

The remaining measures in Appendix R-3 are either monitoring and reporting activities that do not require additional analysis because their environmental effects are negligible, or are other types of measures that cannot be evaluated here because the scope, scale, and/or location of the underlying activities are undefined at this time.

BMPs used in the construction and operation of the Project do not require additional environmental analysis. These measures are specifically designed to avoid and minimize adverse impacts on the environment and these measures are integral components of the alternatives considered in the EIS, so their effects have already been addressed within the environmental impact analysis. The associated actions and supporting rationale for these measures are addressed in Section 9.2.

3.0 Mitigation and Stewardship Measures for Unavoidable Impacts on Oysters and Oyster Fisheries

Oyster mitigation and stewardship measures are included in the Project because eastern oysters (*Crassostrea virginica*) and the oyster fishery in the Project Area are projected to decline under both the No Action Alternative (NAA) and the Applicant Proposed Alternative (APA). Current oyster grounds are expected to become less productive in the future under the NAA because of projected habitat loss and

changes in estuarine salinity structure due to sea level rise and coastal erosion. The oyster fishery is expected to experience greater adverse effects under the APA than would occur under the NAA, driven by the effect of planned diversion operations on salinity conditions in current growing and harvest areas. Influx of fecal coliform in Mississippi River water could also lead to restrictions on oyster harvest in current oyster areas closer to the diversion outfall (e.g., Little Lake Public Seed Ground). The resulting effects on the oyster fishery would be major and permanent without additional mitigation. This determination considers anticipated impacts on oyster abundance, the resulting effects on the commercial fishery, and the anticipated response from commercial fishers.

While these potential effects are recognized to affect certain areas currently suitable for oyster growing and harvest, Project-related changes in salinity structure within the lower basin are likely to create suitable conditions for oyster growing and harvest in areas that are currently unsuitable. This presents an opportunity to mitigate for the loss of oyster culture areas elsewhere in the basin. The mitigation and stewardship measures would partially or fully offset losses in oyster resources and existing oyster growing and harvest areas by promoting the rehabilitation of historical oyster growing areas previously lost to coastal erosion and establishment of new growing and harvest areas where suitable conditions are projected to occur under the APA.

3.1 Environmental Review

The oyster mitigation and stewardship measures include programmatic actions that are further explained in the Mitigation Plan and MAM Plan for the Project. See Appendix R. Identified measures include:

- Alternative oyster aquaculture (AOC) includes the initiation or expansion of alternative oyster culture techniques, such as “off-bottom” culture with floating or suspended containers, which allow oysters to grow in new areas and protect them from predation, siltation, potential fecal coliform exposure from river waters, and salinity changes.
    - AOC introduction and training to introduce oyster industry members to the tools, techniques, laws, and other information necessary to conduct AOC.
    - AOC startup assistance via small grants to procure necessary equipment and oyster seed production.
    - Establishment of hatcheries to support AOC establishment and operations.
    - AOC designated use areas to facilitate siting and permitting of AOC on state-water bottoms. These would be focused within the Barataria Basin; however, they may also include some locations in adjacent basins with suitable conditions.
- Marketing to support the oyster industry in cooperation with partners to provide additional market exposure to oyster products.
- Establishment of new public seed grounds in the Lower Barataria Basin, including relocation of native cultch materials or the provision of new cultch material to re-establish oyster beds.
- Provision of cultch material (cultch or spat/shell) in areas suitable under the APA to create or enhance appropriate substrate for larval recruitment and establishment of public or private oyster beds.
- Creation or enhancement of broodstock reefs to provide larval supply, as needed, based on hydrologic data to determine the suitable locations. Where possible, these will be located in

shallow or intertidal areas in areas of appropriate salinity to enhance that resource as well as protect new reefs from predators.

These measures fall into three categories including measures that do not result in or have negligible environmental impacts such as activities that are administrative, educational, or informative in nature; measures that are likely to have definable environmental impacts requiring additional analysis, and; measures that may have environmental impacts but are not sufficiently defined in terms of scope, scale, or location to evaluate their effects at this time. For the later two categories, analyses are presented in this document and existing environmental analyses (e.g., NEPA analysis completed for Restoration Plans) addressing these topics are summarized and incorporated by reference.

3.1.1 No Environmental Impacts or Negligible Environmental Impacts

Four of the measures listed above and identified in Appendix R-3 include measures that do not result in environmental impacts or have negligible environmental impacts, and therefore no additional NEPA analysis is required at this time. These include:

- *Alternative oyster aquaculture introduction and training:* Activities that are educational, informational, or advisory to other agencies, public and private entities, visitors, individuals, or the general public, including training exercises and simulations, result in no environmental impacts. Such actions are consistent with the nature of actions addressed in the PDARP/PEIS Section 6.4.14 and the finding of no environmental impacts.
- *Marketing to support the oyster industry:* These activities will serve to enhance market presence of the affected oyster industry through non-environmental actions. Such actions are consistent with the nature of actions addressed in the PDARP/PEIS Section 6.14.4 and the finding of no environmental impacts.
- *Alternative oyster aquaculture startup assistance via small grants to procure necessary equipment and oyster seed production*: These administrative actions would be implemented consistent with the implementing agency's grant management program including any necessary environmental review. Grants used for procurement of equipment and oyster seed production are not anticipated to have more than negligible environmental impacts.

3.1.2 Analysis Provided; Additional Analysis May be Required in the Future

Oyster mitigation and stewardship measures are described below, and their environmental impacts are addressed in this document. These measures are similar to previously evaluated Louisiana Trustee Implementation Group (LA TIG) oyster restoration actions and, therefore, this document draws upon and incorporates by reference those prior analyses. These measures include:

- *Establishment of hatcheries to support AOC establishment and operations.*
- *Establishment of new public seed grounds in the Lower Barataria Basin, including relocation of native cultch materials or the provision of new cultch material to re-establish oyster beds.*
- *Provision of cultch material in areas suitable under the APA to create or enhance appropriate substrate for larval recruitment and establishment of public or private oyster beds.*
- *Creation or enhancement of broodstock reefs to provide larval supply based on hydrologic data to determine the suitable locations. Where possible, these will be located in shallow or intertidal areas with appropriate salinity to enhance those resources as well as protect new reefs from predators.*

- *Alternative oyster culture designated use areas to facilitate siting and permitting of AOC on state-water bottoms.*

Some, if not all, of the environmental impacts associated with these measures, falls within the range of impacts identified in past analyses (see discussion below). However, the potential environmental impacts of these measures could vary from prior analyses depending on the specific locations chosen and the proposed scale of the identified activities. At the time, specific locations and project scope are identified for implementation of these measures, a review will be undertaken to determine what, if any, additional environmental review is required, and, if so, that review will be completed at that time.

Previously Evaluated LA TIG Restoration Activities for Oyster Resources

The LA TIG Restoration Plan (RP)/Environmental Assessment (EA) #5: Marine Mammals and Oysters included two projects—*Enhancing Oyster Recovery Using Brood Reefs* and *Cultch Plant Oyster Restoration*—that included both planned and programmatic components which are similar to mitigation measures for impacts to oyster resource planned for the MBSD proposed action.

LA TIG RP/EA #5 contains OPA/NEPA evaluation of those projects. That analysis is summarized and incorporated by reference in the subsections below (i.e., physical resources, biological resources, socioeconomic resources) to evaluate the effects of mitigation measures included in the MBSD Project. The anticipated impacts of these measures on physical, biological, and socioeconomic resources are anticipated to be similar to the impacts identified in LA TIG RP/EA #5.

Physical Resources

Brood reef construction, cultch plant projects, and re-establishment of oyster grounds could result in short- or long-term minor adverse impacts on substrate and water quality conditions.

Oyster reef creation could convert limited areas of nearshore habitat from soft to hard substrates, which would constitute an effectively permanent habitat modification. However, most reef sites would be located in areas currently having hard substrates to increase the likelihood of successful implementation. Therefore, permanent habitat modification would likely be limited in extent.

Short-term, minor water quality impacts could occur at restoration sites from suspended sediments released during bed-disturbing activities. Over the long term, brood reef construction could generate beneficial water quality effects. Reef creation would increase oyster abundance and distribution, increasing removal of suspended sediment and nutrients from the water column through filter feeding. Brood reef construction and cultch planting projects may also benefit adjacent floodplains and wetland habitat by dissipating wave energy and accreting sediments, leading to increased wetland formation.

Biological Resources

Brood reef construction, cultch plant projects, and re-establishment of historic oyster grounds could result in short-term, minor adverse impacts on biological resources through temporary releases of suspended sediments, underwater noise, and physical disturbance of the bed and water column during materials placement. In-water construction BMPs would help to avoid and minimize these impacts, meaning that any adverse effects would be localized and short-term in duration. In the long-term, these types of actions would replace a limited area of soft substrates with hard substrates. Substrate conversion effects would be limited by the intentional siting of brood reef construction sites or cultch plant locations in areas that currently have hard substrates; however, small, patchy areas of soft sediment within these locations may be permanently converted to hard bottom. The resulting habitat

conversion would be limited in extent, representing a negligible fraction of available soft-bottomed habitats in the Project Area as a whole.

These types of projects could result in long-term, beneficial impacts on estuarine habitats due to the ecosystem services provided by oyster production. Oyster reef expansion and increased oyster abundance can reduce shoreline erosion, improve water quality, enhance nutrient recycling, and provide productive habitat for commercially and recreationally important fish.

Brood reef construction, cultch plant projects, and re-establishment of historic oyster grounds could result in short-term, minor adverse impacts on some terrestrial wildlife near project areas. Shorebirds, wading birds, and other waterfowl could be temporarily displaced by construction activities. Birds would likely avoid areas affected by construction-related disturbance but could readily reoccupy the affected habitats once construction is complete. This may temporarily disrupt foraging and related behaviors, potentially increasing stress and causing other sublethal effects. However, these effects would be short-term in duration and likely biologically insignificant given the abundance of suitable foraging habitats in proximity to potential reef sites. Once complete, reef and cultch planting projects would likely generate long-term beneficial impacts to terrestrial wildlife such as ducks, by supporting increased prey abundance and foraging habitat.

Brood reef construction, cultch plant projects, and re-establishment of historic oyster grounds could result in similar minor short-term impacts on marine and estuarine fauna within or near Project sites. Potential impacts could include temporary noise, vibration, water quality effects, and visual disturbances resulting from vessel activity and bed and water column disturbance. The biological significance of these effects would vary depending on the organism and the extent and duration of exposure. For example, immobile benthic species within the reef construction footprint could be injured or killed by crushing and burial. These effects would be limited to a small number of individuals and insignificant at the population scale. Mobile species like fish and marine mammals would likely avoid injury and mortality-level effects, but displacement may lead to lost foraging opportunities, stress, or indirect mortality (e.g., through increased predation exposure). In-water construction BMPs would be implemented to avoid and minimize these construction-related effects (DWH Trustees, 2016; Leonard & Macfarlane, 2011).

These types of projects could result in long-term, beneficial impacts on marine and estuarine fauna because the brood reefs would enhance oyster spat production, potentially increasing oyster abundance and recruitment in Louisiana waters. Brood reefs and cultch plant projects could also benefit other reef-associated marine and estuarine species including fish, invertebrates, and other shellfish.

Brood reefs, cultch plant projects, and the re-establishment of historic oyster reefs could result in short-term, minor adverse impacts on Essential Fish Habitat (EFH). Bed disturbance, increased suspended sediment levels, underwater noise, and vessel activity during brood reef construction or cultch plant activities could directly impact EFH species or temporarily displace them from otherwise suitable habitats. The significance of these effects would depend on the type of organism affected. Mobile species would likely avoid the area for the duration of in-water work, avoiding direct injury or mortality. However, displaced individuals may experience decreased foraging opportunities, elevated stress, or indirect mortality (e.g., due to increased predation exposure). Immobile or slow-moving benthic species could be crushed or buried during brood reef construction or cultch plant placement, resulting in direct mortality. Siting mitigation activities in areas where hard bottom currently exists would minimize potential adverse impacts on soft-bottom benthic fauna. Construction-related effects on EFH would be short-term in duration, returning to baseline conditions when construction is complete. Given the

temporary nature and limited extent of construction effects relative to the amount of EFH available in the Project Area, these short-term effects on EFH are likely to be insignificant.

Over the long-term, brood reef, cultch plant projects, and re-establishment of historic oyster grounds could generate beneficial impacts to EFH because they provide productive, structurally complex habitat for EFH species as well as abundant prey and foraging opportunities.

Brood reef construction, cultch plant projects, and re-establishment of historic oyster grounds could result in short-term, minor adverse impacts on protected species. Project sites would be located in the Barataria Basin or other suitable settings; protected species in inshore waters in these parishes include the West Indian manatee, piping plover, red knot, green sea turtle, Kemp's ridley sea turtle, and the loggerhead sea turtle. West Indian manatees and sea turtles are primarily found in calm waters where seagrass is present, and brood reef sites would be selected to avoid seagrass beds. Thus, these species are unlikely to be adversely affected by future projects.

Temporary disturbances to or displacement of other protected species could result from an increase in turbidity, underwater noise, and human activity during brood reef or cultch plant construction and monitoring; however, in-water construction BMPs would be implemented to localize and ameliorate any adverse impacts (DWH Trustees, 2016; Leonard & Macfarlane, 2011). Although less mobile benthic species could be injured or killed during brood reef deployment, the affected protected species are mobile and would likely avoid the area for the duration of in-water work, avoiding direct injury or mortality. Following brood reef placement or cultch plant implementation, turbidity and noise would return to baseline levels. These projects could result in long-term, beneficial impacts for protected species because oyster reefs provide habitat for epibenthic fauna, mobile invertebrates, and fish that may be sources of prey for the protected species in this area, such as sea turtles, as well as numerous other commercially and ecologically important species.

Socioeconomic Resources: Commercial Oyster Fishery

Brood reef construction and cultch plant projects could result in short- or long-term, minor adverse impacts on marine management. Specifically, brood reefs, cultch plant projects, or the re-establishment of historic oyster grounds could be sited in areas currently used by commercial and recreational fishers. This in turn could affect the target species that frequent those areas, and the types of gear suitable for the habitat conditions in those areas. Signage would be installed around the areas to mark their location and alert commercial and recreational fishers to the changed conditions. Over the long term, oyster reefs may generate benefits for commercial and recreational fishers because they provide habitat and foraging opportunities for desirable species, which may increase fishing opportunities for the lifespan of the brood reefs or cultch plant projects.

Brood reef construction, cultch plant projects, and re-establishment of oyster grounds are not anticipated to result in any short-term adverse impacts to fisheries and aquaculture at restoration sites. These actions could result in long-term, beneficial impacts to fisheries and aquaculture. Brood reefs, cultch plant projects, and re-establishment of oyster grounds would be constructed with the goal of increasing oyster spawning stock, connecting existing oyster reefs, and increasing recreational and commercial oyster harvest opportunities as well as also increasing natural productivity in the area by increasing oyster recruitment. This, in turn, could enhance the quality of the area’s reef habitat for associated fish, which could benefit commercial and recreational activities.

4.0 Mitigation Measures for Unavoidable Impacts on Commercial Brown Shrimp, Blue Crab, and Finfish Fisheries

The effects of the MBSD Project on commercially important fish and shrimp are projected to range from beneficial to major and adverse, depending on the species in question. In the case of finfish, the Project is projected to have negligible adverse effects on most commercially important species, and many species are likely to benefit from the improved habitat conditions generated by Project operations over the long term. Certain species, specifically flounder and spotted sea trout, may be adversely affected and experience changes in abundance and distribution within the Project Area. While the long-term impacts on the commercial saltwater finfish industry are anticipated to be small, the state is implementing several measures to mitigate these impacts.

The Project is projected to have a major, adverse permanent impact for the brown shrimp resource and a negligible to minor beneficial permanent impact on the white shrimp resource. These species account for almost all of the commercial shrimp fishing activity in the Project Area. Based on the predicted declines in brown shrimp abundance and uncertainty about the offsetting effects of increased white shrimp productivity, the Project would likely result in a moderate to major permanent adverse impact on the commercial shrimp fishery. A range of measures would be implemented to avoid and mitigate these unavoidable effects.

While the MBSD Project includes a range of measures to avoid and minimize the adverse effect on commercial fisheries resources, some unavoidable effects are nevertheless likely to occur. In response, the mitigation and stewardship measures identified in Appendix R-3 and listed below for commercial finfish and shrimp fisheries are intended to help fishers adapt to shifts in resource availability.

4.1 Environmental Review

The following mitigative and stewardship measures for commercial shrimp, blue crab, and finfish fisheries are further explained in the Mitigation Plan and MAM Plan for the Project. See Appendix R. Identified measures include:

- Marketing to support the Louisiana finfish, blue crab, and shrimp industry
- Grant funding to equip commercial shrimp fishing vessels with refrigeration
- Grant funding to support improvements to crab fishing gear
- Assistance with federal considerations (assistance with review of Federal Shrimp Permit Moratorium)
- Workforce and business training for commercial fishers

These measures all fall into the category of no environmental impacts or negligible environmental impacts as described below.

4.1.1 No Environmental Impacts or Negligible Environmental Impacts

The mitigation measures for unavoidable effects on commercial finfish, blue crab, and shrimp fisheries are all educational and informational in nature, and/or provide grant funding to help commercial fishers adapt to changing fishery and market conditions such as refrigeration and gear improvements and changes. Educational and informational activities generally have no measurable effects on the environment, nor would engaging NOAA in discussions related to the Federal Shrimp Moratorium, and therefore do not require NEPA analysis. Similarly, the implementation and administration of grant

programs to help commercial fishers adapt to changing fishery conditions would not result in measurable environmental impacts, so additional NEPA analysis is not required under established policy and procedure for NEPA compliance (NOAA Administrative Order 216-6A Companion Manual). Fishers that choose to use mitigation funds to substitute gear (e.g., skimmer to trawl) would continue to be managed under existing management plans and regulations. The resulting environmental effects have been or will be evaluated through these existing regulatory and management frameworks and therefore do not require additional analysis in this EIS. To the extent that the Federal Shrimp Permit Moratorium is revised in the future, the environmental impacts of that change would be evaluated at that time as part of the revision process.

5.0 Mitigation Measures for Unavoidable Impacts on Communities with Environmental Justice Concerns

The objective of mitigation measures related to environmental justice is to engage with communities with environmental justice concerns who may be disproportionately impacted by the Project, to reserve mitigation and stewardship program benefits for those communities, and to improve public access for recreational and subsistence fishing.

5.1 Environmental Review

The environmental justice mitigation and stewardship measures include actions that are further explained in the Mitigation Plan and MAM Plan for the Project. See Appendix R-1 and R-2. Identified measures include:

- Engagement with the community of Ironton during Project construction;
- Direct engagement with property owners and residents of communities with environmental justice concerns to provide notice and facilitate participation in Project mitigation measures;
- Improving/raising access roads;
- Improving/replacing septic/sewerage systems;
- Providing Project servitudes;
- Providing funding to enable property owners to elevate their residences or make other improvements to their boat docks and boathouses;
- Voluntary individual buyouts;
- Improved public access for recreational and subsistence fishing;
- Grand Bayou specific measures: including constructing floating gardens, constructing community connecting walkways, Grand Bayou Canal backfilling and ridge restoration; and
- Reservation of a portion of each of the following mitigation and stewardship programs for individuals from identified communities with environmental justice concerns that may be disproportionately impacted by the Project: shrimping vessel, and gear improvement grants, enhancing public and private oyster seed grounds, Alternative Oyster Culture, and overall fisheries workforce and business training.

The number, location, and scale of new public access facilities planned as Project mitigation has not yet been determined; however, many potential environmental impacts of these actions have been previously analyzed.

5.1.1 No Environmental Impacts or Negligible Environmental Impacts

Community engagement activities, such as developing and implementing a targeted outreach plan, holding meetings, email communications, and phone calls, are not expected to result in any adverse impacts on the environment. Nor would the development and implementation of a Community Communications Plan for Ironton. Therefore, these activities do not require NEPA analysis.

Reservation of a portion of mitigation and stewardship programs for individuals from identified communities with environmental justice concerns who may be disproportionately impacted by the Project is not expected to result in any adverse impacts on the environment. The environmental impacts of the underlying mitigation and stewardship programs were considered elsewhere in the EIS and in this Appendix R-4 and were determined to have no environmental impacts or negligible impacts.

With respect to acquisition of property interests, see discussion in Section 6.1.1. below.

5.1.2 Analysis Provided; Additional Analysis May be Required in the Future

With respect to improving/raising access roads and improving/replacing septic and sewerage systems, the potential environmental impacts of these activities will be evaluated prior to implementation as part of any required permitting analysis. Similarly, with respect to mitigation measures that involve providing funding to elevate residences, boat docks, and boathouses, the potential environmental impacts of the implementation of those actions will be evaluated prior to implementation as part of any required permitting analysis.

The LA TIG has previously considered the potential environmental effects of activities intended to increase recreational activities as part of LA TIG RP #4 Nutrient Reduction and Recreational Use. The projects analyzed by the LA TIG in that plan are similar in scope, scale, and intent to the recreation access mitigative measures being considered for the Project. As a result, this document summarizes and incorporates by reference those prior analyses below. At the time the particular locations and other details for these public access facilities are determined, analysis will be undertaken to determine what, if any, additional environmental review is needed and, if so, that review will be completed at that time.

The LA TIG has also considered the potential environmental effects of projects similar to the Grand Bayou Canal backfilling and ridge restoration project (see LA TIG RP #1.2 Spanish Pass Ridge and Marsh Creation Project and Lake Borgne Marsh Creation Project). The potential environmental impacts of the Grand Bayou Canal backfilling and ridge restoriation project will be evaluated prior to implementation as part of any required permitting analysis.

Previously Evaluated LA TIG Restoration Measures for Subsistence and Recreational Access

In general, improving public access for recreational and subsistence fishing are anticipated to include facility construction that would involve clearing and grading of uplands and riparian/shoreline areas in designated and permitted locations. In-water work would include excavation and grading of the shoreline and nearshore bed to prepare the site for hardened boat launch placement and floating dock construction. Ramps may be constructed of interlinked concrete blocks or crushed rock fill. Docks may be constructed of a variety of materials, including treated wood, steel, or concrete piles, floats, and treated wood, steel or composite framing and decking. Typical construction equipment would likely include bulldozers and graders, flatbed and dump trucks, and barge- or truck-mounted pile driving equipment. Equipment would likely be staged within the Project footprint of each site. Operation and maintenance of these facilities may involve periodic vegetation trimming and clearing, resurfacing of

parking lots and access roads, and repair and/or replacement of boat ramps, docks, and related in- and over-water structures.

The development and/or improvement of recreational access facilities has been evaluated in the LA TIG RP/EA #4: Nutrient Reduction and Recreational Use. That EA considered the environmental effects of developing up to five new boat launches and improving or expanding two additional recreational boat launches, including two sites within the MBSD Project Area. This document summarizes and incorporates by reference that prior analysis.

LA TIG RP/EA #4 Sections 3.3 and 4.6 contain OPA/NEPA evaluation of the planned recreational access projects in the Project Area and vicinity, respectively. This document summarizes and incorporates by reference that prior analysis.

Physical Resources

Aspects of this mitigation measure that may affect geology, soils, and substrates include construction of parking lots, roadways, pavilions and other appurtenances, boat ramps, floating and wooden docks, and footpaths. Operation and maintenance of these facilities may also affect soils and substrates. Dock construction would include the placement of new wooden, steel, or concrete piles using an impact pile driver. Sidewalls may be placed along boat launches, maneuvering areas, and fishing piers using coated steel sheet piles, commonly installed using vibratory pile driving equipment. These Project elements would displace and compact soils and sediments.

Short-term, minor impacts to terrestrial soils and substrates would occur on-site from construction and site preparation activities. However, the impacts would be localized to several small areas across the alternative. Some selected sites may already be partially developed, meaning that less vegetation and soil compaction would be required. Excavated soils would be stockpiled on-site in order to reclaim and revegetate disturbed areas that are not needed for alternative features.

Bed and shoreline disturbance during construction could result in the release of fine sediments and a short-term increase in suspended sediment concentrations in affected waterbodies. Construction BMPs would avoid and minimize these effects to the extent practicable, but minor, short-term, localized suspended sediment effects are likely to occur. The permanent increase in impervious surfaces for parking areas and roadways may increase sedimentation and stormwater runoff into the receiving water body. These effects to water quality and hydrology would be long-term and localized, but minor in scale due to the relatively limited size of boat launch facilities in general. The presence of new launch facilities is likely to lead to incidental releases of fuel, oil, and other pollutants into the associated waterbody.

Biological Resources

The creation of improved public access facilities would permanently impact shoreline areas where ramps, maneuvering areas, docks, and fishing piers are placed. Impacts on nearby shoreline and open water areas may result from increased human activity, boat traffic, incidental spills, and littering. These impacts are expected to be ongoing and chronic but localized and limited in severity, and therefore minor. Temporary construction-related disturbances are expected to be limited in scope and duration, and therefore minor. Mobile terrestrial and aquatic species would likely be displaced from the project footprint during construction and potentially over its long-term use. These species would likely occupy suitable habitats in proximity; therefore, the effects of displacement would likely be insignificant. Sessile or slow-moving benthic species could be injured or killed by excavation and fill placement in nearshore habitats, and/or exposed to short-term suspended sediment effects. However, the number of

individuals impacted would be limited and insignificant at the population level. These effects would therefore be minor.

One of the primary objectives of this mitigation measure is to promote recreational and subsistence fishing. Increased fishing pressure would likely result in increased fishery impacts and the potential loss of fishing gear. Recreational fishing would be altered from current levels for a variety of target species with minor adverse impacts to spotted seatrout fishing (most targeted) and moderate beneficial impacts to red drum fishing (second-most targeted). Fishing opportunities for several freshwater fish species such as catfish and carp would increase. These changes to recreational fishing are not expected to have long-term, substantive, adverse effects on aquatic habitats and species.

Improved public access facilities could be sited in undeveloped shoreline environments, meaning that existing areas of relatively intact upland and riparian habitat may be permanently converted to developed features like parking areas, roadways, outbuildings, and walkways. This would permanently displace wildlife and bird species known or likely to occur in the affected areas. Upland construction may require clearing of vegetation, eliminating cover, roosting, and foraging habitat for certain species. Individual animals within project footprints would be permanently displaced. In general, the amount of clearing and development associated with a public access facility would be relatively limited, so this mitigation measure is unlikely to substantially reduce, fragment, or limit access to nearby suitable habitats. As such, while individual animals may be permanently displaced from formerly suitable habitats, these effects would be insignificant at the population level and, therefore, minor.

Terrestrial birds and wildlife in and around the alternative may be exposed to short-term construction-related noise effects that extend beyond the Project development footprint. Noise from sources like construction vehicle and vessel engines, generators, and pile driving equipment can exceed observed disturbance thresholds for some species. This can lead to indirect effects on survival and fitness. For example, construction noise exposure during critical nesting periods could cause adults to abandon nests or miss feeding cycles, leading to reduced cohort survival. The Mitigation Plan (Appendix R-1) would likely include construction BMPs similar to those described in Section 4.3.1 of LA TIG RP/EA #4 and the Final PDARP/PEIS best practices (DWH Trustees 2016: Section 6, Appendix A) to avoid and minimize these types of effects. In addition, CPRA would coordinate with LDWF as part of E&D to avoid and minimize effects to species before construction begins. Therefore, while some adverse short-term impacts to individual birds and wildlife may occur, the resulting effects would be limited in scale, and therefore minimal.

Protected species may or may not be affected by mitigation-related improved public access facility development depending on the ultimate locations selected. Public access facility sites located towards the southern end of the Project Area are most likely to overlap habitats known or potentially used by protected terrestrial or aquatic species, whereas sites located closer to or to the north of the diversion are unlikely to measurably affect these species or their habitats. Improved public access facility locations would likely be located in the central and northern portions of the Project Area in proximity to communities with environmental justice concerns and would likely be sited to avoid potential effects on protected species and their habitats consistent with USACE nationwide and regional general permit requirements.

Socioeconomic Resources

The development of improved public access facilities would not lead to disproportionately adverse environmental justice effects primarily because this mitigation measure has been proposed specifically to expand and improve access to recreational and subsistence fishing, hunting, and foraging

opportunities. These facilities would be sited to avoid any further effects to communities with environmental justice concerns. As such, this measure would provide a net benefit to environmental justice populations.

6.0 Mitigation Measures for Unavoidable Impacts from Tidal Flooding

The objective of these measures is to adaptively manage the operation of the Project to avoid and minimize adverse tidal flooding, and, where necessary for construction or operation of the Project, acquire affected properties' interests and compensate affected parties, and/or implement infrastructure improvements and structural mitigation measures to maintain accessibility and function of the affected area. These measures may result in the removal or relocation of dwellings and commercial or public structures from floodplain environments, allowing these areas to become or return to natural or managed habitat conditions.

6.1 Environmental Review

The Mitigation Plan and MAM Plan include a set of measures intended to address impacts resulting from potential changes in tidal flooding patterns associated with the long-term operation of the Project. These include:

- Monitoring and adaptive management of Project operations to avoid and minimize adverse tidal flooding effects
- Infrastructure improvements and structural mitigation measures to offset unavoidable tidal flooding effects
- Providing funding to property owners to elevate homes and other structures on private properties
- Acquiring property interests in the form of Project Servitudes or voluntary buyouts to compensate property owners for unavoidable tidal flooding impacts

Details regarding these measures are set forth in the Mitigation Plan.

These measures fall into three categories: monitoring activities and acquisition of property interests that have no or negligible environmental impacts; potential adaptive management of operations that will be developed in response to specific conditions as they arise, which would fall within operations fully analyzed in the EIS; and infrastructure improvements and structural mitigation measures which may have environmental impacts beyond those considered in the EIS, but insufficient information is available for analysis at this time. Additional permitting and environmental analysis will be undertaken, as necessary, prior to the implementation of such infrastructure improvements and structural mitigation measures.

6.1.1 No Environmental Impacts or Negligible Environmental Impacts

Monitoring of tidal flooding and inundation rates throughout the Project Area is planned to determine the extent and degree of flooding. Monitoring would occur through the use of existing and new gauges positioned throughout the basin. The MAM Plan details the monitoring methods and locations. Installation of the new monitoring equipment would have negligible environmental impacts given the small size of the monitoring devices. Monitoring and data collection activities have no measurable or significant environmental effects on the environment and are therefore considered negligible for the

purpose of NEPA analysis. Monitoring of frequency, depth, and duration of inundation is an essential component of the adaptive management component of the Project.

Property rights acquisitions (Project Servitudes and voluntary buyouts) are not expected to result in environmental impacts and would limit the amount and type of development that would be allowable on these properties. To the extent such acquisitions had environmental impact, such acquisitions would likely result in minor beneficial impacts to physical and biological resources by reducing the potential for future development activities. If following an acquisition, structures or infrastructure are proposed to be removed from any acquired properties, a review would be undertaken to determine what, if any, additional environmental review is required and, if so, that analyses would be completed at that time.

6.1.2 Addressed in the EIS

Project operations may be adapted over time to manage observed flooding rates. While the specific operational modifications that may be made in the future are unknown, they will fall within the range of alternatives and environmental effects considered in the EIS. Therefore, no additional analysis of this specific adaptive management measure is required.

6.1.3 Analysis Provided; Additional Analysis May be Required in the Future

The construction of infrastructure improvements and structural mitigation measures are likely to result in short- and long-term effects on the environment. Depending on the specific scope, scale, or location of these actions, it is possible that projects may produce environmental impacts beyond or different from those covered in previous analyses. In such cases, the environmental effects of these future activities will be analyzed as required by applicable regulations before specific actions are implemented.

Many actions similar to those planned for mitigation for tidal flooding impacts have been previously considered as part of Florida Trustee Implementation Group (FL TIG) Restoration Plan (RP) #2 Restoration of Habitat Projects on Federally Managed Lands. The projects analyzed by the FL TIG are similar in scope, scale, and intent to the mitigative measures being considered for the Project. As a result, this document summarizes and incorporates by reference those prior analyses below.

Previously Evaluated FL TIG Restoration Measures Infrastructure Improvements and Structural Mitigation

The FL TIG Restoration Plan #2 and Environmental Assessment includes the evaluation of environmental impacts of infrastructure improvements and structural measures such as removal of dune crossovers, construction of raised crossovers, and acquisition of multiple parcels.

Physical Resources

Infrastructure improvements and structural measures typically would involve construction and use of heavy equipment such as bulldozers, trucks, backhoes, tractor-trailers, cranes, small excavators, forklifts, asphalt machines, rollers, small power tools, generators, small trucks, and hand tools. Construction vehicles and staging equipment would utilize previously existing roads, parking areas, or other disturbed areas. Construction activities are expected to result in short-term adverse impacts to geology and substrates in the sites where ground disruption would occur. Ground-disrupting activities and vegetation removal may result in increased erosion. Erosion mitigation measures such as silt fences would be implemented during construction.

Further, the use of construction equipment and barriers placed to protect public safety during construction could result in some minor to moderate short-term impacts to aesthetic and visual quality at the site. These impacts would result from the presence of equipment, barriers, and construction-related dust and emissions. During the construction period, visible impediments would detract from the natural landscape and create visual contrast for observers.

Post-construction, these actions are likely to result in long-term beneficial impacts as the intended improvements allow for decreased access to sensitive areas and will result in avoidance or reduction of tidal flooding impacts.

Biological Resources

Construction activities would disturb habitat and wildlife resources in the short-term during active ground-disrupting activities associated with proposed actions. This could include vegetation removal and habitat disruption in certain locations. As such, associated wildlife and aquatic species may experience short-term adverse impacts. Conservation measures would be implemented to reduce disturbance to habitats and species. These projects would also have long-term benefits such as habitat recovery through reduced disturbance and re-establishment of natural vegetation beneficial to a variety of species and their habitats.

In summary, these actions are anticipated to result in short-term minor to moderate adverse impacts and long-term benefits to biological resources.

Socioeconomic Resources

These projects would also be expected to result in a short-term increase in construction jobs. Further, infrastructure projects would also be expected to result in long-term economic benefits by enabling the continued occupancy and utilization of areas otherwise affected by increased tidal flooding. During construction and demolition activities, short-term closures of some areas may be required to accommodate construction activities, which could adversely affect visitors.

In summary, such projects are anticipated to result in minor, short-term adverse impacts, as well as short and long-term benefits to socioeconomic resources.

7.0 Measures Addressing Impacts to Navigation (Sediment Maintenance)

The objective of the measures requiring maintenance dredging is to address the potential for operation of the Project to cause aggradation in Barataria Bay Waterway, Wilkinson Canal, and the Mississippi River, to an extent that would impact navigability. Although construction of the Project is not anticipated to impact navigation-related maintenance dredging frequencies or volumes in the Mississippi River (see EIS Section 4.21), mitigation measures include dredging of the Mississippi River and other locations, to the extent needed to address aggradation caused by the Project and that impacts navigability.

7.1 Environmental Review

The Mitigation Plan, MAM Plan, and ESA RPMs include a set of measures intended to address impacts resulting from aggradation. These include:

- Conduct maintenance dredging of the canal to address aggradation in Barataria waterway, if needed,
- Conduct maintenance dredging to address aggradation in Wilkinson Canal, as needed, and

- Dredging (cutterhead/suction) in the Mississippi River would be conducted using dredge operational parameters coordinated with the U.S. Fish and Wildlife Service (FWS).

7.1.1 Addressed in the EIS

Maintenance dredging is contemplated as part of the APA and the impacts of maintenance dredging are analyzed throughout the EIS (See EIS sections 4.2, 4.6. 4.7, 4.8, 4.12, 4.14, and 4.19).

7.1.2 Analysis Provided; Additional Analysis May be Required in the Future

While the general impacts of maintenance dredging are addressed in the EIS, specific location, extent, and frequency of maintenance dredging will not be known until after the Project has begun operating. Depending on the specific scope, scale, or location of these actions, it is possible that projects may produce environmental impacts beyond or different from those covered in previous analyses, which could necessitate additional environmental review.

8.0 Mitigation Measures for Unavoidable Impact on Bottlenose Dolphins, Essential Fish Habitat, Threatened and Endangered Species, and Fish and Wildlife Coordination Act Resources

The objective of these measures is to address unavoidable impacts associated with sensitive and special status species and habitats. These resources received extensive analysis in the EIS, as well as associated analyses through ESA Section 7 consultation, Magnuson Stevens Act EFH evaluation, and FWCA review. The analyses and associated coordination with relevant regulatory agencies identified impacts to these resources as well as measures to mitigate or reduce those impacts. These measures are detailed in the Mitigation Plan and MAM Plan and include monitoring activities, RPMs and associated terms and conditions, and the conservation recommendations in the FWCA Report.

8.1 Environmental Review

The Mitigation Plan and MAM Plan include measures intended to address unavoidable impacts to bottlenose dolphins, EFH, threatened and endangered species (T&E species), and FWCA requirements resulting from the long-term operation of the Project. These include:

- Mitigation measures for bottlenose dolphins and EFH per negotiation with the National Marine Fisheries Service (NMFS)
- Enhanced stranding response and mitigation measures for marine mammals and T&E species
- Increased vessel and unmanned aerial systems (UAS)-based monitoring of marine mammals
- Reasonable and prudent measures (RPMs) and terms and conditions to protect ESA-listed species and their habitats
- Required actions resulting from FWCA coordination

These measures fall into two categories: monitoring, data collection, reporting and planning activities that have no or negligible environmental impacts; and a range of potential measures that will be developed to result in further reduction of adverse impacts or will result in beneficial impacts to sensitive species and habitats (i.e., dolphin mitigation, RPMs, and FWCA actions). The latter category of activities, discussed below, are likely to have limited to no negative environmental impacts or have

minor to moderate impacts and are similar to activities implemented in other areas and previously evaluated in other RPs or in the evaluations of NMFS activities.

8.1.1 Environmental Effects of FWCA Recommendations

Measures under FWCA include pre- and post-construction sampling of fish and shellfish from the outfall area and the Mississippi River, which is anticipated to have a negligible environmental impact.

FCWA recommendation 1 includes construction of crevasse projects that may include terracing to offset the indirect loss of 926 acres on the Delta NWR and 37 acres on the Pass-A-Loutre WMA. In lieu of implementing this recommendation, within 5 years of the commencement of Project operations, CPRA or the LA TIG will provide $10,000,000 of additional funding for wetland preservation and restoration work in the Delta NWR and the PAL WMA to offset modeled acres of indirect wetland losses in those areas. That funding may be accomplished through additional funding through the CWPPRA program, through additional restoration work sponsored by the LA TIG (for example, construction of the E&D work discussed in the DWH LA TIG's Restoration Plan and Environmental Assessment #7), or through a direct contribution for additional work. The potential environmental impacts of these activities will be evaluated prior to implementation as part of any permitting analysis.

The effects of the other FCWA recommendations are captured under other measures. Specifically, FWCAR Recommendation 2 is included in the EFH measures. FWCAR Recommendations 4, 5, 6, 7, 8, and 9 are all included in the MAM Plan. The portion of Recommendation 7 recommending beneficial reuse of dredged material is covered by the measure on beneficial use placement of excess soils and sediments. FWCAR Recommendations 10, 12, and 14 are included in the ESA measures. FWCAR Recommendations 11 and 13 are included in the BMPs. To avoid redundancy, the environmental analyses related to those measures are not repeated here.

8.1.2 Environmental Effects of ESA Reasonable and Prudent Measures

FWS RPM1 requires that Gate operation that would significantly increase or decrease the velocity through the structure should be implemented over several hours to allow fish sufficient time to migrate back to the river or swim away from the structure. Because this measure is directly designed to reduce the impact of Project operations on listed species, no adverse impacts to the environment are expected as a result of ensuring that gate operation changes are implemented over several hours. Further, full opening and closure of the gates is anticipated to take several hours under planned Project operations, so this impact has been addressed within the impact analysis in the EIS.

FWS RMP 2 requires that dredging in the Mississippi River would be conducted using dredge operational parameters coordinated with FWS. Should dredging (cutterhead/suction dredge) activities be necessary in the Mississippi River, the following operational parameters would be included as conditions of the permit and in the design of the project:

> 1) The cutterhead must remain completely buried in the bottom material during the dredging operation. If pumping water through the cutterhead is necessary to dislodge material or to clean the pumps or cutterhead, etc., the pumping rate will be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased.
>
> 2) During dredging, the pumping rates will be reduced to the slowest speed possible while the cutterhead is descending to the channel bottom.

Using the suggested operational parameters is not expected to have adverse environmental impacts beyond the impacts of maintenance dredging already considered in the EIS. The intent of the RPM is to reduce the impact of dredging on aquatic species.

FWS RPM 4 requires that, upon locating a dead, injured, or sick individual of an endangered or threatened species, care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury. Collection of dead, injured, or sick individuals can have negligible effects on nearby marine fauna. Aquatic species may be affected by close vessel approach, restraint, handling, capture, transport and relocation, and other activities associated with handling sick or injured individuals. This RPM is intended to reduce such impacts to aquatic species and thus would have a negligible impact on the environment.

8.1.3 Environmental Effects of Mammal Mitigation Measures

Mitigation measures for marine mammals include a range of enhanced monitoring, stranding response, and other potential actions identified through adaptive management. While less well defined, these measures are within the scope of actions considered in the NOAA (2009) *Final Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program*. That EIS identified potential minor to moderate environmental effects resulting from monitoring activities and stranding and entanglement response as summarized below.

Physical and Biological Resources

Certain monitoring activities as well as stranding and entanglement response involve direct contact with distressed animals. Marine mammals are directly affected by close vessel approach, tagging, marking, restraint, handling, capture, transport and relocation, tissue sampling, and other activities associated with monitoring and stranding response. In some cases, injured or sick animals may be transported to controlled facilities for rehabilitation prior to release. Target animals may suffer extreme stress and possibly injury or mortality during these interactions, particularly if rescuers are forced to respond under risky circumstances. Animals held for rehabilitation may not survive the stress of temporary captivity. However, these potential effects must be considered relative to the broader intent of animal rescue measures. Marine mammals that are stranded or entangled in fishing gear or debris are already at elevated risk of injury and may not survive without direct intervention. On balance, stranding and entanglement response is likely to inadvertently injure or kill fewer individuals than these measures would save. This constitutes a minor to a potentially major long-term beneficial effect on marine mammals at individual population levels.

Monitoring and stranding response activities commonly involve the use of vessels and small boats, off-road vehicles, and other motorized equipment. This presents an inherent risk of incidental spills of hazardous materials like fuel, oil, hydraulic fluids, and coolants into soils, sediments, and surface waters. This could in turn result in localized adverse effects on these resources and associated protected and sensitive habitats. Toxic spills could damage submerged aquatic vegetation (SAV) and macroalgae, and sicken or injure sea turtles, fish, shellfish, other invertebrates, birds, and marine mammals. Monitoring programs will include Spill Prevention, Control, Countermeasure plans, and other BMPs to avoid most spill events and minimize their extent and severity should they occur. Based on the nature and scale of planned monitoring activities and the BMPs, these effects would be short-term in duration and limited in extent and therefore minor in severity.

Boat and vehicle activity alone may result in unintended impacts on sensitive species and habitats. For example, in-air and/or underwater noise and disturbance from boat, vehicle, or UAS operation could

alter the behavior of fish and wildlife. SAV and macroalgae beds could be damaged by vessel anchoring, grounding, and propwash during marine mammal rescue activities. Sea turtles, birds, and their nests could be disturbed or damaged by foot traffic or vehicle and equipment use on shorelines. Collectively, these periodic disturbance effects may result in short-term adverse impacts on species and habitats that are limited in extent and minor in severity. Any short-term effects would generally be offset by the value of monitoring data for improving species conservation and management and, in the case of activities like stranding and entanglement response, by increasing the survival of animals that would otherwise be lost to the population. On balance, any adverse effects would be minor and offset by the long-term beneficial effects of this category of mitigation activities.

Socioeconomic Resources

The socioeconomic effects of marine mammal monitoring and stranding and entanglement response measures would generally be negligible to beneficial. Monitoring activities at the scale of those included in the MAM Plan could generate socioeconomic benefits through purchases of fuel, food, and incidentals in local communities, but these benefits would likely be negligible in scale. Marine mammal stranding events and rescue activities could in theory lead to a temporary increase in visitors to specific areas. Similarly, the successful rescue of stranded animals and the expedient removal of carcasses would avoid and minimize odors from decomposition that could have negative effects on property owners and business in the immediate vicinity. On balance, the socioeconomic effects of monitoring and marine mammal stranding and entanglement response activities are likely to be negligible to beneficial.

9.0 Remaining Mitigation and Stewardship Measures and Monitoring and Adaptive Management Activities Not Requiring Additional Environmental Analysis

The Mitigation Plan and MAM Plan include several measures not discussed above for which additional environmental analysis is not required. Actions that do not require additional environmental analysis include a range of BMPs, and adaptive management measures that have been already been considered in the EIS, and measures like environmental monitoring and reporting, educational and informational programs, economic support, and other activities that have negligible impacts.

The objectives of these remaining measures and activities vary, but in general are intended to avoid and minimize environmental impacts where possible, offset or compensate for unavoidable impacts, and/or monitor the effects of the project on natural and socioeconomic resources.

9.1 Environmental Review

No additional environmental review is required for the following measures in the MAM Plan because these actions either have no or negligible environmental impacts and/or have already been addressed in the EIS effect analysis.

9.1.1 No Environmental Impacts or Negligible Environmental Impacts

The following activities are included in the MBSD MAM Plan (Appendix R):

- Funding and administration of educational, informational, and economic support programs:
  - AOC training, startup programs, and marketing (see Section 3.1)
  - Finfish and shrimp fishery marketing assistance, workforce and business training, and funding to support fishing vessel and gear improvements (see Section 4.1)

  - Advising staff that manatees may be present in the Project area, advising them of applicable speed zones and the need to avoid collisions with and injuries to manatees. Also providing staff with materials to assist in the identification of manatees, instructing staff to avoid feeding manatees, and contacting the USFWS and LDWF if a manatee is sighted
- Planning
  - Pre-construction planning
- Monitoring of the environment to inform adaptive management of the project, including:
  - Environmental inspections
  - Tidal flooding impacts (see Section 6.0)
  - Mississippi River discharge, suspended sediment, and nutrient levels
  - Discharge, sediment concentrations, and nutrient loads conveyed into the Barataria Basin
  - Topography and bathymetry monitoring within the project influence area
  - Flow velocities within the Barataria Basin
  - Upland soil monitoring, including rate of land formation, surface elevation changes, soil bulk density, and organic and mineral matter density
  - Habitat formation, vegetation community composition, water quality, and biological community response (including commercial fish species response)
- Reporting activities, including:
  - Annual environmental monitoring reports
  - Annual operations and maintenance performance and monitoring reports
  - Regulatory compliance reporting

The Trustees' approach to compliance for these MAM activities is consistent with, and follows where applicable, the PDARP/PEIS Section 6.4.14. Resources considered and impacts definitions (minor, moderate, major) align with the PDARP/PEIS. Relevant analyses from the PDARP/PEIS are incorporated by reference. All source documents relied upon are available to the public and links are provided in the discussion where applicable. Further, similar measures were evaluated by NOAA in its Final Programmatic Environmental Impact Statement for habitat restoration activities implemented throughout the coastal United States (June 2015). See e.g., sections 4.5.1.2 and 4.5.1.3 available at https://www.fisheries.noaa.gov/resource/document/restoration-center-programmatic-environmental-impact-statement.

No additional NEPA evaluation would be needed for activities that can be carried out under existing permits and authorizations. The data gathered are expected to lead to beneficial impacts to biological resources through increased understanding of Louisiana coastal resources and the application of this understanding to ongoing operations of the MBSD Project. Should there be activities that fall outside of current permits or that would require modification of current permits, those actions would be evaluated and any environmental review required for such permit modifications would be completed at that time.

Based on the review of the activities against those actions previously evaluated in the PDARP/PEIS and actions authorized under existing permits, no additional NEPA evaluation of related MAM activities is necessary at this time.

9.1.2 Actions Evaluated in the EIS Effects Analysis

Several of the mitigation measures identified in Appendix R-3 are standard BMPs applied to a range of project-related construction and maintenance activities These measures are specifically designed to avoid and minimize adverse impacts on the environment and these measures are integral components of the alternatives considered in the EIS, so their effects have already been addressed within the environmental impact analysis.

- Stormwater Pollution Prevention Plan (SWPPP) and Spill prevention, control, and countermeasure plan (SPCC) (EIS Section 4.1, 4.5 4.9, 4.10, 4.20, 4.25).
- Stabilization and revegetation measures (EIS Section 4.2.5.1, 4.9.3.2)
- Soil compaction minimization measures (EIS Section 4.25)
- Temporary erosion control measures (EIS Section 4.25)
- Construction dust management (EIS 4.7)

R5: Marine Mammal Intervention Plan

Dolphin Intervention Plan: A framework for potential marine mammal interventions related to the Mid-Barataria Sediment Diversion Project

(CPRA Project Number BA-O153)

This Dolphin Intervention Plan for the Mid-Barataria Sediment Diversion (MBSD) Project (the Project) provides a strategy and best practices for marine mammal interventions. This Plan is by nature a living document and never "final". This Plan will be "draft" at least until if, and if so when, the US Army Corps of Engineers (USACE) New Orleans District issues the permits and authorizations required for the Project and the Louisiana Trustee Implementation Group (LA TIG) decides to fund the Project. The State of Louisiana Coastal Protection and Restoration Authority (CPRA), at that point, will then work with the National Oceanic and Atmospheric Administration (NOAA) to add any Compliance Monitoring requirements contained in those permits related to marine mammal interventions to this Plan and make any decisions on implementation of any of the aspects of this framework.

1. Purpose and Goals

The purpose of the Dolphin Intervention Plan is to outline a framework for potential intervention activities and the process for decision making that may be used to respond to free-swimming, live dolphins that are ill; behaving abnormally; injured; in poor condition/health; or are at risk for injury, illness, or death due to adverse environmental changes in the Barataria Basin, Louisiana. Models project that the Project will result in substantial morbidity and mortality of dolphins in the Barataria Bay Estuarine System stock, including 585 dolphin mortalities (95 percent confidence interval [CI]: 131 to 1459) in the first year of operations alone and loss of 96% of the entire population (95 percent CI: 80% to 100%) by the end of the Project (Thomas et al. 2021). Obviously, no set of dolphin mitigation/intervention activities could entirely offset such an impact, however, the resources available (including trained and qualified personnel, equipment and supplies, budget, and time) need to be deployed in a strategic manner in order to be as effective as possible. The goals of this intervention framework for dolphins in the Barataria Basin are to reduce illness, pain, and suffering, as well as collect scientific information that may inform operational mitigation actions and adaptive management of the monitoring and response activities.

This Dolphin Intervention Plan for the Project will follow the Small Cetacean Intervention Best Practices (and other associated appendices) developed as part of the 2022 Marine Mammal Health and Stranding Response Program (MMHSRP) Programmatic Environmental Impact Statement (PEIS) to the best extent practicable, but may include modifications to meet the specific needs for MBSD interventions. This intervention framework includes activities above and beyond normal emergency response activities, either due to the scale or nature of the activities (such as rescues of dolphins in their usual habitat but when the conditions within that habitat are affected by the low salinities from the Project; remote treatment of free-swimming

dolphins that are not entangled or victims of a boat strike; or broader-scale hazing or translocations). Interventions may require no additional action beyond those in the MAM plan, or include such activities as remote sample collection, assessment, and/or treatment; capture and release, rehabilitation, and/or translocation of free-swimming individual(s); and/or capture and euthanasia of sick or injured, free-swimming animals.

1.1. Background

In 1992, the MMHSRP, under the National Marine Fisheries Service (NMFS), was established by Congress under Title IV of the Marine Mammal Protection Act (MMPA). The goals of the program are to: collect and disseminate health and health trend data for marine mammals in the wild; correlate the health and health trends of marine mammals in the wild with biological, chemical, and physical environmental data; and to coordinate effective responses to marine mammal unusual mortality events (UMEs). As part of the work of the MMHSRP, the program develops best practices and guidance; maintains MMPA, Endangered Species Act (ESA), Convention on International Trade in Endangered Species (CITES) permits, and NOAA Institutional Animal Care and Use Committee (IACUC) authorizations; and maintains a PEIS that addresses responses and research activities nationally (NOAA 2021). Through these permits, the program authorizes qualified individuals to conduct interventions on small cetaceans (such as the bottlenose dolphins living in and near the Barataria Basin) as either response activities for animals with health concerns or as scientific studies on health conditions in order to reduce injuries or risks. The MMHSRP published best practice guidelines for free-swimming, distressed small cetacean interventions prior to onsite release, translocation, or admission to rehabilitation (NOAA 2021).

1.2. Legislation Pertinent to Non-ESA Small Cetaceans

Marine Mammal Protection Act (MMPA): The MMPA, signed into law in 1972, prohibits the "take" of marine mammals, which includes harassing or disturbing these animals, as well as harming or killing, unless such take is specifically exempted in the statute or authorized. The MMPA divides responsibility for marine mammal species between the Secretary of Commerce, who oversees NMFS, and the Secretary of the Interior, who oversees the U.S. Fish and Wildlife Service (USFWS). NMFS has jurisdiction over cetacean (including the dolphins living in and near the Barataria Basin) and pinniped species (with the exception of walrus), and USFWS has jurisdiction over walrus, polar bear, sea otters, and manatees. The 1992 amendments to the MMPA included Title IV of the MMPA, which established the MMHSRP under NMFS to collect and disseminate information about the health trends in marine mammal populations through the collection of data from strandings, bycatch, subsistence harvest, and research. The PEIS best practices support these efforts and focus on data collection from small cetacean interventions using the Network or other authorized personnel.

On February 9, 2018, Congress passed the Bipartisan Budget Act of 2018 (Budget Act), Public Law 115-123, which included a requirement that the Secretary of Commerce, as delegated to the Assistant Administrator of the National Marine Fisheries Service (NMFS), issue a waiver of the Marine Mammal Protection Act (MMPA or Act) moratorium and prohibitions for three specific

Louisiana wetland restoration projects, including the MBSD. Specifically, Section 20201 in title II of the Budget Act directs the Secretary of Commerce to issue a waiver pursuant to section 20201 and section 101(a)(3) of the MMPA for three projects included in the 2017 Louisiana Comprehensive Master Plan for a Sustainable Coast. Specifically, in Congress' recognition of their consistency with the findings and policy declarations in section 2(6) of the MMPA, the Budget Act directs the Secretary to issue a waiver for the Mid-Barataria Sediment Diversion, the Mid-Breton Sound Sediment Diversion, and the Calcasieu Ship Channel Salinity Control Measures projects from the requirements of sections 101(a) and 102(a) of the MMPA for the duration of the construction, operation, and maintenance of the projects. NMFS issued the waiver on March 15, 2018. Section 20201 of the Budget Act further indicates that, upon the issuance of the waiver, the State of Louisiana (State) shall, in consultation with the Secretary of Commerce: (1) To the extent practicable and consistent with the purposes of the projects, minimize impacts on marine mammal species and population stocks, and (2) Monitor and evaluate the impacts of the projects on such species and population stocks.Intended Uses of Best Practices

NMFS and the Marine Mammal Stranding Network (the Network) have developed protocols and procedures for responding to live marine mammals stranded or otherwise in distress to ensure the health, welfare, and safety of human responders, animals, and the public (NOAA 2021). These protocols balance the need for standardized procedures while allowing flexibility to address the specific needs of different situations for diverse species and habitats, as well as unforeseen circumstances. In particular, this Intervention Framework will rely on the recommendations in (but not limited to) Appendix XII to the PEIS (Small Cetacean Intervention), Appendix X (Cetacean and Pinniped Transport), Appendix XIII (Euthanasia), Appendix XV (Mass Strandings), and Appendix XXI (Small Cetacean Entanglement). For more information on general stranded marine mammal rescue and rehabilitation, the reader should consult references such as *Marine Mammals Ashore* (Geraci *et al.* 2005) and the *CRC Handbook of Marine Mammal Medicine* (Gulland *et al.* 2018). Human and animal safety are the top priorities for NMFS and the Network, and these two entities evaluate many factors before making a decision to intervene. Each event is unique and requires the consideration of multiple aspects, some predictable (which are addressed below) and some unpredictable.

However, it is important to emphasize that MBSD interventions may require specific needs and modifications to the best practices. Operations of interventions will be handled based on the Incident Command System (ICS) standardized by the National Incident Management System (NIMS) and adjusted (with additional guidelines) for marine mammals and oil spill response by Ziccardi et al. (2015), with the Dolphin Resource Team working closely with the MMHSRP and the NOAA Southeast Stranding Program (Southeast Regional Office/Southeast Fisheries Science Center). Although these guidelines were developed specifically for oil spill response, the general structures and guidelines are applicable to the management of other marine mammal-related emergency situations (such as UME response and the responses to the projected freshwater impacts from the Project).

2. Planning Strategy for Interventions

2.1. Authorization and Training

Dolphin interventions in and around the Barataria Basin will be conducted under the MMHSRP's MMPA/ESA permit, a Stranding Agreement (for live strandings or out-of-habitat animals), or the MMPA 109(h) authority for local, state, and federal officials. The permit and Stranding Agreement activities fall under the MMHSRP's PEIS. Even though the specific Barataria Basin intervention activities will most likely be conducted under the MMHSRP's MMPA/ESA permit due to their complexity and risks, any dolphin intervention in the Barataria Basin should follow the ICS structure, including being discussed with the State Stranding Coordinator, Southeast Regional Stranding Coordinator(s) (RSC), and MMHSRP headquarters (HQ) staff in the planning and implementation phases as appropriate. Additionally, the Network, Dolphin Resource Team, and associated staff who have been authorized by NMFS to conduct monitoring, response, and interventions must have the training, experience, equipment, and necessary support to safely and humanely conduct those specific dolphin activities. In some cases, particularly if interventions include more than one animal, the Network and Dolphin Resource Team may also rely on partners such as local, state, and federal employees (including law enforcement, police, fire department, USFWS, and the U.S. Coast Guard), aquaria, non-governmental organizations, academic, and other appropriately trained and capable individuals/groups to assist.

To maintain safety and increase the capacity to conduct interventions, authorized Dolphin Resource Team and Network personnel will provide opportunities for apprenticeships or assistant roles to develop additional personnel with the necessary hands-on expertise, as well as conduct community outreach for more general assistance. Specific training issues or requirements may also exist for certain activities (e.g., in-water dolphin research or response captures outside of the Barataria Basin).

2.2. Strategy for Development of Intervention Activities

The initial intervention planning will occur in phases, either in parallel or sequentially. However, some activities to benefit planning can begin as soon as possible. Consistent data collection and diagnostic analyses will occur (according to veterinary discretion) in live animal interventions for out-of-habitat dolphins, entanglement response, and live strandings as a part of ongoing MMHSRP-led response efforts. These data will be synthesized for discussions in Phase 1 planning efforts.

Phase 1: In the first 18-24 months of the pre-operational period, planning activities will consist of a series of workshops with a wide variety of subject matter experts (SMEs) in dolphin health, research, low salinity exposure, hydrology, dolphin welfare, population and abundance, and biology. These SMEs will evaluate a suite of potential intervention activities ranging from remote monitoring to hands-on capture, rehabilitation, release/translocation, and/or euthanasia. The assessments would consider such issues as health risks; human safety; animal welfare; likelihood of success in reducing illness, pain, and suffering; risk to the individual and

population(s) affected by these intervention activities; likelihood of increasing scientific understanding and improving future interventions/assessments; feasibility; benefits to individual and population; and enhancement of survival and/or resilience. The SMEs will also develop recommendations for how to triage cases when the number of animals in need of intervention is greater than the available personnel/resources can reasonably manage (see, for example, Figure 1). In addition, the workshop participants may also discuss data gaps that might improve our interventions and/or inform operational mitigation evaluations. Finally, Phase 1 may identify possible studies, including pilot studies, that might address those data gaps.

Phase 2: During the pre-operational period and/or in the first year/years of the post-construction period, pilot projects or studies may be initiated to investigate dolphins in the Barataria Basin that are exposed to low salinity waters for various periods of time using recommendations from Phase 1. The pilot studies will be developed based on the discussions and recommendations of the SME workshops and further evaluated with input from SMEs.

Phase 3: In the post-construction period (with particular emphasis on the first years of operations, and in areas likely to have the lowest salinities and the longest exposures), interventions will be implemented as informed by the monitoring and stranding programs, using intervention funds and personnel as needed.

3. Potential Intervention Activities

3.1. Overview

There are many considerations that go into the decision of when and how to respond to free-swimming small cetaceans in distress. Based on past interventions with out-of-habitat dolphins, the following are a general progression of possible intervention actions, listed from least to most intensive/invasive. Combinations of these may be used for future out-of-habitat dolphins, including storm surge displaced animals, in the Barataria Basin as well as for MBSD-related interventions in which the animal is in adverse environmental conditions or exhibiting poor health. Intervention decisions and implementation will require rapid access to biological and environmental data and predictions/forecasts to identify intervention triggers, as well as for adaptive management of the dolphin monitoring program.

3.2. Behavioral Observations (Remote)

In each case/event, animals should be assessed through physical, behavioral, and environmental observations. The Dolphin Resource Team, as part of their monitoring effort, will undertake observations on groups and individuals throughout the year and throughout the basin. Based on specific environmental or animal triggers, additional observations may be needed for specific groups or individuals to identify any intervention actions needed. These targeted observations will enable better decision-making for the appropriate course of action for that particular individual or group of individuals (refer to Small Cetacean Intervention Best

Practices for individuals and the Mass Stranding Best Practices for information on groups of animals), but these observations will also provide important information for future cases. For these observations, a standardized remote health assessment form will be used. All data will be linked to the dolphin photo-id catalog number whenever possible, and the data entry and management will be integrated with the Dolphin Resource Team activities. In an emergency case (e.g., an animal in imminent danger of death, such as an anchored animal), immediate intervention (following approval from NMFS) may be necessary.

3.3. Sample Collection (Remote)

Remote samples may be collected to provide additional data on the health of an individual, to aid in intervention decision-making. Samples that may be remotely collected may include, but are not limited to:

- Remote collection of floating feces for parasite identification, hormones, etc.
- Remote collection of breath via pole or UAS for microbiology, hormones, etc.
- Remote collection of skin and blubber via biopsy dart for genetics, epigenetics, omics, sex, hormones, pathogen screening/microbiome, contaminants, etc.
- Remote collection of blood for a variety of analyses

3.4. Herding/hazing/deterrence

While more commonly used to prevent mass strandings of small cetaceans, herding or deterrence actions may be appropriate for single or small groups of dolphins for short distances and brief periods of time. Various methods of deterrence or hazing can be used by experienced individuals, including:

- Vessel action, close approaches, percussive slaps on the water, which can be attempted from non-motorized watercraft such as stand up paddleboards and kayaks, as well as motorized vessels (e.g., boats, jet ski)
- Pingers, playbacks, or other acoustic devices (e.g., diver recall sirens)
- Hukilau, Oikomi pipes, streamers, non-entangling nets, and bubble curtains

For a more in-depth discussion of various non-lethal deterrence options, see NMFS Marine Mammal Non-Lethal Deterrence Guidance.

4. Remote Treatments

The development of remote treatments will leverage the ongoing work to develop remote delivery protocols, tools, and techniques for sedation of free swimming small cetaceans. As part of a NOAA John H. Prescott Marine Mammal Rescue Assistance Grant Program grant, Mote Marine Laboratory's Stranding Investigations Program is developing a remote sedation protocol and delivery device for free-swimming small cetaceans. This is a response to the increasing number of cases where existing small cetacean intervention tools are inappropriate or not possible. These tools and protocols will make inaccessible free-swimming small cetaceans more accessible for safer interventions.

The Mote Marine Laboratory's Stranding Investigations Program team has initiated a multi-step process for developing remote sedation as a potential tool for small cetacean interventions, to ensure that it is safe and effective, culminating in standardized protocols accepted by the National Marine Fisheries Service (e.g., IACUC and NMFS permitting office protocols), modeled on the existing Pinniped Remote Sedation Entanglement Response Capture Protocol and similar protocols being finalized for large whales. The steps include the establishment of an international SME working group to assist in the design of the development and testing, initiate the testing, evaluation of delivery devices, development of pilot projects, and development of protocols and procedures including training for deployment of remote sedation. The delivery mechanism for sedation will also open the path for remote delivery of antibiotics and other drug administration to free swimming cetaceans. The MBSD intervention strategy may utilize these tools and protocols once they are developed.

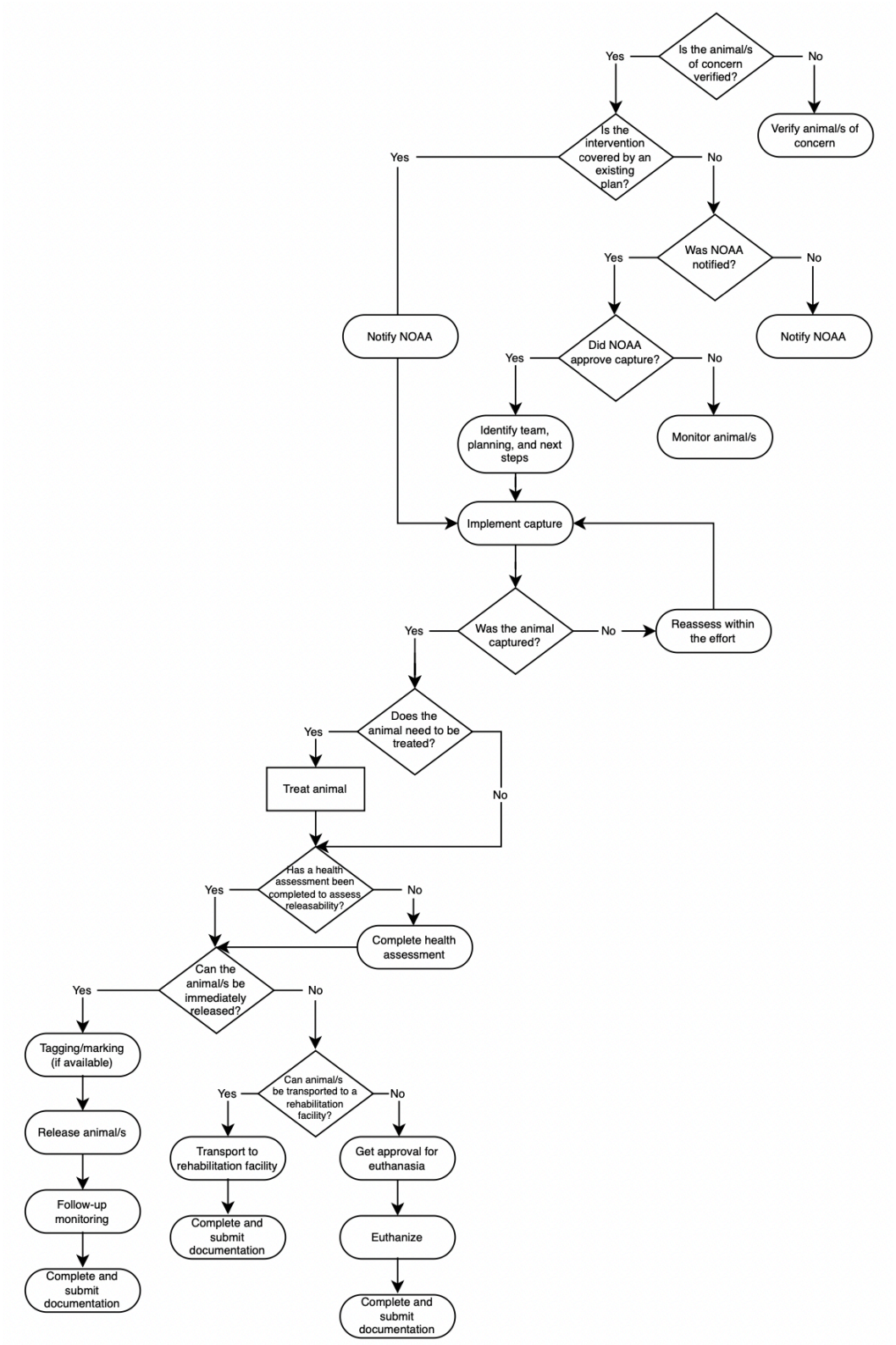


Figure 1: Potential Decision/Process Matrix for Dolphin Interventions. Diagram is provided as an example of what the SME working group will develop in Phase 1.

4.1. In-Water Capture

If a distressed cetacean is determined to have a life-threatening condition or is not likely to survive in its current habitat, a live capture may be warranted. This activity will require the availability of trained personnel, necessary resources, and safety considerations for both responders and the animal. The decision on when, where, and how to intervene needs to be approved by the RSC and MMHSRP HQ staff (following ICS procedures, e.g., Figure 1), and if needed, will include an intervention plan and follow an established protocol for the triage of cases when more than one animal requires a response. There are four potential methods for capture of small cetaceans: soft-tail line, hoop net, encircling net, or hand-set nets. For details for these procedures refer to the PEIS best practices (e.g., Appendix XII or XXI).

After the animal is captured, a thorough examination will be performed by an experienced marine mammal veterinarian. The animal may also receive appropriate treatment, such as removal of entangling gear, administration of medications, and marking/tagging if release is imminent. Following the examination, the appropriate course of action should be determined by the attending veterinarian and capture lead, in consultation with other experienced personnel and NMFS. Options may include immediate release, release in an alternate location, keeping the animal for rehabilitation prior to future release, and euthanasia. Project-specific criteria for this triage process, including the timing and location of releases, will be developed by the Core team and the SME workshops. Special consideration will be given for the potential capture and translocation of social groups, based on pilot projects and evaluations by outside experts for feasibility, safety, and other considerations. If animals are released, plans should be considered for follow-up monitoring of the individual.

5. Animal Disposition Options

Once the animal(s) are in hand, there are four options for the animal disposition: 1) immediate release (*in situ* or after translocation to alternate release site; with or without treatment), 2) short term rehabilitation and release (with tag) into same area or translocated to areas with healthier habitat; 3) longer term rehabilitation (release at a later date), and 4) euthanasia.

5.1. Immediate *in situ* Release or Translocation and Release

Per the best practices in the PEIS, immediate release is an option if the following factors are met:

- The animal is healthy or medically stable, and able to function normally as determined by the NMFS, capture lead, and the Network veterinarian (on-site or via phone consultation). Certain situations (*e.g.*, hurricanes) may have time constraints which may not allow for consultation with veterinarians and the only option may be transport/immediate release;
- Social requirements can be met (*e.g.*, maternal care for young)
- It is highly recommended the animal be marked or tagged in some manner prior to release (only by trained individuals), using NMFS-approved methods such as:

- Marking – paint stick/crayon marking;
- Notching or freeze-branding of the dorsal fin; or
- Tagging - a roto tag or cattle ear tag or a single-pin radio or satellite tag (if available).

The animal may be released *in situ* if:

- Environmental conditions are favorable;
- The animal is unlikely to strand/re-strand; and
- The capture location is near the animal's natural habitat.

The animal may be translocated to a different site and released immediately if:

- A different release site is a more suitable site for release;
- The animal is manageable and adequate logistical support is available, including transport vehicles; and
- The new site is believed to improve the chances of a successful release for the captured cetacean, and reduce the likelihood of re-stranding.

5.2. Rehabilitation

Rehabilitation, per 50 CFR 216.3, is defined as "treatment of beached and stranded marine mammals taken under section 109(h)(1) or 112 (c) or imported under section 109(h)(2) of the MMPA, with the intent of restoring the marine mammal's health and, if necessary, behavioral patterns." An authorized animal care facility provides treatment with the goal of releasing the animal back to the wild. Short-term (i.e., <96 hours) rehabilitation in temporary pools may be an option, as well as longer term rehabilitation in more permanent, authorized rehabilitation facilities. Short- and long-term rehabilitation facilities are authorized by NMFS and require a Stranding Agreement.

5.3. Euthanasia

The decision to euthanize a small cetacean is made in consultation with the RSC and other individuals (following the ICS) and the procedure must be conducted by one of the following:

- a Network veterinarian;
- an experienced, trained, and authorized Network member;
- an appropriately trained local, state, tribal, or federal law enforcement, or wildlife/animal control agent; or
- a non-marine mammal veterinarian in consultation with an experienced Network or federal veterinarian.

Euthanasia is an option when:

- The veterinarian determines that euthanasia is the most humane course of action, given the animal's prognosis. For example:
    - The animal is deemed to be critically injured or ill with little chance of recovery;

    - The animal is suffering or unlikely to survive if released; and/or
    - It is necessary to end the suffering of an animal.
- No rehabilitation facilities are available and immediate release is deemed inhumane or unlikely to succeed.

6. Literature Cited

2007. Differentiating Serious and Non-Serious Injury of Marine Mammals. Report of Serious Technical Workshop.

Barratclough, A., et al. 2019. Health assessments of common bottlenose dolphins (Tursiops truncatus): Past, present, and potential conservation applications. Front Vet Sci 6:444. doi: 10.3389/fvets.2019.00444

Cape Cod Stranding Network. 2008. Cetacean Health Assessment Guidelines. A Project of the International Fund for Animal Welfare.

Gulland, F.M.D., L.A. Dierauf, and K.L Whitman. 2018. CRC Handbook of Marine Mammal Medicine, 3rd Edition. CRC Press, Boca Raton, FL.

Geraci, J.R. and V.J. Lounsbury. 2005. Marine mammals ashore: a field guide for strandings 2nd Edition. National Aquarium in Baltimore, Baltimore, MD.

"Injured Dolphin, Babyface Spotted with Her Own Calf." Clearwater Marine Aquarium, 30 July 2018, www.seewinter.com/injured-dolphin-babyface-calf/.

Kraus S.D., M.W. Brown, H. Caswell, C.W. Clark et al. 2005. North Atlantic right whales in crisis. Science 309:561-562

NMFS. 2009. Release of NMFS Decision Process for Responding to Live Marine Mammals that are Stranded or Otherwise in Distress.

NOAA. 2021. Draft Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program. May 2021. Final PEIS pending.

NOAA. 1997. Draft release of stranded marine mammals to the wild: background, preparation and release criteria.

NOAA Fisheries West Coast. Orphan Killer Whale A73 (Springer). https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/orphan-killer-whale-a73-springer. NOAA/NMFS Marine Mammal Health and Stranding Response Program

Reynolds, J. and D. Odell. 1991. 2nd Workshop on Marine Mammal Strandings; sponsored by the Marine Mammal Commission and the National Marine Fisheries Service Department of Commerce, NOAA Tech. Rep. NMFS 98.

Rommel S.A., A.M. Costidis, T.D. Pitchford, J.D. Lightsey, R.H. Snyder, and E.M. Haubold. 2007. Forensic methods for characterizing watercraft from watercraft-induced wounds on the Florida manatee (Trichechus manatus latirostris). Mar Mamm Sci 23:110−132

Guidance for Southern Resident Killer Whale Intervention. Available Intervention Options & Response Plan Template. West Coast Region, October 2018

St. Aubin, D.J., J.R. Geraci and V.J. Lounsbury. 1996. Rescue, Rehabilitation, and Release of Marine Mammals: An Analysis of Current View and Practices. NOAA Tech. Memo. NMFS-OPR-8. 65pp.

Thomas, L., Marques, T., Booth, C., Takeshita, R., and Schwacke, L.H. Predicted population consequences of low salinity associated with the Mid-Barataria Sediment Diversion project on bottlenose dolphins in the Barataria Bay Ecosystem Stock. Technical Report. Prepared for the Marine Mammal Commission, Bethesda, MD. 12th May 2021. https://www.mmc.gov/wp-content/uploads/21-05-13-BB-dolphin-popn-trajectory-MMC-response.pdf

Whaley, J.E. and R. Borkowski. 2006. Interim best practices marine mammal stranding and response, rehabilitation, and release: standards for release. National Oceanic and Atmospheric Administration, National Marine Fisheries Office of Protected Resources, Marine Mammal Health and Stranding Response Program and U.S. Fish and Wildlife Service, Fisheries and Habitat Conservation, Marine Mammal Program.

Wilkinson, D. and G. Worthy. 1999. Marine Mammal Stranding Networks. Pages 396- 411 in J. Twiss and R.R. Reeves, eds. Conservation and Management of Marine Mammals. Smithsonian Press, Washington DC.

Ziccardi, M., S. Wilkins,T. Rowles, and S. Johnson. 2015. Pinniped and Cetacean Oil Spill Response Guidelines. NOAA Tech. Memo. NMFS-OPR-52. 138pp.