

# **APPENDIX R: MITIGATION & MONITORING AND ADAPTIVE MANAGEMENT PLANS**

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**R1: Mitigation and Stewardship Plan**

**R2: Monitoring and Adaptive  
Management Plan (MAMP)**

**R3: Mitigation Summary Table**

**R4: Mitigation Measures  
Environmental Analysis**

# **R1: Mitigation and Stewardship Plan**

## **Mid-Barataria Sediment Diversion Draft Mitigation and Stewardship Plan**

### **1. INTRODUCTION**

The Coastal Protection and Restoration Authority of Louisiana (CPRA) is proposing 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—wetlands and other waters of the United States, U.S. Army Corps of Engineers (Corps) 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) draft environmental impact statement (DEIS) for the Project.

The Purpose of this Mid-Barataria Sediment Diversion Mitigation and Stewardship Plan (Mitigation Plan) is to demonstrate how incidental 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); and (2) conservation recommendations provided by the National Marine Fisheries Service (NMFS) and adopted by the Corps to conserve, avoid and/or minimize adverse effects to EFH; and (3) stewardship actions to address project-related changes to the environment.

### **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, intermediate, and brackish habitats near the diversion outflow.

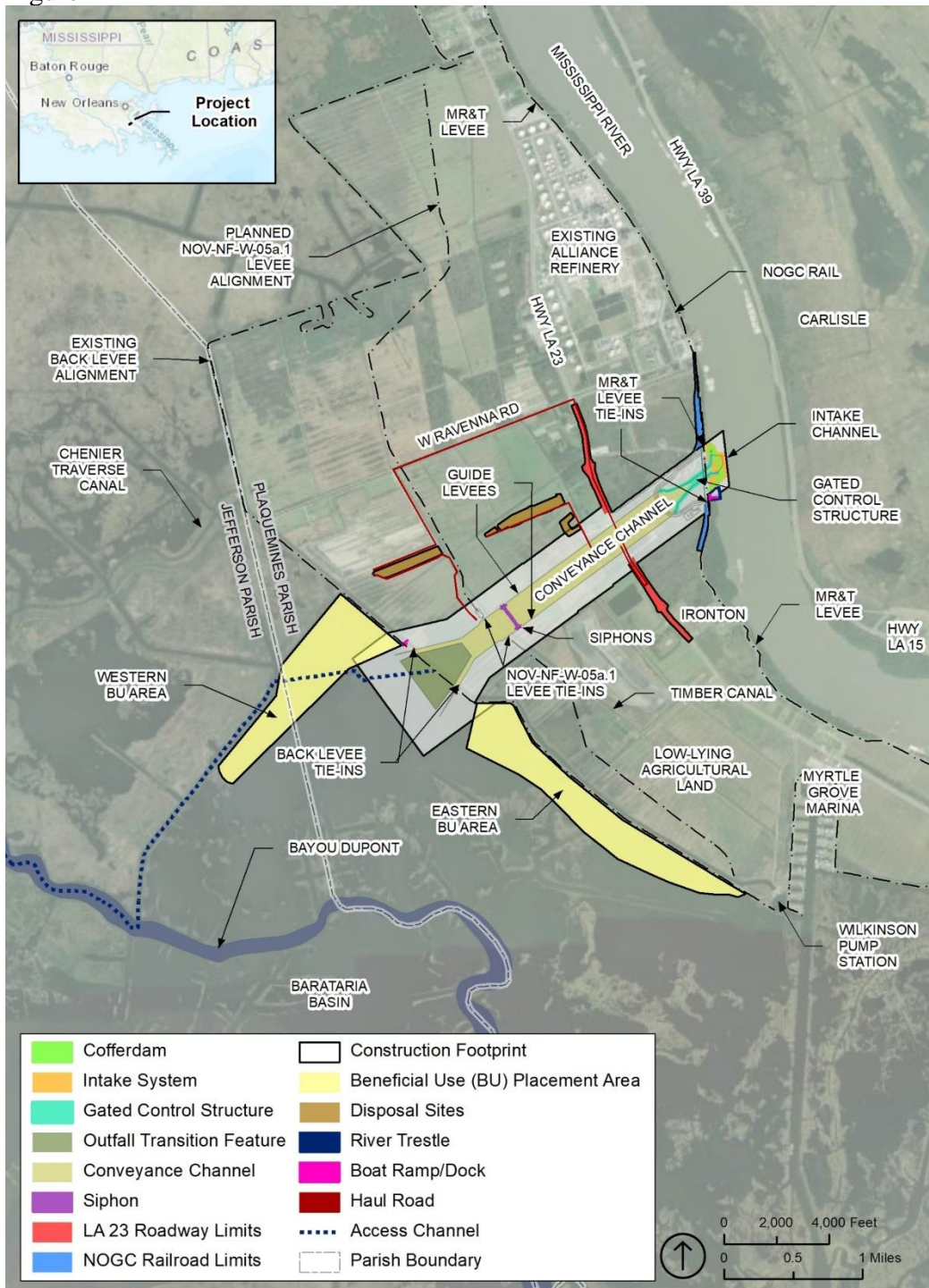
As more fully explained in Section 5 below, the Project is anticipated to have major, permanent benefits on wetlands and other U.S. jurisdictional waters in the Barataria Basin. The purpose of the diversion of fresh water, sediments, and nutrients into the Barataria Basin is to build, sustain, and maintain 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 Ch.3 of the NEPA DEIS.

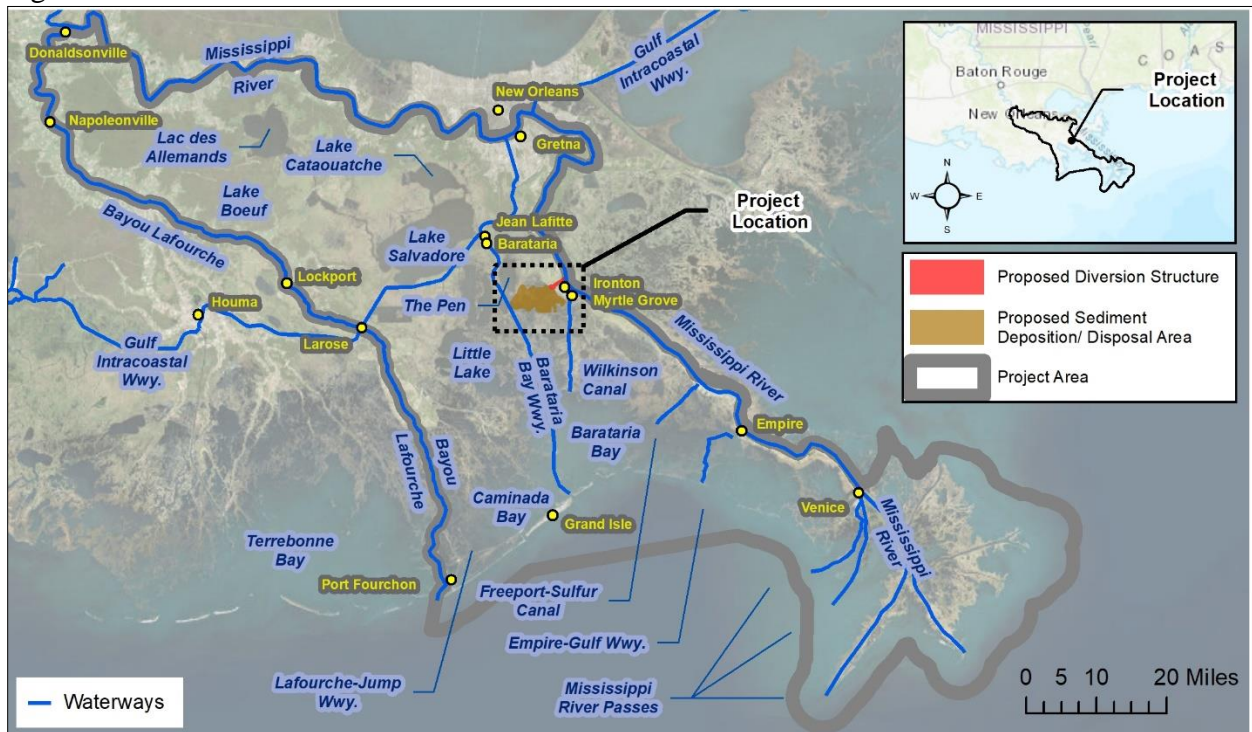
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Figure 1



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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 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).

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 DEIS, 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. Conversely, the upper Barataria Basin wetlands are still relatively intact and more protected from the combined influence of erosion, relative sea-level rise and saltwater intrusion compared to lower reaches of the basin. The upper Barataria Basin continues to be the least fragmented of marshes and forested wetland in the Barataria Basin (Couvillion et al. 2016) and was relatively protected from the oiling of the DWH oil spill (PDARP/PEIS Chapter 4). The lower Barataria Basin consists of large expanses of relatively deep open water. Due to the combination of deeper water, highly fragmented marsh, and higher relative sea level rise rates, there is less opportunity for effective sediment capture and an expected longer timeframe for a diversion project in the lower Barataria Basin to demonstrate benefits. It would take longer, and require a larger sediment volume, for the coarse-grained sediments that are the foundation of wetland creation to accumulate and reach a subaerial elevation suitable for marsh development.

#### **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 Corps.

CPRA submitted a Joint Permit Application on June 23, 2016, to the Corps' 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 Corps' 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.<sup>1</sup> 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.”<sup>iii</sup> Compensatory mitigation may be required to ensure that an activity requiring authorization is not contrary to the public interest.<sup>iii</sup>

In addition, pursuant to CWA Section 404, compensatory mitigation is required to offset environmental losses from unavoidable impacts to waters of the United States.<sup>iv</sup> The U.S. Environmental Protection Agency (EPA) and the Corps 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).<sup>v</sup> 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.”<sup>vi</sup> 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.<sup>vii</sup> 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.<sup>viii</sup>

Compensatory mitigation involves replacing or providing substitute resources for impacts that remain after avoidance and minimization measures have been applied. The Section 404(b)(1) Guidelines make the purchase of mitigation bank credits and in-lieu fee payments the preferred mitigation methods over permittee responsible mitigation.<sup>ix</sup> Where justified, the mitigation technique selected may be out of order in terms of mitigation preference. The implementation of the compensatory mitigation should be in advance of or concurrent with the impacts.<sup>x</sup>

### **4.3. Rivers and Harbors Act Section 408**

Section 408 of the RHA provides that the Corps 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.<sup>xi</sup> As in the context of Section 404/10 permits, the Corps may require mitigation to ensure the proposed alteration is not injurious to the public interest.<sup>xii</sup>

The Project has the potential to alter Corps civil works projects and requires Section 408 permission to proceed. The following Corps 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



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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) Corps, 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 Corps is the lead federal agency for compliance with NEPA. The Corps determined that the Project may significantly affect the quality of the human environment and therefore, decided to prepare an EIS. The Corps 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 Corps 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 (“EPA”), 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 (DOI) U.S. Fish and Wildlife Service (USFWS), the Louisiana State Historic Preservation Office (LA SHPO), and the Louisiana Department of Transportation and Development (LDOTD). The Corps 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 DEIS and associated technical analyses (as well as in other analyses outside of the NEPA process, such as the public interest review) were used as the basis for mitigation in the Mitigation Plan. A final EIS is expected to be published in 2022. If impacts are identified in the final EIS that were not identified in the DEIS, CPRA will coordinate with the Corps and other participating agencies to revise the Mitigation Plan accordingly. The FEIS 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 DEIS

evaluates any environmental consequences associated with implementation mitigation and stewardship measures presented here. That evaluation is included in Appendix R of the DEIS.

#### **4.5. Endangered Species Act**

Section 7(a)(2) of the ESA requires federal agencies to consult with NMFS and/or the USFWS (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.<sup>xiii</sup> 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.<sup>xiv</sup> 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. 50 C.F.R. § 402.14(i). 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 Corps will submit a biological assessment to the Services and initiated Section 7 consultation for the Project in February 2021. The Corps will consult with the Services under Section 7. Such consultation is anticipated to result in a biological opinion from each Service in November 2021.

#### **4.6. Fish and Wildlife Coordination Act**

The Fish and Wildlife Coordination Act 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.<sup>xv</sup> 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.<sup>xvi</sup>

Pursuant to FWS guidance,<sup>xvii</sup> 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 Corps initiated consultation with the FWS and the state under the Fish and Wildlife Coordination Act 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 and 37 acres on the Pass-A-Loutre (PAL) WMA. Funding for these crevasse projects is currently 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, funded 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 WM 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](mailto: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](mailto:atvmcdonald@wlf.la.gov)).

*Applicant Response:* CPRA agrees to Conservation Recommendation 1.

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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.

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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.

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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 list of contaminants to be analyzed would be taken from the most recent EPA Priority Pollutants and Contaminants of Concern (COC) list. 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).

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*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 and is actively coordinating with the Service regarding potential impacts to pallid sturgeon.

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 and is considering the species listed therein as part of the ongoing Endangered Species Act consultation with the Service.

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 an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at <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.

*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.

#### **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.<sup>xviii</sup> 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.<sup>xix</sup> EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.”<sup>xx</sup> Once designated, the MSA requires that federal agencies consult with NMFS regarding actions that may adversely affect EFH.<sup>xxi</sup>

The MSA consultation obligation is triggered when a federal action “may adversely affect” identified EFH.<sup>xxii</sup> 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.<sup>xxiii</sup> 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.<sup>xxiv</sup>

The Corps contacted NMFS regarding EFH consultation in December 2019 to notify NMFS that the Project may impact EFH. The Corps will provide an EFH assessment and requested EFH consultation with NOAA in February 2021. NMFS will issue a response to the EFH consultation in June 2021, and may make conservation recommendations at that time.

#### **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 USFWS 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. As such, 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. Based on this direction from Congress, on March 15, 2018, the Secretary of Commerce waived application of the MMPA to the Project 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, 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.

#### **4.9. National Historic Preservation Act**

The National Historic Preservation Act (NHPA) and its implementing regulations<sup>xxv</sup> 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 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.<sup>xxvi</sup>

The Corps sent a letter of introduction and invitation to informally begin the NHPA consultation process on October 21, 2016. The Corps 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 Corps initiated formal consultation between the ACHP, State Historic Preservation Officer (SHPO), and participating Tribal Nations.

The Corps 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.

Cultural resources surveys were conducted from August to October 2019 within the Construction Impacts APE and the Operational Impacts APE. The cultural resources surveys found: 1) no historic properties are within the Construction Impacts APE; 2) the majority of the 31 previously recorded archaeological sites within the Operational Impacts APE are submerged due to forces such as subsidence and erosion and, as a result, no longer contain integrity; 3) four (4) previously-recorded archaeological sites within the Operational Impacts APE do retain integrity despite impacts from subsidence and erosion and these 4 archaeological sites are historic properties eligible for listing in the NRHP; and 4) two (2) new archaeological sites were identified in the cultural resources survey of the Operational Impacts APE, but only one of these sites contains integrity but its NRHP eligibility is undetermined. Section 106 Consultation is

expected to conclude concurrent with the Final EIS or Record of Decision (ROD) with execution of a Programmatic Agreement. At that time, CPRA will update this Mitigation Plan to reference that Programmatic Agreement.

## **5. STEWARDSHIP MEASURES INCLUDED AS PART OF THE PROJECT**

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 river bed. (CPRA 2011; Allison et al. 2014).

The Project is designed to provide large-scale wetland restoration benefits while promoting 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 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.

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, intermediate, and brackish habitats near the diversion outflow. The 5,000 cfs base flow maximizes wetland benefits, resulting in approximately 30 percent more wetland area maintained and sustained because of the increase in fine materials transported, relative to a future without sediment diversion or an operation plan with no base flow after 50 years. The 5,000 cfs base flow effectively promotes the long-term sustainability of existing marshes and sustainability of newly created wetland habitats.

At the end of the 50-year analysis period, the Project is projected to create and sustain 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 species, increased shallow bottom habitat, net increase in 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 AND MITIGATION 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 under the NEPA environmental review include both structural and non-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) and environmental protection measures (EPMs) to minimize the impacts associated with the construction and operation of the Project on each element of the environment. Such BMPs and EPMs are described in Appendix A.

### **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 (i.e., riffle/pool complexes).

#### **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. The Project will also cause (1) moderate, short-term to permanent, adverse and beneficial impacts on existing wetland soils in the outfall area due to existing soils and associated ecological communities being buried (adverse impact), and new soils and ecological communities being established (beneficial impact); and (2) moderate, short-term, adverse erosion and loss of some emergent wetlands near the outfall transition feature (offset when total wetland impacts are considered over the life of the Project).

**Mitigation.** As discussed above, the Project itself is projected to create and sustain 12,700 acres of tidal wetland habitat in Barataria Basin through operation of the diversion by 2070. In addition to the wetland benefits built into the Project, CPRA will mitigate direct impacts (construction excavation and placement) to wetland soils to the extent practicable including both beneficial use placement and upland reuse (e.g. filling existing borrow pits).

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. The nearby disposal areas that have been identified currently exist as abandoned borrow pits that were excavated for Post-Katrina HSDRSS levee construction.

These abandoned borrow pits could be filled to mitigate pre-existing impacts to the landscape and congruent with landowner and Parish interests.

In the area of the outfall transition feature, if sufficient suitable upland or wetland soil is available during construction, the beneficial placement of these soils would occur in two locations currently occupied by open water in the basin. The placement of beneficial use materials would be designed to create new emergent wetland, nourish existing wetlands, or provide shallow habitat.

In the Basin, the selected construction access routes—to allow access channels for vessels, equipment, and material transport—will be 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 would 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 access channel.

### **6.3. Public Interest Mitigation – Clean Water Act Section 404, Rivers and Harbors Act Sections 10 and 408**

The purpose of the mitigation proposed 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.

#### **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 would be primarily limited to changes in bed elevation (siltation) that may occur in the Barataria Bay Waterway and Wilkinson Channel.

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.
- 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 canal to address impacts from the Project, or
  - implement outfall management measures to limit the loss of sediments to the waterway.

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- To the extent that Project operations lead to aggradation within Wilkinson Canal to a degree that inhibits navigation, and as long as Wilkinson Canal is being used for that purpose, CPRA may take one or more of the following actions to mitigate the identified Project impact:
  - adjust operations of the Project,
  - conduct maintenance dredging of the canal to address impacts from the Project, or
  - provide alternative boat access to Myrtle Grove and Woodpark communities.

Site Selection. Mitigation will occur at the site of the impact

6.3.2. Property Impacts

Impacts. Property related impacts from the Project are described in detail in Chapter 4 Section 20 of the DEIS, and briefly summarized below.

Inundation

In the absence of the Project, the properties in the tidal floodplain in the Project Area are subject to high rates of land subsidence and sea level rise, which has resulted in an increased frequency of nuisance flooding. With the implementation of the Project, the communities outside flood protection subject to increased water surface elevations or tidal durations could extend from the lower portion of Bayou Barataria to Grand Bayou (see Figure 6a). The majority of these areas are mapped as *Coastal High Hazard Areas*<sup>1</sup> (Figure 6b).

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<sup>1</sup> Coastal High Hazard Area - n area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. The coastal high hazard area is identified as Zone V on Flood Insurance Rate Maps (FIRMs) (<https://www.fema.gov/coastal-high-hazard-area>)

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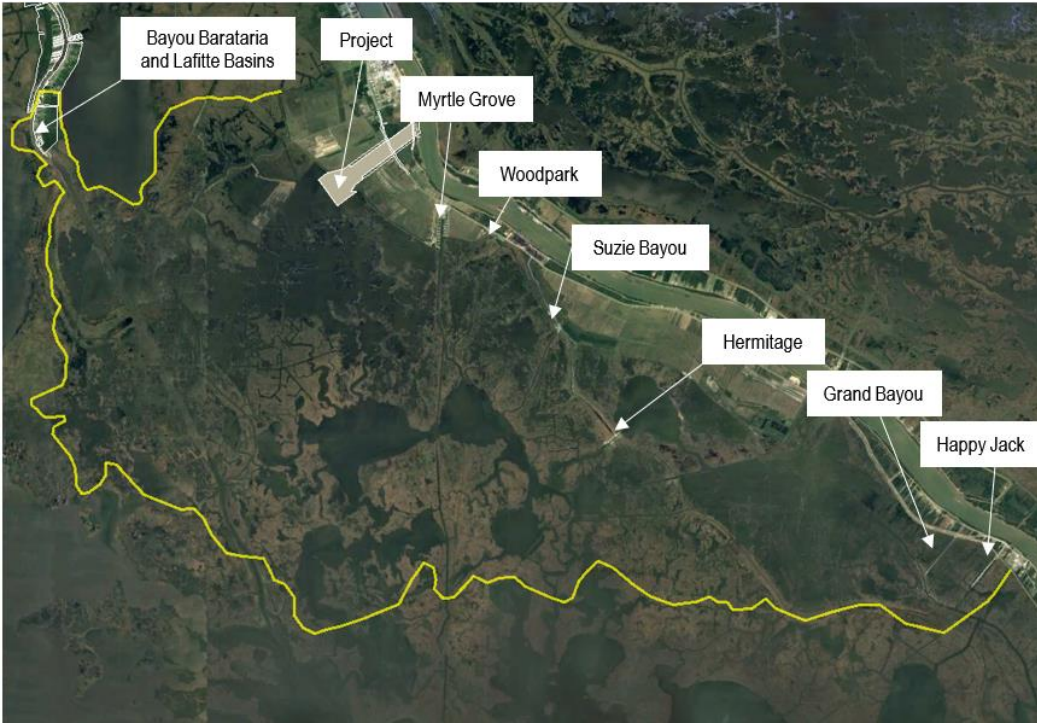


Figure 6a. Communities and subdivisions subject to potential inundation with the Project and the maximum extent of inundation impacts (yellow line).

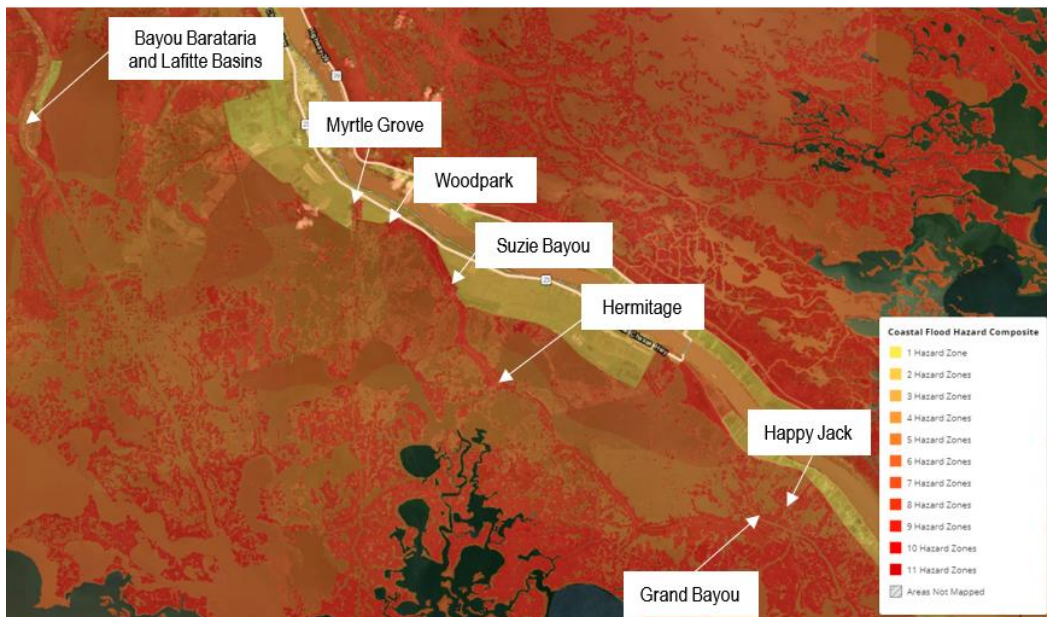


Figure 6b. The communities and subdivisions subject to potential inundation with the Project are largely designated as Coastal High Hazard Areas. Image and data from the NOAA Coastal Flood Exposure Mapper (<https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html>).

With the Project, there are foreseeable inundation impacts to properties that occur outside of a defined flood protection system. These properties generally occupy two land area categories (termed, *polderlands* and *tidelands*) that have different levels of exposure to tidal and meteorological flooding events:

### **Tidelands**

Tidelands properties (subdivisions) subject to additional inundation from the Project may include the following:

- Myrtle Grove
- Woodpark
- Suzie Bayou/Deer Range
- Hermitage
- Grand Bayou
- Happy Jack

These properties currently experience a low-to-moderate frequency of short duration and shallow flood events from astronomical and meteorological tides. Within the next 20 to 50 years, these communities are projected to be regularly flooded due to the effects of subsidence and sea level rise (SLR) irrespective of the Project.

In general, each of these subdivisions has parcels that rank from 8 to 10 (out of 11 total hazards) of the coastal flood hazard composite<sup>2</sup>. Hazard zones that are common to tidelands properties are described below, which shows a composite score of hazards that sum to 10 (also see Figure 6c).

#### Hazard Zones:

- FEMA Zones (% annual chance): V zone (1%) & A zone (1%) & 0.2%
- High Tide Flooding
- Sea Level Rise (Above MHHW): 1 ft & 2 ft & 3 ft
- Storm Surge (by Hurricane Category): 1 & 2 & 3

These subdivisions are occupied by residences and largely non-residential campsites, and other properties with storage structures. Although these properties are currently subject to *Plaquemines Parish Floodplain Management Regulations*<sup>3</sup> 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 those regulations.

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<sup>2</sup> See definition of Coastal Flood Hazard Composite (<https://coast.noaa.gov/data/digitalcoast/pdf/flood-exposure-faq.pdf>)

<sup>3</sup> The floodplain management regulations include: zoning ordinances, subdivision regulations, building codes, health regulations, and special purposes ordinances.

Project related impacts may include:

- shallow inundation of roads, driveways, non-habitable structures (e.g., carports, parking areas, storage structures), and property at grade
- variable duration of annual flood events and inundation depth depending on river stage and diversion operation capacity



Figure 6c. Example of tidelands properties in the Project area from the Myrtle Grove subdivision and the composite number of coastal hazards. Image and data from the NOAA Coastal Flood Exposure Mapper.

## Polderlands

These properties currently experience infrequent flooding events from astronomical and meteorological tides but are generally subject to inundation with tropical events (surge and wave height > 3 ft), additionally by intense rainfall, which may affect the pumping capacity and removal of floodwaters.

Polderland properties subject to Project inundation may include the following:

- Agricultural lands occurring between the Plaquemines Parish back levee and proposed location of the NOV-NF Levee 05a.1 (see Figure 6d)
- Lafitte Area Independent Levee District (tidal protection basins, TPB; Figure 6e)
  - Lower Barataria/Privateer Dr TPB
  - Lower LA 45 TPB



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Figure 6d. An example of agricultural polderlands that may be inundated with the Project, located within the Plaquemines Parish back levee. Under current conditions, the back levee is subject to breaching and overtopping and subsequent inundation of the polder when low intensity tropical storms with onshore winds that produce water levels > 3.5 ft. Image and data from the NOAA Coastal Flood Exposure Mapper.



Figure 6e. The Lafitte area tidal protection basins (polderlands) that have a marginal risk of being inundated by the Project are the Lower LA 45 (yellow) basin and the Lower Barataria basin (green). Other basins, such as Goose Bayou and Lower Lafitte, will have received upgraded tidal protection (>7.0 ft) prior to the Project operation.

**Mitigation.** CPRA is evaluating the areas that could be exposed to Project-related inundation and researching regulatory and policy issues that pertain to polderlands and tidelands in the Project area. A comprehensive inventory of potentially affected properties and land services planning is progressing under an assumption that CPRA would mitigate for inundation caused by the Project to properties, which could take the form of:

- Monitoring and adaptive management of operations
- Assisting property owners to elevate homes and other structures on private properties
- Property rights acquisition (e.g., flowage easement, fee acquisitions, or other). CPRA would prefer to acquire easement rather than acquiring full ownership of affected properties.
- Structural mitigation (e.g., elevating public roadways, utility upgrades, water control structures, or other structural measures to offset additional inundation)

**Site Selection.** Mitigation could occur at the site of the impact, or other locations where structural measures would reduce inundation, or through property rights agreements.

### 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 (NAA) and the Project related to loss of habitat primarily driven by changes the estuary's salinity structure. The oyster fishery is expected to experience major, permanent, adverse impacts under the Project relative to the NAA 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 is proposing options 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 to beneficial uses related to oyster harvest. Given that, it is assumed that any potential mitigation to the oyster resource is of benefit to the oyster industry and may 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 MBSD Adaptive Management Plan in order to appropriately site and scale the measure based on post-operational conditions. CPRA intends to 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 considering options to tailor these measures to ensure they reach those populations. This is further discussed in Section 6.3.8 below.

- **Re-establishment of Reefs within Public Seed Grounds**

Currently there are three public oyster areas within the Barataria Basin, the Hackberry Bay Seed Reservation, and the Little Lake and Barataria 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 Seed ground salinities are elevated to promoting deleterious impacts from disease and predation. Predictive modeling indicates that conditions within the Hackberry seed ground may be further lowered 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. The Monitoring and Adaptive Management 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.

- **Provision of Cultch Material**

Cultch material will be provided to the Louisiana Department of Wildlife and Fisheries for resource enhancement. This may be accomplished either on the public or private growing areas. It is anticipated that this material will be used to augment programs like the Public Seed Ground Cultch Plant program or those geared to leased production such as the Private Oyster Lease Rehabilitation Program.

- **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 now highlight that is not the case in many areas. To mitigate for potential future adverse changes in hydrology, circulation, and overall habitat from the MBSD Project, broodstock reefs may 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 the Monitoring Program, hydrologic data will be assessed to understand the salinity regime within the Basin, 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. Additionally, these reefs will be located, where possible, in shallow or intertidal areas to enhance that resource as well as protect new reefs from predators.

- **Alternative Oyster Aquaculture (AOC)**

To adjust to changing coastal conditions new techniques may 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 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 address mitigation for the potential effects of the MBSD Project on the oyster fishery within the Barataria Basin specific components of an AOC Program may include:

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 may be made available to procure equipment necessary to enter the alternative oyster aquaculture industry, including seed oyster production.

3. *Designated Use Areas*

The State recognizes that siting and permitting may be a barrier to entry in alternative oyster culture. Therefore, areas on state-water bottoms could be designated specifically for use by oyster growers engaged in alternative oyster culture 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.

- **Marketing**

A Marketing program in cooperation with the oyster industry and partners would further mitigate potential changes in harvest. Additionally, marketing will be a key component in the establishment of the AOC program and other efforts.

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, there are still several mitigation measures being proposed for implementation by the State to address these impacts. These measures 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 will work with the Seafood Promotion and Marketing Board and the Louisiana Finfish Task Force to 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.

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, an overall Project effect determination of a moderate to major permanent adverse impact to the commercial shrimp fishery is given. 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 is considering options to tailor these measures to ensure they reach those populations. This is further discussed in Section 6.3.8 below.

- **Vessel Refrigeration**

When discussing how the industry might best adjust to coastal change and restoration projects (LSF 2019) vessel refrigeration was repeatedly mentioned as strategy to help mitigate those changes. Equipping a vessel with 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. Modeled after previous state-run programs, grants can be made available to offset the cost of purchase and installation of the necessary equipment. This grant program would be initiated prior to start of project operation.

- **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).

- **Gear Improvements**

Grants may be made available to help offset costs of rigging vessels with different types of gear (for example skimmer to trawl) or substitute gears that would increase efficiency and therefore lower overall costs to the industry to mitigate for any realized changes in abundance of brown shrimp (e.g. spectra trawl to replace nylon trawl).

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

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employment or enhance revenue within current employment, respectively. This training would be made available to qualified participants within the commercial fishing industry.

Implementation of Aquatic Stewardship Measures. The table below outlines the details associated with the implementation of the aquatic/fisheries stewardship measures. Where possible, 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. Details for many of the Measures are not yet finalized and are reflected as such below.

<u>Measure</u>	<u>Location</u>	<u>Implementation Period</u>	<u>Program Status</u>	<u>Agency</u>
Re-establishment of Reefs within Public Seed Grounds	Barataria Basin	Operation	New	LDWF
Provision of Cultch Material	Barataria/Outside	Construction/ Pre-operation	Augment Existing program	LDWF
Provision of Broodstock Reefs to provide larval supply, as needed	Barataria	Operation	Companion to NRDA program	LDWF
Alternative Oyster Culture (AOC) <i>Introduction and Training</i>	Barataria/Outside	Pre-operation	Augment proposed program	LDWF
Alternative Oyster Culture (AOC) <i>Startup Assistance,</i>	Barataria/Outside	Pre-operation	Augment proposed program	LDWF
Alternative Oyster Culture (AOC) <i>Designated Use Areas</i>	Barataria/Outside	Pre-operation and Operation	Augment proposed program	LDWF
Marketing to Support the Oyster Industry	Industry	Pre-operation and Operation	Augment existing program	LDWF & Office of Lt. Governor
Marketing to Support the Finfish Industry	Industry	Pre-operation and Operation	Augment existing program	LDWF & Office of Lt. Governor
Grant Program to Equip Fishing Vessels with Refrigeration	Basin/Industry	Pre-operation and Operation	New	LDWF
Marketing to Support the Louisiana Shrimp Industry	Industry	Pre-operation and Operation	Augment existing program	LDWF & Office of Lt. Governor
Grant Program to Support Gear Change/Improvements	Basin/Industry	Pre-operation and Operation	Reproduce previous programs	LDWF

Workforce and Business Training for Commercial Fishers	Basin/Industry	Pre-operation	New	TBD
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#### 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 DEIS Chapter 4 Section 12. Effects determination for six of the ten listed species and designated critical habitat are anticipated to be *Not Likely to Adversely Affect* or *No Effect*. Effects determinations for the remaining four species (pallid sturgeon, green sea turtle, Kemp’s ridley sea turtle, and loggerhead sea turtle) are anticipated to be *Likely to Adversely Affect* and are anticipated to include:

- (1) Minor adverse effects to pallid sturgeon from underwater noise associated with pile driving in the River during construction.
- (2) Minor to moderate impacts 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.

Mitigation. Formal consultation may result in the identification of Reasonable and Prudent Measures (RPMs) and Terms and Conditions (T&C’s) to avoid and minimize effects to listed species and designated critical habitat. CPRA will undertake the RPMs and implement the T&C’s identified in the Services’ Biological Opinions for the Project.

#### 6.3.5. Non-ESA Listed Fish and Wildlife

Impacts. The MBSD Project anticipates benefiting the Barataria Basin with a basin wide increase of 12,684 marsh acres and near field (e.g., close proximity to the outfall) increase of 13,151 marsh acres (3,848 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 APE would directly impact 182.9 acres of jurisdictional wetlands and 266.3 acres of vegetated shallows (SAV) and other waters of the U.S. Of the 182.9 acres (-135.7 Average Annual Habitat Units AAHUs) of total permanent direct wetland impacts, 21.6 acres (-12.1 AAHUs) are of bottomland hardwood forest, 151 acres (-102.4 AAHUs) are of wet pasture, and 10.3 acres (-21.2 AAHUs) are of scrub/shrub. The Project is expected to benefit (nourish and restore) 13,151 acres (3,848 AAHUs) of marsh. Project benefits far outweigh the permanent loss in existing wetland function; thus offsetting the need for compensatory mitigation.



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 a portion, 926 acres of marsh is projected to be lost in the Delta National Wildlife Refuge (Delta NWR) and 37 acres on the Pass-A-Loutre Wildlife Management Area (PAL WMA) because of the reduced sediment being delivered to the area.

### 6.3.6 Marine Mammals

Impacts to Bottlenose Dolphins. Impacts on BBES dolphins 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 action alternatives would likely 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 consistent with the purposes and performance of the project) the Project's impacts on bottlenose. Given the dynamic conditions of any estuarine system, and the uncertainty around future conditions, the minimization measures will rely on the MBSD Monitoring and Adaptive Management Plan to inform future implementation.

State-wide Stewardship Measures. CPRA will also support non-operational stewardship measures to reduce existing and future threats to BSE and coastal dolphins throughout Louisiana. While these measures will 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,
- 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 Unusual Mortality Events**

As described in the DEIS, 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 UME 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 Essential Fish Habitat (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 DEIS Chapter 4 Section 10.3.3 and Section 10.4.3. Impact to EFH and managed species include:

- (1) Negligible to minor impacts from construction due to structure placement, dredging, and turbidity and sedimentation.
- (2) Major beneficial changes from conversion of less sensitive 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.

Mitigation. Formal consultation on EFH with NMFS may result in the identification of EFH Conservation Recommendations. CPRA will evaluate NMFS' conservation recommendations based on a scientific review of anticipated effects in relation to the recommended measures.

#### 6.3.8 Environmental Justice

Impacts. Impacts to Environmental Justice populations from the Project are described in detail in Chapter 4 Section 15 of the DEIS, and briefly summarized below.

The Project is projected to have minor to major impacts on populations near the Project outfall (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 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 in operational years before 2030, 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 to sea-level rise.

The Project is also projected to adversely impact 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. 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. 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 sustenance fishing. Additional measures may also be taken to address items such as wildlife viewing and other recreational activities.

CPRA is continuing to evaluate mitigation measures to address the unique vulnerabilities that minority and low-income commercial fishing populations may experience. Unique vulnerabilities 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.

CPRA is considering how the commercial shrimp and oyster fishing mitigation measures described in Section 6.3.3 above can be adapted to address the potential for disproportionately high and adverse impacts (e.g., equity considerations relating to: startup grants, workforce

training, shrimping vessel refrigeration and gear improvement grants, and overall fisheries workforce and business training).

In addition, CPRA will provide mitigation for potential tidal flooding and storm hazard impacts as explained in Section 6.3.2 above. These measures include the possibility of acquiring property interests ranging from fee title to flowage easements from affected property owners. CPRA would prefer to acquire easement rather than acquiring full ownership of affected properties. CPRA is also considering structural measures (e.g., elevating public roadways, utility upgrades, water control structures, or other structural measures to offset additional inundation) to reduce the tidal flooding and storm hazard impacts on communities near the Project outfall and outside of levee protection.

In addition, to address the potential for disproportionately high and adverse impacts from tidal flooding and storm hazards, CPRA is continuing to evaluate mitigation measures to address the unique vulnerabilities that minority and low-income populations may experience. Unique vulnerabilities include 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.

Consistent with CEQ's guidance regarding outreach and engagement to low income and minority populations, CPRA engaged in additional outreach to the low income and minority populations potentially impacted by increases in tidal flooding and storm hazards, as well as those low income and minority populations reliant on commercial or subsistence fishing, prior to issuance of the DEIS to seek their input on additional or alternative mitigation measures. CPRA is continuing to evaluate additional mitigation measures, including the feedback received through that outreach. CPRA further encourages and requests low income and minority populations that may be adversely impacted by the Project to provide comments on the mitigation measures identified in this Plan, and to identify alternative or additional mitigation measures to CPRA through their comments on the DEIS. CPRA will thereafter consider those measures and append this Mitigation Plan as appropriate.

#### 6.3.9 Cultural Resources

Impacts. Impacts to Cultural Resources from the Project are described in detail in Chapter 4 Section 23 of the DEIS, and briefly summarized below.

USACE determined, and consulting parties concurred, the Project will have an adverse effect on four (4) historic properties (archeological sites) eligible for the NRHP located within the Operational Impacts APE. 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, the Louisiana State Historic Preservation Office (SHPO), Federally-recognized Tribes, and the Advisory Council on Historic Preservation are currently consulting pursuant to Section 106 of the National Historic Preservation Act regarding the effects of the Project on historic properties in the APE. The consulting parties are developing a Programmatic Agreement (PA) for the Project. As currently proposed, the PA includes an alternative mitigation plan, agreed to by the Applicant, to resolve adverse effects within the Operational Impacts APE. That alternative mitigation plan includes a peer-reviewed scholarly ethnohistoric publication regarding Tribes in the Barataria Basin and larger Mississippi River Delta region, a compilation of information intended to only be available to Tribes, and public-facing components that may include a website or K-12 educational materials or other accessible materials providing greater information to the public-at-large. It also includes the agreed upon plan for monitoring Project impacts on cultural resources within the Operations Impacts APE as well as an unanticipated discoveries plan. CPRA anticipates that the PA will be executed concurrent with the Final EIS or Record of Decision (ROD).

## **7. PLAN IMPLEMENTATION**

### **7.1. Performance, Monitoring, Maintenance, and Adaptive Management**

Evaluation metrics and implementation guidance and goals are identified in the Monitoring and Adaptive Management Plan for the Project (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 would 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 MAM Plan.

The Mitigation Plan contains different types of mitigation with varying times to reach maturity or to become established. As such, the monitoring, maintenance, and adaptive management requirements for the different types of mitigation components vary. Some mitigation components provide immediate benefits and require no ongoing monitoring, maintenance efforts, and adaptive management. Other components will need to be monitored, maintained, and adaptively managed over time to ensure that they are achieving their intended effects.

Once construction is completed, CPRA will be responsible for monitoring the Project site mitigation areas, as set forth in the MAM Plan and until any performance goals are met and the Corps approves any required mitigation.

It is anticipated that some active management and maintenance activities would need to occur to maintain the long-term viability and sustainability of the proposed mitigation. Maintenance activities would occur on an as needed and/or as identified basis. CPRA will continue to monitor and maintain the site until the mitigation project has met its stated goals and objectives as confirmed by the Corps. It is anticipated that once the goals and objectives have been met, the mitigation site would be a self-sustaining system.

If monitoring reports comparing mitigation progress to performance standards indicate that mitigation progress is falling short of the identified performance standards, consultation with the Corps would be initiated regarding the need for adaptive management.

## 8. FINANCIAL ASSURANCES

If the *Deepwater Horizon* Louisiana Trustee Implementation Group (LA TIG) decides to fund the Project, that funding will include an allocation of funds adequate to ensure each component of this Mitigation Plan will be funded as part of the LA TIG's funding decision.

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<sup>i</sup> 33 C.F.R. § 320.4.

<sup>ii</sup> 33 C.F.R. § 320.4.

<sup>iii</sup> 33 C.F.R. § 320.4(r).

<sup>iv</sup> 40 C.F.R. § 230.93(a)(1).

<sup>v</sup> 33 C.F.R. Part 332; 40 C.F.R. Part 230.

<sup>vi</sup> 40 C.F.R. § 230.93(a)(1).

<sup>vii</sup> 40 C.F.R. § 230.93(e).

<sup>viii</sup> 40 C.F.R. § 230.93(e).

<sup>ix</sup> 40 C.F.R. § 230.93(b)(4).

<sup>x</sup> 40 C.F.R. § 230.93(m).

<sup>xi</sup> 33 U.S.C. § 408(a).

<sup>xii</sup> U.S. Army Corps of Eng'rs, 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](https://www.publications.usace.army.mil/Portals/76/Publications/EngineerCirculars/EC_1165-2-220.pdf?ver=2018-09-07-115729-890).

<sup>xiii</sup> 50 C.F.R. § 402.14(g)(3), (4).

<sup>xiv</sup> 50 C.F.R. §402.02.

<sup>xv</sup> 16 U.S.C. § 662.

<sup>xvi</sup> 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.”)

<sup>xvii</sup> 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.

Mid-Barataria Sediment Diversion  
Draft Mitigation and Stewardship Plan  
January 29, 2021  
Subject to Change

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<sup>xviii</sup> 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).

<sup>xix</sup> 16 U.S.C. § 1853(a)(7).

<sup>xx</sup> *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).

<sup>xxi</sup> 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).

<sup>xxii</sup> 16 U.S.C. § 1855(b)(2).

<sup>xxiii</sup> NMFS, Essential Fish Habitat Consultation Guidance, Version 1.1 (2004).

<sup>xxiv</sup> 16 U.S.C. § 1855(b)(4).

<sup>xxv</sup> 36 C.F.R. part 800.

<sup>xxvi</sup> 36 C.F.R. § 800.6.

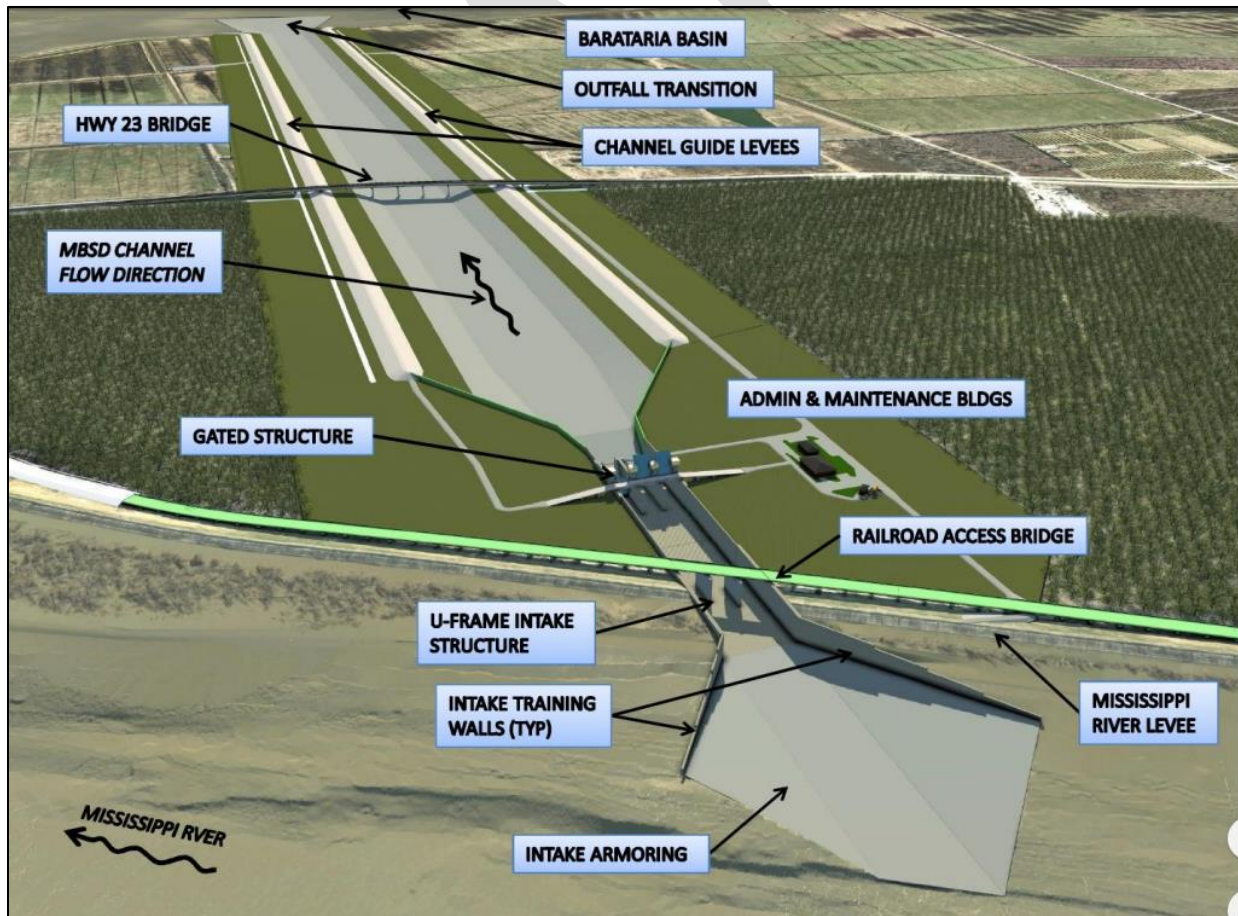
## **R2: Monitoring and Adaptive Management Plan (MAMP)**





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# Revised Draft of the Initial MONITORING AND ADAPTIVE MANAGEMENT PLAN FOR THE MID-BARATARIA SEDIMENT DIVERSION PROJECT (CPRA PROJECT NUMBER BA-0153)



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201 **LIST OF ACRONYMS**  
202

Acronym	Description	Page First Used
ADCIRC	Advanced Circulation Model	12
ADCP	Acoustic Doppler Current Profiler	29
AM	Adaptive Management	1
AMO	Atlantic Multi-decadal Oscillation	5
AMT	Adaptive Management Team	14
APA	Applicant's Preferred Alternative	22
BACI	Before-After-Control-Impact (Study)	21
BBES	Barataria Bay Estuarine Stock	60
BICM	Barrier Island Comprehensive Monitoring	24
CASM	Comprehensive Aquatic Systems Model	12
CEM	Conceptual Ecological Model	4
cfs	Cubic Feet per Second	22
Chl	Chlorophyll	8
CIMS	Coastal Information Management System	85
CMP	Coastal Master Plan	2
CMR	Capture Mark Recapture	61
CoNED	Coastal National Elevation Database	37
CPRA	Coastal Protection and Restoration Authority	1
CRHA	Capture Release Health Assessment	61
CRMS	Coastwide Reference Monitoring System	21
CTD	Conductivity/Temperature/Depth	32
DEIS	Draft Environmental Impact Statement	1
DIVER	Data Integration, Visualization, Exploration, and Reporting	86
DMT	Data Management Team	82
DWH	Deepwater Horizon	1
DO	Dissolved Oxygen	8
DRP	Draft Restoration Plan	1
E&D	Engineering and Design	10
EIS	Environmental Impact Statement	11
ENSO	El Niño Southern Oscillation	5
EwE	Ecopath with Ecosim (and Ecospace) Model	12
FIMP	Fisheries-independent Monitoring Plan	22

204 **LIST OF ACRONYMS (continued)**

205

Acronym	Description	Page First Used
FWOP	Future Without Project	12
FWP	Future With Project	12
GRSLR	Gulf-regional Sea Level Rise	5
HCAB	Harmful Cyanobacterial and/or Algal Bloom	53
HSI	Habitat Suitability Index	11
IMPLAN	Impact Analysis for Planning	13
LA TIG	Louisiana Trustee Implementation Group	1
LCA	Louisiana Coastal Area (Ecosystem Restoration Study)	12
LDEQ	Louisiana Department of Environmental Quality	19
LDWF	Louisiana Department of Wildlife and Fisheries	19
LiDAR	Light Detection and Ranging	37
LMRFC	Lower Mississippi River Forecasting Center	29
LOI	Loss on Ignition	44
MAM	Monitoring and Adaptive Management	1
MMSN	Marine Mammal Stranding Network	62
MR	Mississippi River	3
MR&T	Mississippi Rivers & Tributaries Project	5
MRHDMS	Mississippi River Hydrodynamic and Delta Management Feasibility Study	12
N	Nitrogen	32
NFWF	National Fish and Wildlife Foundation	2
NOAA	National Oceanic and Atmospheric Administration	25
NRDA	Natural Resource Damage Assessment	1
NTU	Nephelometric Turbidity Unit	55
OM&M	Operations, Maintenance and Monitoring	81
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation	1
OMT	Operations Management Team	17
P	Phosphorus	32
PDARP	Programmatic Damage Assessment and Restoration Plan	1
PDDA	Project Delta Development Area	22
PDT	Project Design Team	12
PEIS	Programmatic Environmental Impact Statement	1

206 **LIST OF ACRONYMS (continued)**  
 207

Acronym	Description	Page First Used
PIA	Project Influence Area	22
QA/QC	Quality Assurance/Quality Control	18
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act	2
RM	River Mile	36
RSET	Rod Sediment Erosion Table	46
RSLR	Relative Sea Level Rise	5
S	Sulfur	32
SAV	Submerged Aquatic Vegetation	8
SLR	Sea Level Rise	2
SME	Subject Matter Expert	19
SWAMP	System Wide Assessment and Monitoring Program	21
TC	Total Carbon	45
TN	Total Nitrogen	45
TP	Total Phosphorus	45
TSS	Total Suspended Sediments	8
TWIG	The Water Institute (of the Gulf)	2
UAS	Unmanned Aircraft System	61
USACE	United States Army Corps of Engineers	1
USFWS	United States Fish and Wildlife Service	88
USGS	United States Geological Survey	29
WY	Water Year	81

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210 **1. INTRODUCTION**

211

212 **1.1. Purpose of the Project Monitoring and Adaptive Management Plan**

213

214 Following the 2010 Deepwater Horizon (DWH) explosion and oil spill, the Natural Resource Damage  
215 Assessment (NRDA) Trustees identified implementation of monitoring and adaptive management  
216 (MAM) as one of the NRDA programmatic goals in the Final Programmatic Damage Assessment and  
217 Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS; DWH Trustees,  
218 2016). As described therein, the MAM Framework provides a flexible, science-based approach to  
219 implement effective and efficient restoration over several decades and to provide long-term benefits to  
220 the resources and services injured by the DWH oil spill. This MAM plan for the Mid-Barataria Sediment  
221 Diversion Project (the Louisiana Coastal Protection and Restoration Authority’s (CPRA’s) Project Number  
222 BA-0153; hereafter ‘the Project’), has been drafted by the State and federal Project partners on the  
223 Louisiana Trustee Implementation Group (LA TIG).

224

225 This MAM plan serves as a companion to the Project Draft Phase II Restoration Plan (DRP); the Project  
226 Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Plan; and the Project  
227 Mitigation Plan prepared for the Project’s draft Environmental Impact Statement (DEIS). This MAM plan  
228 provides a framework for adaptive management (AM) decision-making and implementation that:

229

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

253

254 MAM Plans are by nature living documents and never “final”. This Plan will be “draft” at least until if,  
255 and if so when, the US Army Corps of Engineers (USACE) New Orleans District issues approval and  
256 issuance of the permits and authorizations required for the Project. CPRA at that point will then add any

257 Compliance Monitoring requirements contained in those permits to this Plan.

258

259 **1.1.1. Purpose of Adaptive Management**

260

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

266

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

271

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

283

284 **1.1.2. Overview of CPRA Programmatic Adaptive Management**

285

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

294

295 In March 2018, the LA TIG funded a project focused on formalizing programmatic AM for restoration in  
296 coastal LA by describing the status of, and identifying opportunities for, institutionalizing AM within  
297 CPRA and the LA TIG. That work, conducted in partnership with The Water Institute of the Gulf (TWIG),  
298 was intended to integrate across the multiple implementing mechanisms (e.g., CPRA, LA TIG, the  
299 Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf  
300 Coast States Act (RESTORE) Program, National Fish and Wildlife Foundation (NFWF) Gulf Environmental  
301 Benefits Fund) (The Water Institute of the Gulf, 2020). CPRA’s programmatic AM will create a structure  
302 and process for building institutional knowledge, iteratively incorporating new information that  
303 continually improves our system understanding, facilitating informed adjustment of management



304 actions, and improving decision-making to help achieve the long-term sustainability of our coast, and  
305 will build the knowledge base by engaging stakeholders and through internal and external  
306 communication. The goal of CPRA programmatic AM is to maximize the success of the coastal  
307 protection and restoration program by utilizing robust decision-making.  
308

### 309 **1.1.3. Project-Level Adaptive Management**

310  
311 Project AM is particularly important because of its scale and scope. Project-level AM focuses on  
312 identifying project uncertainties (Section 1.4) and, where feasible reducing those uncertainties through  
313 project design, scientific analysis, or monitoring to inform management actions. Conceptual (Section  
314 1.3) and numerical modeling (Section 1.5) provides the expectations against which MAM Plan  
315 monitoring (Section 3) and evaluation (Section 4) has been developed, both with regards to anticipated  
316 Project effects and the constantly changing baseline. As outlined in Section 4, monitoring data and  
317 associated assessments will inform AM evaluations, decisions, and actions.  
318  
319

## 320 **1.2. Restoration Type Goals, Project Purpose and Need, and Project Restoration Objectives**

321  
322 The DWH oil spill caused extensive impacts to marsh habitats and species in Louisiana. These habitats  
323 have a critical role in the overall productivity of the northern Gulf of Mexico. In DWH Trustees (2016),  
324 the DWH Trustees found that coastal and nearshore habitat restoration is the most appropriate and  
325 practicable mechanism for restoring the ecosystem-level linkages disrupted by this spill. Nearshore  
326 habitats provide food, shelter, and nursery grounds for numerous ecologically and economically  
327 important species, including fish, shrimp, crabs, sea turtles, birds, and mammals.  
328

329 The overall programmatic goal for the Project is to Restore and Conserve Habitat. The Restoration Type  
330 is Wetlands, Coastal, and Nearshore Habitats Restoration. The goals of this Restoration Type, outlined in  
331 Section 5.5.2.1 of the PDARP/PEIS (DWH Trustees, 2016) are to:  
332

- 333 • Restore a variety of interspersed and ecologically-connected coastal habitats in each of the five  
334 Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological  
335 functions for the range of resources injured by the spill, such as oysters, estuarine-dependent  
336 fish species, birds, marine mammals, and nearshore benthic communities.
- 337 • Restore for injuries to habitats in the geographic areas where the injuries occurred, while  
338 considering approaches that provide resiliency and sustainability.
- 339 • While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore  
340 habitats in appropriate combinations for any given geographic area. Consider design factors,  
341 such as connectivity, size, and distance between projects, to address injuries to the associated  
342 living coastal and marine resources and restore the ecological functions provided by those  
343 habitats.  
344

345 The Project’s purpose and need, as articulated in the DEIS, is:  
346

347 “... to restore for injuries caused by the DWH oil spill by implementing a large-scale sediment  
348 diversion in the Barataria Basin that will reconnect and re-establish sustainable deltaic processes  
349 between the Mississippi River [MR] and the Barataria Basin through the delivery of sediment,  
350 freshwater, and nutrients to support the long-term viability of existing and planned coastal

351 restoration efforts. The proposed Project is needed to help restore habitat and ecosystem  
352 services injured in the northern Gulf of Mexico as a result of the DWH oil spill.”

353

354 Specific restoration objectives for the Project are to

355

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

362

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

365

366

### 367 **1.3. Conceptual Ecological Model**

368

#### 369 ***1.3.1. Purpose of the Conceptual Ecological Model***

370

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

377

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

384

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

390

#### 391 ***1.3.2. Components of the Conceptual Ecological Model***

392

393 To inform this Plan, the Project partners developed a driver-stressor type of CEM (Fischenich 2008) that  
394 generally follows the top-down hierarchy similar to CEMs developed for Louisiana Coastal Area Program  
395 projects (e.g., CPRA and USACE, 2010, 2011). This CEM identifies specific external *Drivers* and *Stressors*  
396 on the existing Barataria Basin, the *Effects* of those drivers, or processes occurring within the ecosystem,  
397 and the physical, chemical, biological, and/or ecological *Attributes* that can best serve as indicators of

398 ecosystem condition. In doing so, the CEM helps identify the specific parameters to monitor to assess  
399 ecosystem change (both benefits and impacts) resulting from the proposed actions.

400

401 *1.3.2.1. Drivers*

402

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

405

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

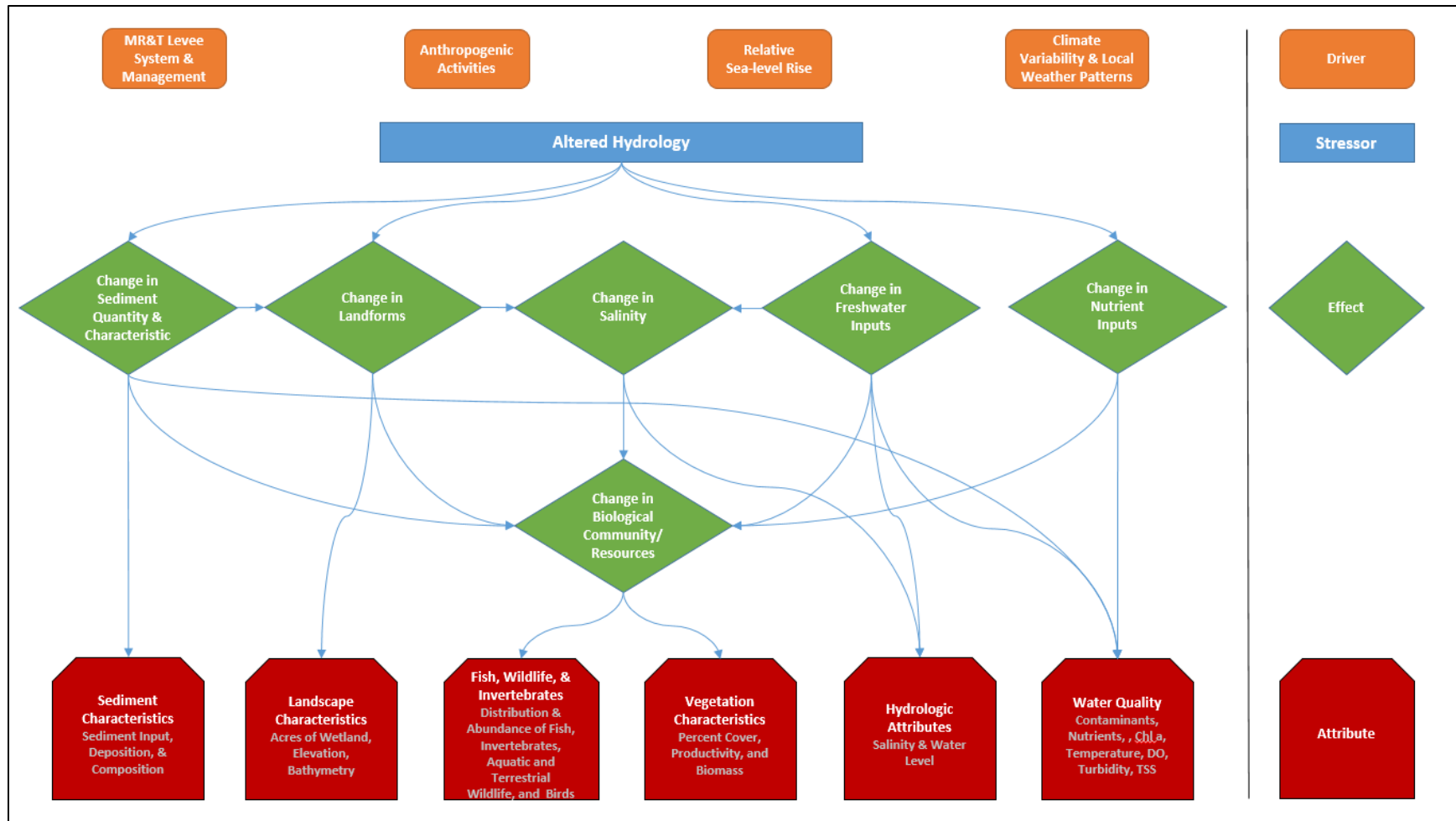
436

437 *1.3.2.2. Stressors*

438

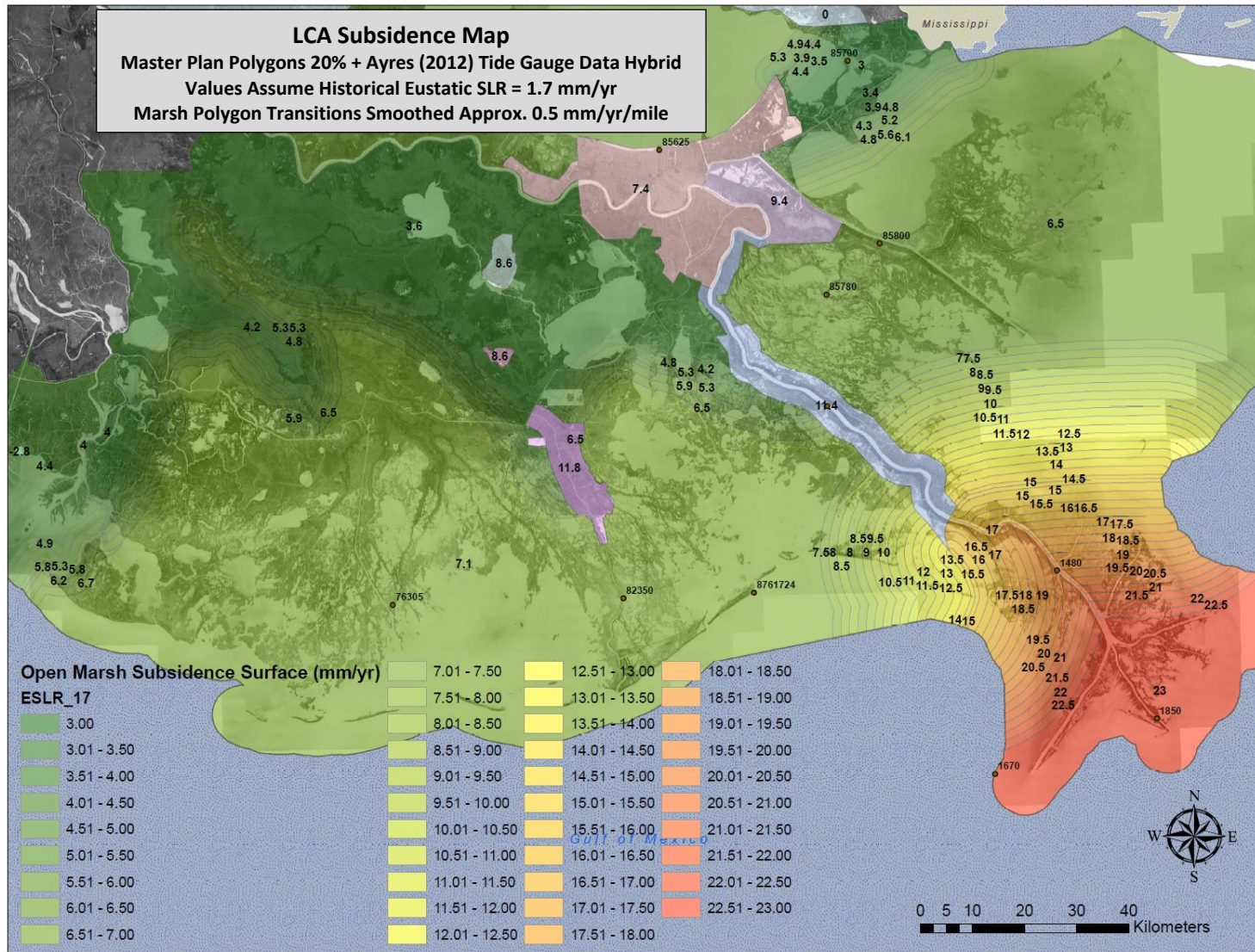
439 Stressors are natural systems physical or chemical changes produced or affected by drivers, and are  
440 directly responsible for significant changes in biological components, patterns, and relationships in  
441 natural systems. Altered hydrology is the primary stressor manifested in Barataria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

445



446  
447  
448  
449

**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.



450  
 451 **Figure 1.3-2.** Estimates of plausible, spatially-variable subsidence developed for the Louisiana Coastal Area Program Delta Management Feasibility Study  
 452 investigations were used as inputs for the Delft3D Basin-wide Model-based Project alternatives analysis.  
 453

454 1.3.2.3. *Effects*

455

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

464

465 1.3.2.4. *Attributes and Relevant Monitoring Parameters*

466

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

472

- 473 • Landscape Characteristics
  - 474 ○ Acres of Wetland, by type (freshwater swamp; fresh + intermediate, brackish, and salt
  - 475 marsh; submerged aquatic vegetation (SAV), etc.)
  - 476 ○ Wetland Surface Elevation
  - 477 ○ Estuarine Open Waterbody Bathymetry
- 478 • Sediment Characteristics
  - 479 ○ Sediment Input
  - 480 ○ Organic Matter Composition
  - 481 ○ Mineral Sediment Composition
- 482 • Fish, Wildlife & Invertebrates
  - 483 ○ Distribution and Abundance of Fish, Invertebrates, Aquatic and Terrestrial Wildlife
  - 484 (including dolphin health), and Birds
  - 485 ○ Alligator Nest Success
- 486 • Vegetation Characteristics
  - 487 ○ Percent Cover
  - 488 ○ Productivity
  - 489 ○ Biomass
- 490 • Hydrologic Attributes
  - 491 ○ Salinity
  - 492 ○ Water Level
- 493 • Water Quality
  - 494 ○ Contaminants
  - 495 ○ Nutrients
  - 496 ○ Chlorophyll (Chl) a
  - 497 ○ Temperature
  - 498 ○ Dissolved Oxygen (DO) Content
  - 499 ○ Turbidity
  - 500 ○ Total Suspended Sediments (TSS)

501 1.3.2.5. *Use of the Conceptual Ecological Model*

502

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

508

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

510

511 “Levees may lead to

512 →Altered Hydrology, which may result in a

513 →Change in Freshwater Inputs, which can be monitored through

514 →Hydrologic Attributes.”

515

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

519

520 “Climate Change may lead to

521 →Altered Hydrology, which may result in a

522 →Change in Sediment Quantity & Characteristic, which may result in a

523 →Change in Landforms, which may result in a

524 →Change in Salinity, which may lead to a

525 →Change in Biological Community and/or Resources,  
526 which can be monitored through

527 →Vegetation Characteristics.”

528

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

533

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

540

541

542 **1.4. Sources of Critical Uncertainty**

543

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

549 partners strove to account for those uncertainties, they do remain, and constrain both the conceptual  
550 and numerical modeling frameworks

551

#### 552 **1.4.1. Environmental Driver Uncertainties**

553

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

565

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

573

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

581

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

590

#### 591 **1.4.2. Uncertainty in the Degree of Altered Hydrology (Stressor)**

592

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



597 important assumption governing Project structure operations, in that it drives the presumed head  
598 differential, is the MR hydropattern. For the alternatives analyses in support of the Environmental  
599 Impact Statement (EIS), the historical 1964-2013 Mississippi River hydrograph was put into the Basin-  
600 wide Model as the MR condition for the 2020-2070 Project analysis period. It is highly likely, if not a  
601 near certainty, that the 1964-2013 hydrograph will not be the actual river condition during the first 50  
602 years of Project operations. Thus, the actual schedule of opening and closing the diversion beyond the  
603 base flow remains highly uncertain because it will depend on actual MR stages throughout the Project's  
604 operational life.  
605

#### 606 **1.4.3. *Uncertainties in Responses of Environmental Resources to Project Inputs***

607  
608 There is a substantial amount of uncertainty surrounding individual physical and ecological phenomena  
609 represented in the CEM. Uncertainties of environmental resource response predominantly lie within  
610 the effectiveness of the diversion in transporting riverine sediment, freshwater, and nutrients into the  
611 receiving basin. Uncertainties associated with the calculations of critical model variables and how they  
612 influence key model outputs remain. The actual balance between land building and water quality  
613 impacts is also uncertain. Continued baseline and future effectiveness monitoring (Section 3) will  
614 improve the predictability of resource response. Future marsh experiments in controlled environments  
615 and in greenhouses, such as those conducted in the past by Graham and Mendelssohn (2014) and  
616 Poormahdi et al. (2018), can lead to a better understanding and predictability of how forming delta  
617 marshes incorporate the sediment and nutrients from the diversion. For now, uncertainties will be  
618 cataloged by the Project AM team (Section 12) for determination of priority and source of funding.  
619

#### 620 **1.4.4. *Uncertainties in Human Systems Response***

621  
622 Human community or socio-economic attributes (also known as human dimensions data) are priority  
623 datasets for management decision-making. However, the complexity in meaningfully collecting  
624 sociological data and the substantial uncertainty in either conceptual or numerical models has generally  
625 limited their formal inclusion in AM schemes.  
626

627 Outputs from the Habitat Suitability Index (HSI) models, and even some of the Delft model outputs, are  
628 generally incompatible with available human system models, which ideally would be used to project  
629 catch or some other measure of resource exploitation based on population size, on which to underpin  
630 subsequent socioeconomic effects. As well, there is, in general, a very high degree of uncertainty in  
631 trying to model human response to projected biophysical and resource changes in either individuals or  
632 communities. Critical to this uncertainty is the ability or willingness to adapt, both of which can vary  
633 widely between communities, and even between individuals within a particular community.  
634  
635

### 636 **1.5. Use of Numerical Models within Project Adaptive Management**

#### 637 638 **1.5.1. *Numerical Models Used in Project Planning***

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

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- 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.

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- 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.

698 The uncertainty structure around the model suite was a factor of

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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.

709 Uncertainties associated with any one model in the modeling suite perpetuate with information

710 exchange with the next subsequent model, and so the total uncertainty compounded for any one

711 alternative was evaluated through the sequence of models. Evaluations of the results of individual

712 models without the acknowledged compounding uncertainty from previous models risk subsequent

713 false assumptions of model output precision.

714

715 In the case of alternatives modeling for the Project EIS, there were uncertainties in the input datasets

716 feeding the Basin-wide Model, and inherent limitations in the model to predict salinities, water levels,

717 land building, and other outcomes. Model outputs should therefore be considered projections, not

718 predictions, because they represent *what would have happened* had the set of conditions in the model

719 been in place at the onset of a particular model production run, rather than a guarantee of *what will*

720 *happen*. Accordingly, alternatives analysis was, for the most part, limited to the comparison between

721 alternatives, e.g., FWP vs. FWOP, or FWP alternative A vs. FWP alternative B.

722

723 CPRA therefore prefers that the numerical modeling conducted for the DEIS not be used directly or

724 solely to establish specific temporal benchmarks of project performance upon which the Project MAM

725 plan will be based. These projections better serve as order-of-magnitude comparative benchmarks for a

726 constrained set of biophysical parameters (e.g., amount of sediment transported through the Project

727 structure), with perhaps some adjustment to acknowledge the model uncertainties.

728

729 **1.5.2. Use of Data and Numerical Models to Inform Project Monitoring and Adaptive**

730 **Management**

731

732 Complex models such as the CASM and EwE ecosystem models listed above are also useful for

733 identifying proxy variables for monitoring when the specific metric of interest cannot feasibly or

734 effectively be monitored directly. For example, the EwE and CASM models will be used to identify

735 additional future monitoring parameters, locations, and frequency (e.g., long-term biomass monitoring,

736 lower trophic level organisms, detritus) to evaluate the Project’s influence on food web dynamics.

737 Those additional monitoring parameters may be incorporated into this MAM plan.

738

739 Numerical considerations of the data for monitoring parameters binned as Range variables in Section 4  
740 could also be informed by historical data from within the Barataria Basin, although Project operations  
741 may lead to data values in time and space outside the available historical ranges. For the remainder of  
742 the objectives-related monitoring parameters outlined in Section 3, trends from the modeling are likely  
743 more appropriate points of comparison. Operational planning will occur on an annual cycle, allowing an  
744 AM approach to test and understand the most effective actual operation of the diversion, considering  
745 the uncertainties of annual river flow and how the climate and weather patterns drive basin hydrology.  
746

747 Throughout the operational life of the diversion, CPRA will periodically utilize numerical modeling to  
748 better examine system responses, confirm project performance assumptions that are not directly  
749 measurable, and test the potential effects of adaptive operational modifications. The schedule for that  
750 modeling will depend on the frequency of Project operations and evaluations of the supporting  
751 monitoring data (Section 4).  
752

753 The Project Adaptive Management Team (AMT) will utilize the most appropriate modeling tools to  
754 address AM-related questions. Currently, the CASM and EwE models are being used to assess baseline  
755 condition and in the future may be used to assess project-driven effects such as potential changes to  
756 aquatic biodiversity, trophic linkages and pathways, and overall assemblage structure. Additional  
757 refinements may be made to make the models more suitable for evaluating potential adaptive  
758 management actions. To accomplish this, additional modifications to the current ecosystem modeling  
759 tools must be accomplished to determine model predictive ability to examine potential adaptive  
760 management options. Initially, the AMT will focus on the EwE and CASM models used in project  
761 planning. In the future, the team may evaluate additional models for use in adaptive management.  
762

763 To address the use of the models to predict changes under with-project conditions the EwE and CASM  
764 models will undergo sensitivity analyses to analyze response of the modeled food web to changes in  
765 salinity. A specific series of steps for a multi-model analysis will be identified to improve predictive  
766 capabilities and enable bracketing of the uncertainty associated with model projections. For example,  
767 two benthic-to-pelagic metrics, biomass and productivity, will be added as output to the two models  
768 and examined as time-series outputs including inter-annual and seasonal variability, in order to  
769 understand whether the metrics are sensitive to year-specific conditions or instead are very consistent  
770 between years and therefore unlikely to vary in the future. The variability in these metrics will then  
771 undergo a statistical analysis to relate them to the environmental conditions used as input to the  
772 models. New simulations will be performed by varying environmental conditions in a systematic way in  
773 order to attribute responses of the food web to changes in salinity  
774

775 The EwE and CASM models described above will be periodically updated with data collected during pre-  
776 operations and post-construction of the Project. Pre-operations data will be used to refine responses of  
777 the individual components to environmental drivers. Post-construction monitoring data will be  
778 incorporated into model refinement to test, predict, and evaluate responses under with-project  
779 conditions.  
780

781 Periodic evaluations of the models listed in Section 1.5.1, updates to working models including  
782 incorporation of new data, the state of the science regarding new models that may be developed over  
783 the Project life, and the appropriate use of those existing or new models, will be planned and led by the  
784 AMT.  
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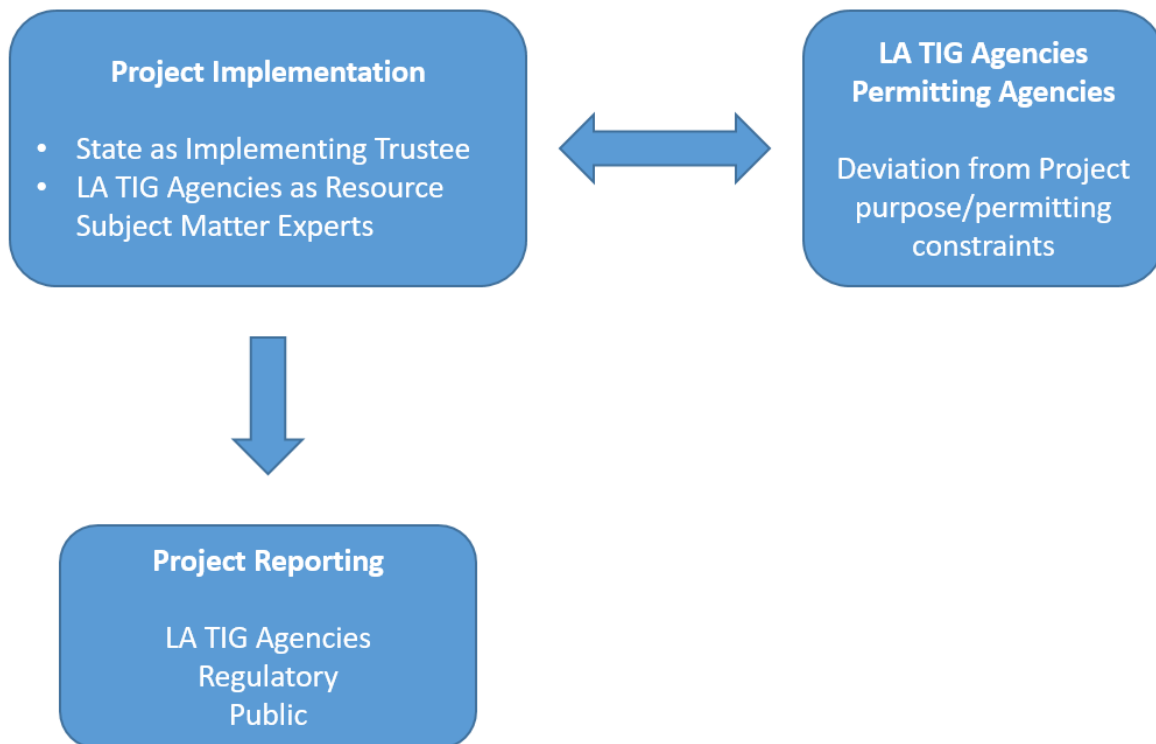
787 **2. PROJECT OPERATIONAL AND ADAPTIVE MANAGEMENT GOVERNANCE**

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789 **2.1. Description and Scope**

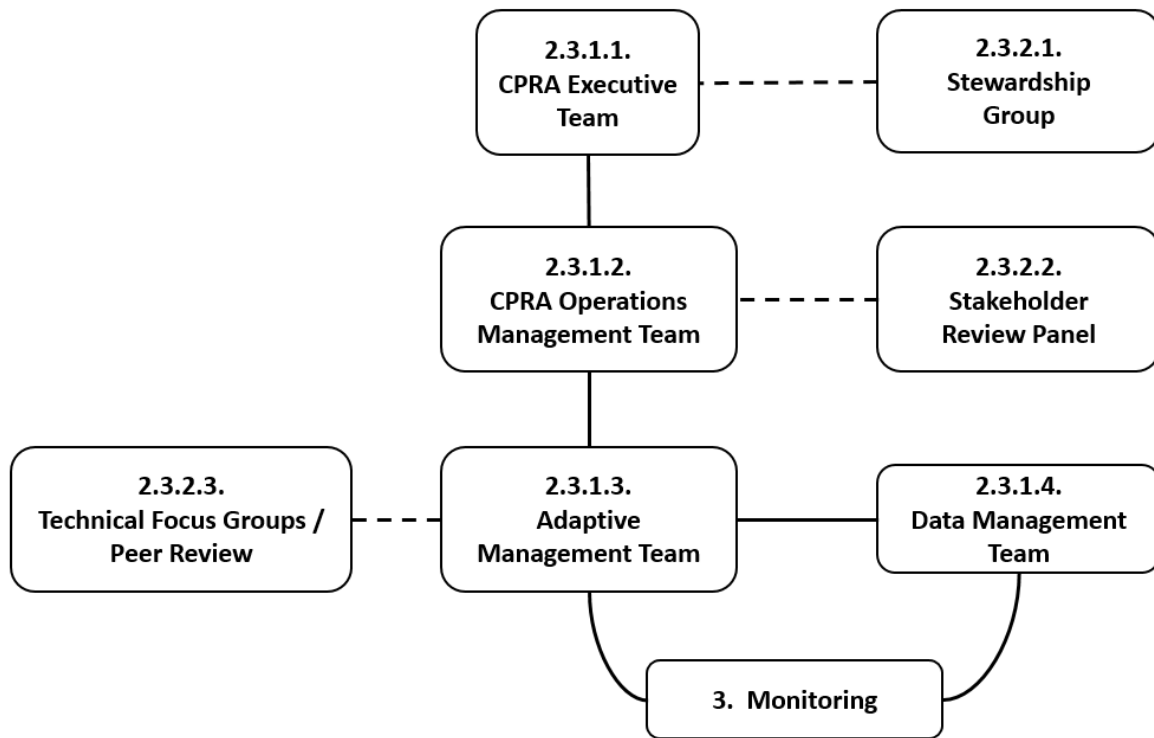
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791 This section outlines the makeup, roles and responsibilities of the State of Louisiana (CPRA) as the NRDA  
792 Implementing Trustee responsible for the governance of the Project, as well as the non-State entities  
793 that will inform the implementation of this plan. Figure 2.1-1 shows the general relationship between  
794 CPRA as the Implementing Trustee and the LA TIG. CPRA will have responsibility for the operation of the  
795 Project, within the limits of the permits and permissions granted to the Project and within the Project  
796 purpose, as found in the PDARP (DWH Trustees, 2016), and subsequent Restoration Plans that examine  
797 and authorize the Project. Proposals for operations or adaptive management decisions that would be  
798 outside the Project purpose or permitted constraints would require consultation with the LA TIG  
799 Agencies and Regulatory authorities.  
800



801 **Figure 2.1-1.** Relationship between the State of Louisiana and the LA TIG regarding governance of Project  
802 operations and adaptive management decision making. Section 7 contains information on Project Reporting.  
803  
804

805 In the context of the Project, governance refers to how CPRA, with input from other stakeholders, will  
806 make decisions over the life of the Project (Figure 2.1-2). Decisions will include, but not be limited to,  
807 continuation of and changes to Project operations, riverside management, monitoring, maintenance,  
808 and adaptive management actions.  
809



810  
 811 **Figure 2.1-2.** Information flow between the Project governance elements outlined in this section. Numbers refer  
 812 to sections of text that further describe each governance element or activity. Solid lines indicate information flow  
 813 underpinning CPRA Project operations and adaptive management decision making. Dashed lines indicate advisory  
 814 opportunities from outside CPRA.

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## 817 **2.2. Data and Information Requirements**

818

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

821

- 822 • A Monitoring Plan that outlines monitoring for sediment delivery efficiency and both ecological  
 823 and sociological response.
- 824 • Data Analysis: The AMT (2.3.1.3) will analyze the Project data. A data analysis plan that  
 825 provides details on when, where, and how data will be analyzed and what will be produced as a  
 826 result of the assessment(s).
- 827 • Project-specific recommendations for adaptive management actions based on the data  
 828 assessments, with input from the Technical Focus Groups (2.3.2.3) as needed. Draft  
 829 recommendations will be assembled into a draft operations plan. It will be important to address  
 830 and incorporate, to the extent practicable, public input into the operation plan early in the  
 831 process.
- 832 • A Data Management Plan to describe how Project-specific data need to be managed to  
 833 facilitate analysis (Section 7 of this Plan).

834

835 **2.3. Governance Structure**

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837 **2.3.1. Project Implementation Teams**

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839 **2.3.1.1. CPRA Executive Team**

840

841 **2.3.1.1.1. Membership**

842

- 843 • Executive Director
- 844 • Deputy Executive Director
- 845 • Engineering Division Chief
- 846 • Operations Division Chief
- 847 • Planning & Research Division Chief
- 848 • Project Management Division Chief

849

850 **2.3.1.1.2. Responsibilities**

851

- 852 • Approve overall recommendations and annual plan from the Operations Management Team (OMT) and AMT for Project operations
- 853 • Adoption of the Project Annual Operations Plan into the larger CPRA Annual Plan to authorize action and funding
- 854 • Interactions with CPRA Board and State Legislature
- 855 • Interaction with Stewardship / Associated Actions Group

856

857 **2.3.1.2. Operations Management Team**

858

859 **2.3.1.2.1. Membership**

860

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

864

865 **2.3.1.2.2. Responsibilities**

866

- 867 • Operates structure in accordance with the water control plan: works on day-to-day issues of diversion operation.
- 868 • Works with AMT team on efficiency and project performance issues.
- 869 • Conducts public and stakeholder review panel meetings
- 870 • Receives information from data team, public information/comments from panel (described below), recommendations from panel
- 871 • Develops draft and final annual operations plans, maintain decision log, out-facing data reports, assessment
- 872 • Hosts and Runs Public Input Sessions
- 873 • 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

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2.3.1.3. *Adaptive Management Team*

2.3.1.3.1. 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
- Agency Technical Representatives for Aquatic Resources

2.3.1.3.2. Responsibilities

- Focuses on the long term achievement of project’s performance
- Basin modelling/existing conditions, Look at future projections: river flow, sediment availability, etc.
- Submit recommendations such as changes to operations, data collection, or other adaptive modifications.
- Managing the models and outputs, and evaluating long-term possibilities for adaptively managing the Project, including the evaluation of additional features and/or monitoring. In addition, they may be called upon to evaluate questions and/or issues that arise during operational periods.
- Periodic Adaptive Management Report: This report 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.
- Issue-specific reports: The AMT may produce reports addressing specific issues 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.
- Coordination with overall Coastal Program Project Planning

2.3.1.4. *Data Management Team*

2.3.1.4.1. Membership

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

2.3.1.4.2. Responsibilities

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



928 **2.3.2. Other Teams**

929

930 2.3.2.1. *Stewardship Group*

931

932 2.3.2.1.1. Membership

933

- 934 • Agency representatives engaged in implementation of stewardship measures.

935

936 2.3.2.1.2. Responsibilities

937

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

940

941 2.3.2.2. *Stakeholder Review Panel*

942

943 2.3.2.2.1. Membership

944

- 945 • CPRA Lead
- 946 • Federal agency representatives
- 947 • Barataria Basin Parishes: Jefferson, Lafourche, Plaquemines, St. Charles;
- 948 • Oyster, Shrimp, Crab, and Finfish Working Group Leads;
- 949 • Louisiana Department of Environmental Quality (LDEQ);
- 950 • Louisiana Department of Health and Hospitals;
- 951 • Louisiana Department of Natural Resources;
- 952 • Louisiana Department of Wildlife and Fisheries (LDWF);
- 953 • Navigation representative.

954

955 2.3.2.2.2. Responsibilities

956

- 957 • Provide insight and comment on a draft Annual Operations Plan
- 958 • Share expertise and perspectives on short term issues
- 959 • Disseminate information to other stakeholders / public

960

961 2.3.2.3. *Technical Focus Group(s) / Peer Review*

962

963 2.3.2.3.1. Membership

964

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

968

969 2.3.2.3.2. Responsibilities

970

- 971 • Provide technical support and use in long term project planning.
- 972 • Assist in the evaluation and interpretation of project monitoring
- 973 • External peer review of the Multi-year Monitoring and Adaptive Management Report, outside of
- 974 the Technical Focus Groups, may be needed or desired

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- 978
- Groups will be constituted and convened on an as-needed basis.
  - Evaluate the state of science concerning adaptive management and tools for adaptive management

DRAFT

979 **3. PROJECT MONITORING PLAN**

980

981 **3.1. Monitoring Plan Development**

982

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

991

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

993

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

999

1000

1001 **3.2. Baseline and Project Monitoring Approach**

1002

1003 Pre-operations baseline data collection defines current conditions and trends to compare against  
1004 observed changes in the system that will occur following initiation of operations. The ‘Before-After-  
1005 Control-Impact’ (BACI; Underwood 1992, Smith et al. 1993) monitoring approach in areas anticipated to  
1006 change is commonly applied with ecosystem restoration projects, and will be used to evaluate  
1007 parameter data as they pertain to the Project objectives (see Section 4). The long-standing network of  
1008 existing gauges and sample locations across the Barataria Basin will enable a robust baseline for the  
1009 Project, against which to compare post-construction data. Additionally, the network of Coastwide  
1010 Reference Monitoring System (CRMS)-*Wetlands* and System-wide Assessment and Monitoring Plan  
1011 (SWAMP) sites across coastal Louisiana will be used to understand broader regional drivers and  
1012 ecosystem trends that may be separate from Project effects. As described in detail below, some of the  
1013 CRMS-*Wetlands* and SWAMP sites, together with to-be-constructed sites dedicated to Project effects  
1014 monitoring, will also provide direct observations of Project effects.

1015

1016

1017 **3.3. Monitoring and Assessment Design**

1018

1019 The sampling design for SWAMP and the additional project-specific sampling proposed herein meets  
1020 requirements for assessment and AM in the following ways:

1021

- 1022 • The design provides the basis to reduce uncertainty, improve analytical solutions, and support  
1023 effective decisions that meet the infrastructure, resource, and social requirements.
- 1024 • The system variables are measured at frequencies and spatial scales to support evaluation of  
1025 Project performance.

- 1026 • Consistency with existing long-term data collection facilitates multiple comparisons (e.g., BACI,  
1027 baseline, gradient) of Project data. Long-term sampling such as CRMS and the LDWF fisheries-  
1028 independent monitoring program (FIMP) will provide a solid baseline that can be followed and  
1029 estimated through the Project life.
- 1030 • The SWAMP coast-wide spatial coverage increasingly will help separate otherwise potentially  
1031 confounding regional processes (e.g., RSLR, temperature), event perturbations (e.g., storms,  
1032 drought,) and climate cycles from real Project effects

1033  
1034 The locations, types of data collected, and frequency of post-construction data collection will be  
1035 reviewed and refined during the Project lifespan to improve operations (e.g., sediment capture from the  
1036 river and sediment retention in the basin). Monitoring design refinement may involve

- 1037
- 1038 • identifying and addressing spatial or temporal data gaps,
- 1039 • adding or modifying parameters (e.g., physical, biological, chemical, geologic),
- 1040 • changing, adding and/or removing data collection station locations, and
- 1041 • undertaking special research or studies (e.g., landscape hydraulic studies; habitat mapping).

### 1042 **3.3.1. Sampling Stratification**

1043  
1044 A stratified sampling approach will

- 1045
- 1046
- 1047 • structure sampling based on known landscape or population (fish and wildlife, human)  
1048 attributes,
- 1049 • improve sampling efficiency and thereby reduce monitoring effort and costs, and
- 1050 • reduce the uncertainty of population estimates within each stratum, which could reduce the  
1051 number of plot measurements.

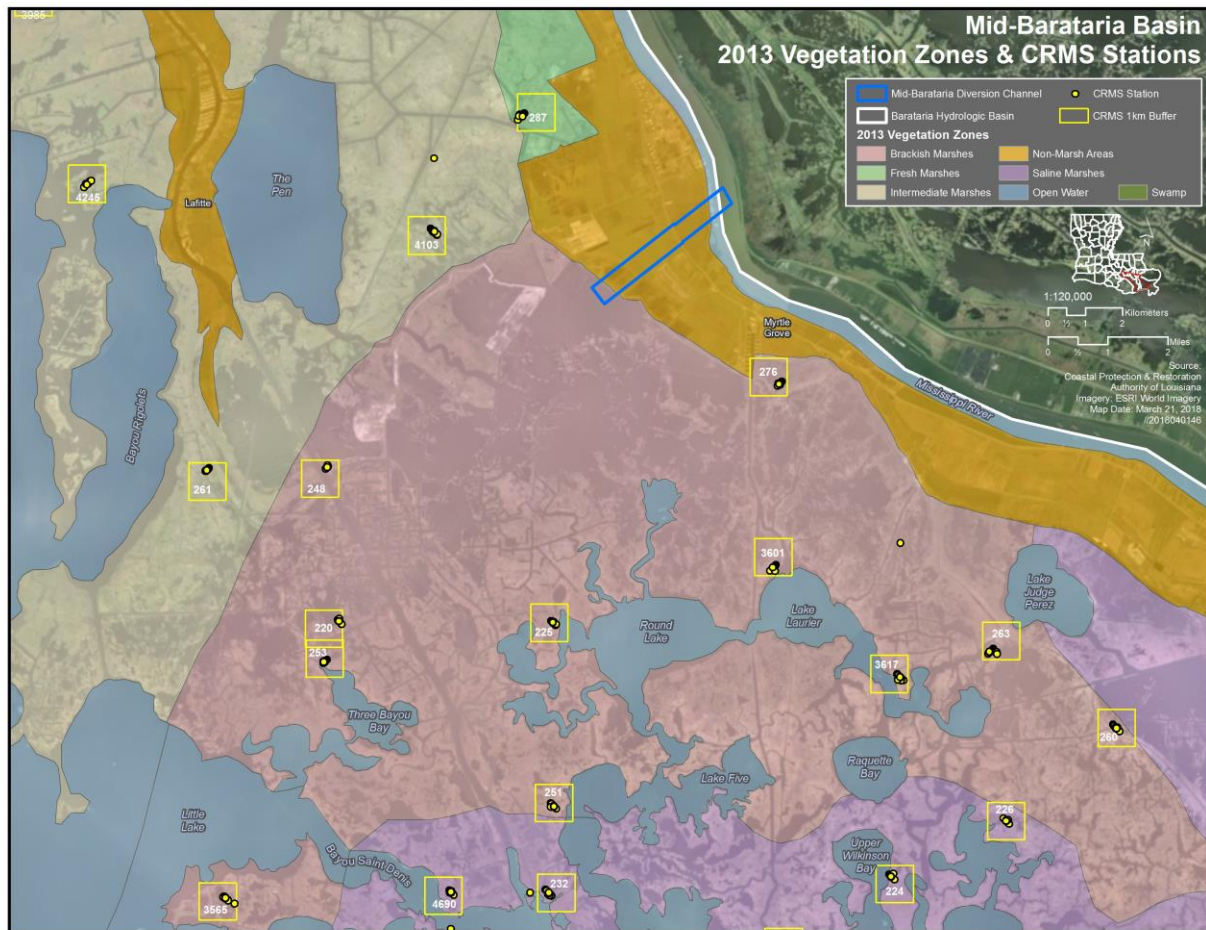
1052  
1053 Given the dynamic nature of the environment and Project, fixed sampling locations may need to be  
1054 changed before and after the onset of Project operations. Thus, re-stratification may be necessary over  
1055 the life of the Project. Examples of habitat strata (Figure 3.3-1) could include, but are not limited to,  
1056 created and natural wetlands, marsh type, and land/terrestrial vs. open water/aquatic.

### 1057 **3.3.2. Estimation of Project Delta Development and Project Influence Areas**

1058  
1059 The proposed Project would introduce sediment, freshwater, nutrients and flows into the Barataria  
1060 Basin, beyond that already provided by the Davis Pond Freshwater Diversion Project and the Naomi and  
1061 West Point a la Hache siphons. Operational histories of those other projects will need to be examined  
1062 to be able to parse out Project effects from those other structures. The extent of the area of influence  
1063 will be different for specific system resources.

1064  
1065 To guide selection of locations for pre-operations monitoring where potential data gaps may occur, two  
1066 areas of projected Project effects were defined. A smaller Project Delta Development Area (PDDA;  
1067 Figure 3.3-2) was defined as the spatial extent that the Delft Basin-wide Model projected bed elevation  
1068 differences would occur between the FWOP and the FWP alternative corresponding to the Applicant's  
1069 Preferred Alternative (FWP/APA) of a 75,000 cubic feet per second (cfs)-capable diversion structure  
1070 without associated terraces. A slightly larger Project Influence Area (PIA; Figures 3.3-3 and 3.3-4) was  
1071 defined that approximates the geographical extent that the Basin-wide Model projected water level  
1072

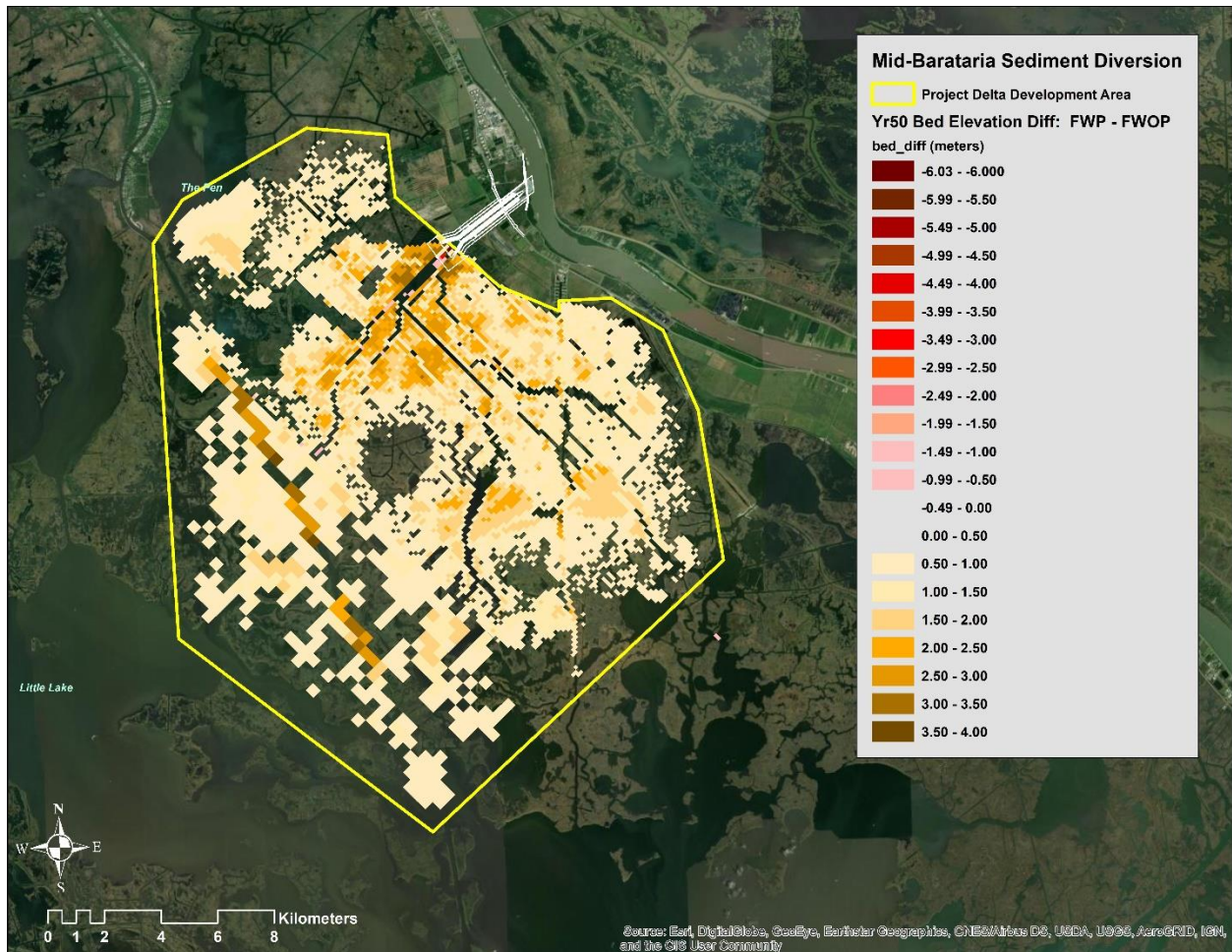
1073 differences between the FWOP and the FWP/APA.  
1074



1075 **Figure 3.3-1.** Example of supporting data to inform stratification and potential selection of additional sites based  
1076 on vegetation community type from CRMS-Wetlands sites and other survey data in the diversion primary influence  
1077 area. The blue polygon shows the location and orientation of the proposed Project conveyance channel.  
1078  
1079

1080 While the geographic scope of the monitoring plan is therefore focused on the middle portion of  
1081 Barataria Basin, it does include the entire basin. Additionally, the PDT is developing riverside  
1082 monitoring. The Plan was developed with existing monitoring locations and expert knowledge, and is  
1083 partially informed by statistical analyses completed coast-wide and for Barataria Basin (Hijuelos and  
1084 Hemmerling 2016).  
1085

1086 The monitoring plan includes continuous and discrete sampling of natural system variables, collecting  
1087 and analyzing remotely-captured data (satellite, aerial), and periodic large-scale surveys. Continuous  
1088 monitoring refers to the collection of data using automated data recording systems that are  
1089 permanently deployed with constant and evenly-spaced sampling intervals (e.g., hourly). Discrete  
1090 monitoring refers to on-the-ground collection usually conducted between longer intervals. Continuous  
1091 sampling satisfies needs for rich temporal data, while discrete sampling allows for greater spatial  
1092 information.  
1093



1094  
 1095 **Figure 3.3-2.** A Project Delta Development Area (yellow polygon) was defined around the Project outfall as the  
 1096 extent of the area where the Delft Basin-wide Model projected bed elevation differences greater than 0.5 meters  
 1097 between the Future without Project and the Future with Project for the 75,000-cfs Project alternative without  
 1098 terraces after 50-years of Project-effects modeling.

1099  
 1100 Project alternatives numerical modeling suggested that Project operations may have effects on  
 1101 ecosystem resources in the lower Breton Sound Basin and Mississippi River Balize Delta. Current plans  
 1102 are to rely on the existing SWAMP network sites to continue characterizing the status of those basins.

1103  
 1104 **3.4. Data Sources**

1105  
 1106 The field data to support assessment of baseline and project conditions for the Project have long-  
 1107 standing historic value and are expertise-driven.

1108  
 1109 **3.4.1. CPRA-Coordinated Monitoring Data**

1110  
 1111 CPRA, cooperating State and federal agencies, and TWIG have contributed to the development and  
 1112 ongoing implementation of SWAMP, which is being implemented throughout the Louisiana coastal zone  
 1113 as a long-term monitoring program to ensure a comprehensive network of data collection activities is in  
 1114 place to support the development, implementation, and AM of restoration and risk-reduction projects.  
 1115 While the Barrier Island Comprehensive Monitoring (BICM) and CRMS-Wetlands programs have been

1116 well established, SWAMP has also deployed monitoring stations in the bays, lakes, and bayous of the  
1117 Barataria Basin to provide a more extensive spatial and temporal capacity to detect change and system  
1118 function. The SWAMP monitoring design provides the framework upon which additional Project-specific  
1119 locations and variables will be needed to evaluate Project effects.  
1120

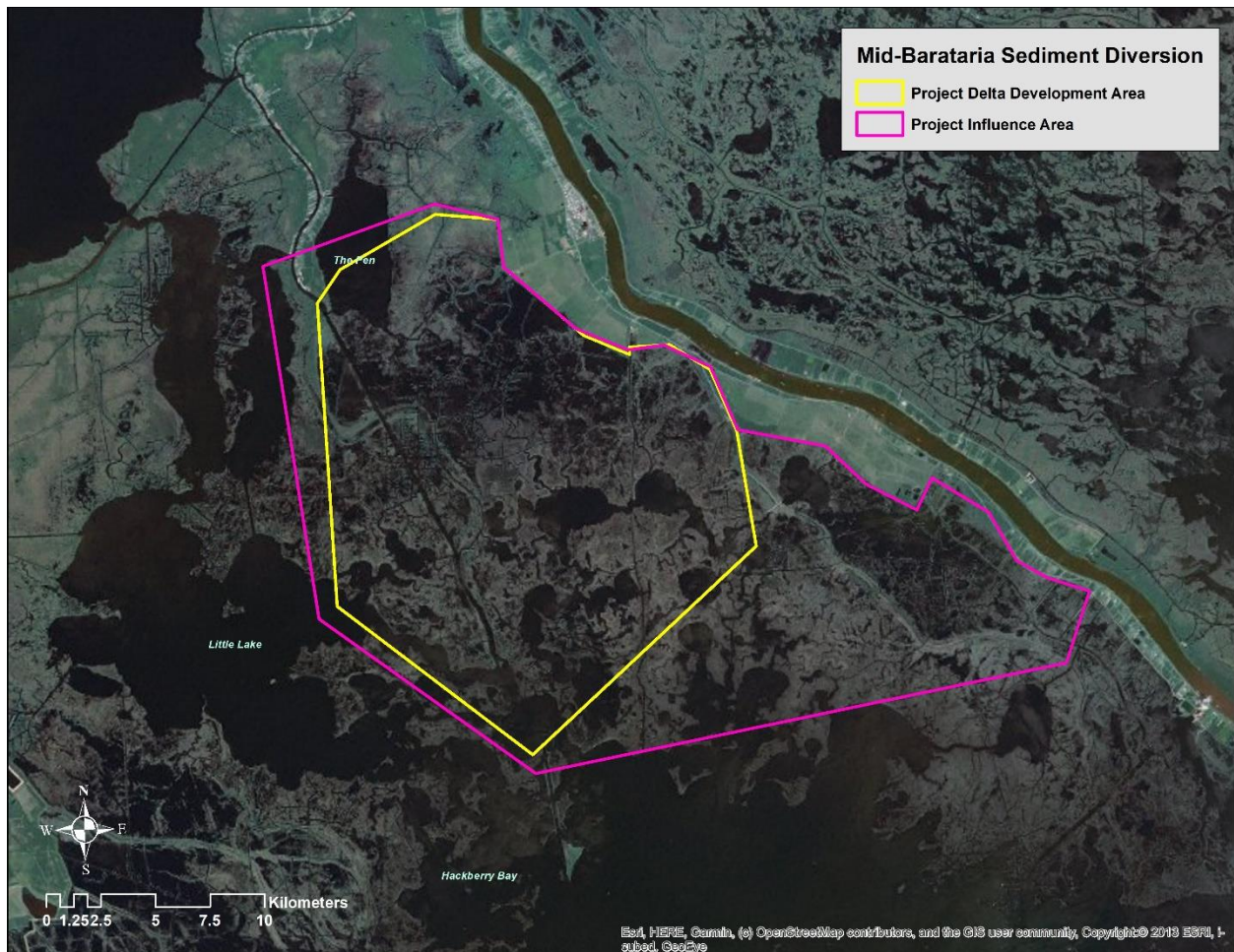


1121 **Fig. 3.3-3.** A Project Influence Area (magenta polygon) was defined around the Project outfall as the maximum  
1122 extent of the area where the Delft Basin-wide Model projected water level differences of at least 0.5 meters (white  
1123 lines) between the Future without Project and the 75,000-cfs Applicant’s Preferred Alternative without terraces.  
1124 The water level differences shown are specifically for the third week of May during the first decade modeled, using  
1125 a 2011 Mississippi River hydrograph.  
1126

1127  
1128 **3.4.2. Other Monitoring and Survey Data**  
1129

1130 There are numerous historic and ongoing data collection efforts in Barataria Basin that will provide data  
1131 for baseline and project assessments of system resources and change (Hijuelos and Hemmerling 2016).  
1132 CPRA is coordinating with other State and federal agencies to supplement and maintain quality long-  
1133 term data collection efforts in the basin (e.g., LDWF fish and invertebrate sampling programs; LDEQ  
1134 water quality sampling; repeated National Oceanographic and Atmospheric Administration  
1135 (NOAA)/DWH-funded marine mammal surveys). Monitoring of previously-constructed restoration  
1136 projects in the Project area (Figure 3.4-1) and Barataria Basin will provide valuable data to define historic  
1137 and current trends, and thus clarify Project effects and potential synergistic or antagonistic responses

1138 from those of other restoration and risk reduction efforts in the basin. CPRA will continue to evaluate  
1139 other sources of research, surveying, and monitoring data that are acceptable for Project use to reduce  
1140 monitoring costs.  
1141



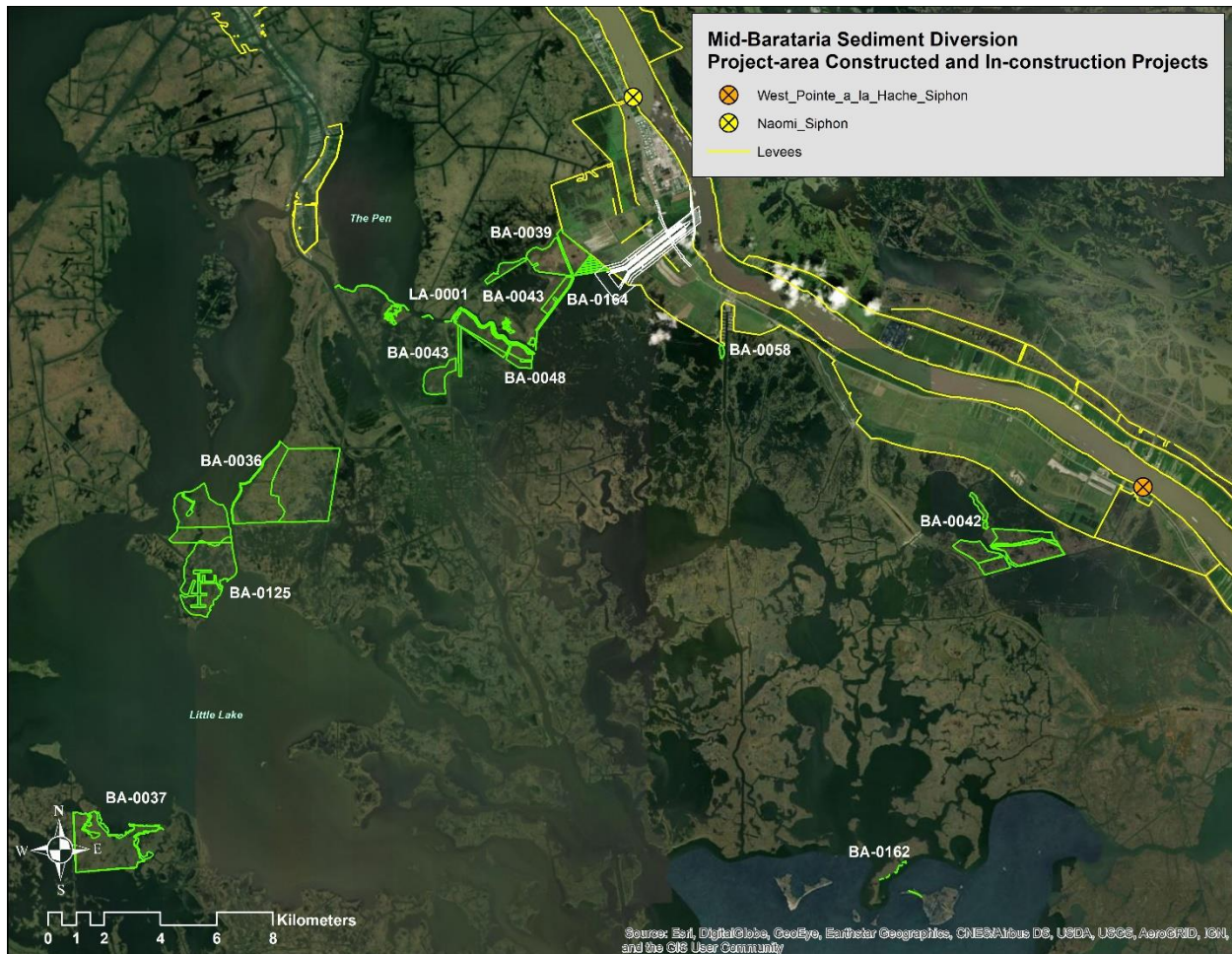
1142  
1143 **Figure 3.3-4.** Comparison of the spatial extent of the Project Delta Development Area (yellow polygon) and the  
1144 Project Influence Area (magenta polygon).  
1145  
1146

### 1147 3.5. Pre-Operations (Baseline) Monitoring

1148  
1149 To establish baseline conditions in the main stem of the MR and in the Barataria Basin, data will be  
1150 collected prior to the onset of Project operations upriver of the diversion structure, from the Alliance  
1151 South lateral sandbar in front of the eventual diversion structure, from near the planned structure  
1152 intake, and from environmental gradients radiating from the outfall into Barataria Basin and from  
1153 existing SWAMP monitoring stations in the Breton Sound Basin and the modern Balize Delta. In addition  
1154 to the existing SWAMP monitoring locations, monitoring plans will evolve as needed to include  
1155 additional variables and/or locations where data collection will be required to evaluate system change  
1156 and Project performance. For example, the types and locations of river monitoring to inform operations  
1157 will progressively be elaborated upon with progress on the design of the intake and conveyance  
1158 structure and physical modeling.



1159



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**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.

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1177

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).

1178 **3.6. Post-Construction (Operations) Monitoring**  
1179

1180 Following the onset of Project operations, data collection will continue as discussed in Section 3.5  
1181 above, and from within the diversion conveyance channel. Post-construction, hydrographic stations in  
1182 the MR will be real-time and accessible from satellite networks to enable forecasting water and  
1183 sediment arrival. Along the gradient from the MR through the diversion and into the basin, CPRA is  
1184 planning for the use of real-time data for key hydrographic variables (turbidity, stage, velocity, and  
1185 water quality). CPRA will also monitor structural and operational features of the Project structure (see  
1186 the OMRR&R Plan for those details).

1187  
1188  
1189 **3.7. Parameters for Evaluating Project Effectiveness and Ecosystem Response**  
1190

1191 Effectiveness monitoring provides the basis for determining whether the Project objectives outlined in  
1192 Section 1.2 will be met. Those restated objectives (below) frame the structure and activities of the  
1193 detailed pre-operations and post-construction monitoring plans that follow. The empirical parameters  
1194 and any secondary calculations based on those parameters are outlined below relevant to each of the  
1195 three Project objectives.  
1196

1197 **3.7.1. Objective #1: Deliver freshwater, sediment, and nutrients to Barataria Bay through a**  
1198 **large-scale sediment diversion from the Mississippi River**  
1199

1200 Objective 1 reflects the primary operational goal of the Project and rationale behind the construction of  
1201 a large sediment diversion, which is that operation of a diversion structure is the most efficient, effective  
1202 and sustainable mechanism for moving large amounts of MR sand-size suspended sediments into the  
1203 middle region of the Barataria Basin.  
1204

1205 Many of the monitoring parameters and resulting calculations listed below will be limited to post-  
1206 construction monitoring because they will involve monitoring aspects of the constructed Project  
1207 structure. However, some in-river monitoring components will be developed for pre-operations  
1208 monitoring to establish baselines of MR resource status and variability and to evaluate potential impacts  
1209 in the MR and the Basin.  
1210

1211 **3.7.1.1. Empirical Monitoring Parameters in Support of Objective 1**  
1212

1213 **3.7.1.1.1. Mississippi River water discharge**  
1214

1215 • Rationale: As proposed in the Project permit request, expectations for an MR discharge of  
1216 450,000 cfs on a rising limb at Belle Chasse will trigger Project operations beyond a base flow of  
1217 up to 5,000 cfs. Sand-size sediment does not typically start mobilizing from lateral bars until the  
1218 MR flow is at 600,000 cfs (Allison et al., 2012), but the first flush of fine sediments typically  
1219 occurs at lower discharges. Mississippi River water discharge is thus fundamental to monitor  
1220 throughout the Project life.  
1221

1222 • Schedule: Real-time measurements planned currently for the entirety of both pre-operations  
1223 and the 50 years of post-construction monitoring.  
1224

- 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.

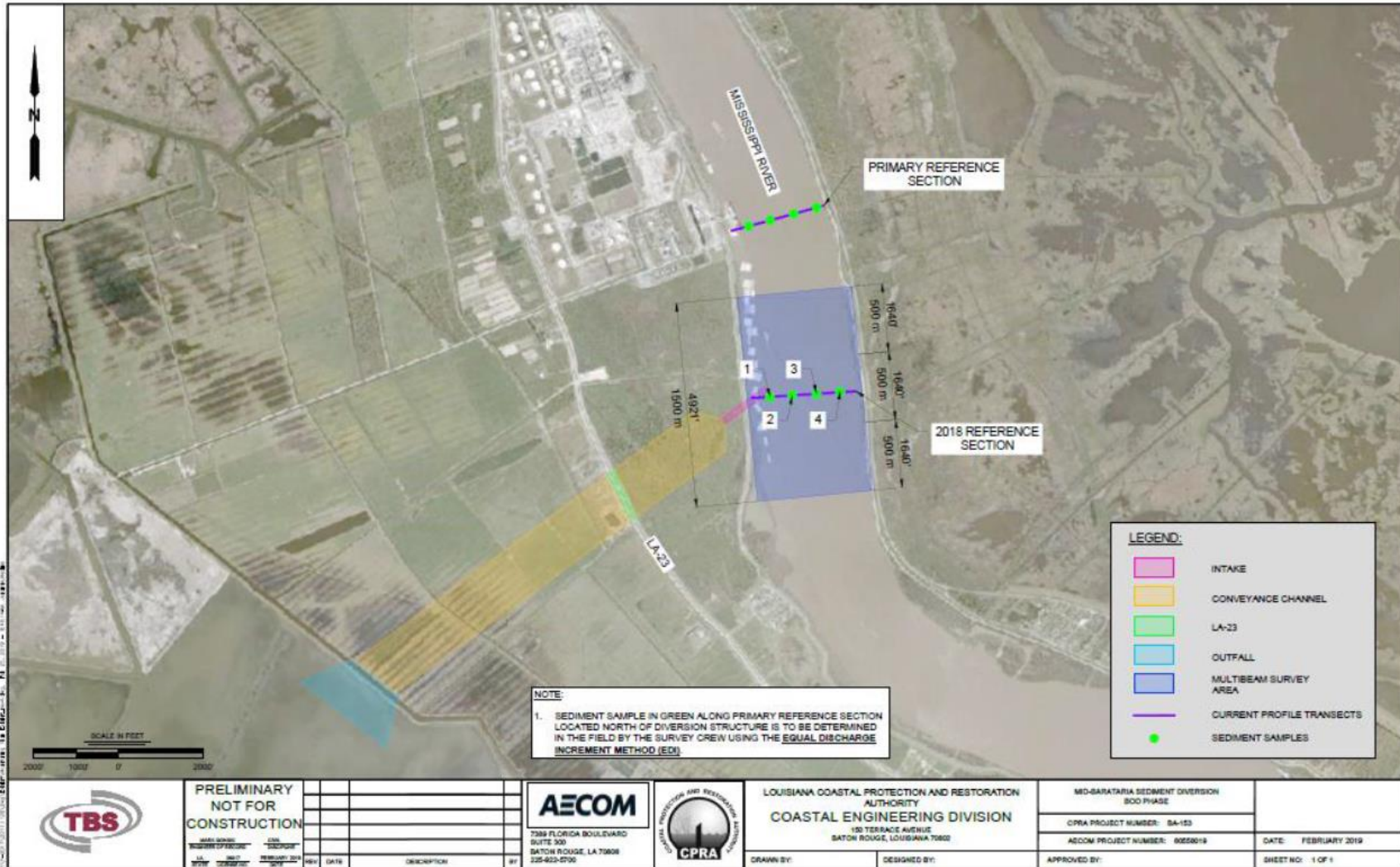
**Table 3.7-1.** Endpoint coordinates of Mississippi River Project cross sections used for preliminary E&D. All coordinates are in UTM 15N meters NAD83. Transect locations are shown in Figure 3.7-1.

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.

$$Discharge (cfs) = Cross-sectional\ area\ of\ flow\ (square\ feet) \times velocity\ (f/s) \quad Eqn. 1$$

- 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.



1264  
 1265 **Figure 3.7-1.** Location of the Mississippi River near the Mid-Barataria Sediment Diversion, showing transects and sampling points currently being studied for  
 1266 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  
 1267 the Alliance refinery.

1268 3.7.1.1.2. Mississippi River suspended sediment concentrations

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- 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 has not yet determined the frequency of additional boat-based data collection at the Belle Chasse gauge and at or nearer the Project structure.
- 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

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- 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

1309 (n = 7 and 6, respectively), and the data reflect only a single MR flood season.

1310

1311 Observed gauge height did provide some predictability with suspended sediment mass for data  
1312 and samples collected at Belle Chasse from December 2018 through January 2020. The direct  
1313 relationship between gauge height and mass of suspended sediments larger than 0.063 mm  
1314 (i.e., sand; USGS P91159) was strong ( $R^2 = 0.5636$ ;  $n = 16$ ), while the relationship between  
1315 observed gauge height and the mass of suspended sediments smaller than 0.063 mm (i.e., silts  
1316 and clays; USGS P91158) was weaker ( $R^2 = 0.2363$ ;  $n = 16$ ).

1317

1318 The USGS Mississippi River at Belle Chasse, LA gauge is roughly 13 miles north of the Project site.  
1319 If used for the continuous monitoring of turbidity, discrete sampling of suspended sediments  
1320 would be required at that site to establish the regression model needed to use turbidity as a  
1321 surrogate for suspended sediments. Prior to selecting this site as the permanent continuous  
1322 monitoring location for turbidity, suspended sediments sampling at the Project site may also be  
1323 required to determine if there is a significant difference in turbidity between the two locations.

1324

1325 Sediment concentration samples at the reference and Project cross-sections will be taken using  
1326 a P-6\_200 isokinetic sampler. TSS and concentrations of sand (> 63 micron) and silt/clay ( $\leq 63$   
1327 micron) will be determined using methods similar to the 2008-2011 (Allison, 2011) and 2018  
1328 (Allison et al., 2018) studies.

1329

1330 Replicate sediment concentration measurements will be made at the two most westward  
1331 vertical stations at 70 and 90% water depth, to provide sufficient sand sample volume for sieve  
1332 analysis. Conductivity/temperature/depth (CTD) casts will be made at the same time as the  
1333 sediment concentration measurements at each vertical station to help calibrate measurements.

1334

1335 ADCP data will be collected during every isokinetic suspended sediment collection activity and  
1336 the start and ending ensemble should be separately noted for the duration of each point  
1337 collection (i.e., the interval between each bottle opening and closing). This data will be used to  
1338 correlate the backscatter data to the sediment concentration data from the isokinetic sampling.

1339

1340 Sediment concentration samples will be collected at four locations (vertical stations) along each  
1341 cross-section and at five depths at each of the vertical stations. The depths are 10, 30, 50, 70  
1342 and 90 percent of the local water depth. At each cross section, the Equal Discharge Increment  
1343 method should be used in the field to determine the four vertical stations. The four vertical  
1344 stations that were sampled at the 2018 cross section are located at coordinates in Table 3.7-2.

1345

1346 ● Parties Responsible for Data Collection

1347 ○ Continuous turbidity and discrete suspended sediment load estimations at Mississippi  
1348 River Baton Rouge and Belle Chasse gauges: USGS

1349 ○ Boat-based direct empirical suspended sediment load estimations: CPRA contractor.

1350

1351 3.7.1.1.3. Mississippi River nutrient concentrations

1352

1353 ● Rationale: Nutrients in Mississippi River water, primarily nitrogen (N), phosphorus (P) and sulfur  
1354 (S), are necessary for phytoplankton and emergent vegetation growth in estuarine ecosystems.

1355 While those resources in Barataria may benefit from diverted MR water, there are concerns that

1356 nutrient delivery in excess of the needs of primary producers could lead to phytoplankton  
1357 blooms in the open estuary, growth alterations to emergent vegetation, and increases in the  
1358 rate of bacterially-mediated soil organic carbon decomposition. Measuring nutrient  
1359 concentrations entering into the diversion discharge will support the calculation of *Nutrient*  
1360 *loads conveyed into Barataria Basin* (3.7.1.2.4).

- 1361
- 1362 ● Schedule: Planned to occur biweekly during operational events (beyond base flow), and  
1363 quarterly during base flow operations, during the 50 years of post-construction monitoring.  
1364
  - 1365 ● Locations: Currently the USGS estimates MR (nitrate + nitrite)-N concentrations at the  
1366 Mississippi River at Baton Rouge, LA gauge (#07374000) using a continuously-reading sensor.  
1367 USGS periodically collects and analyses grab samples of river water at Baton Rouge for several  
1368 chemical species of N, P and S.

- 1369 ● Methodology:  
1370  
1371 USGS measures (nitrate + nitrite)-nitrogen at the Baton Rouge gauge using a continuously-  
1372 reading sensor. USGS periodically collects and analyses grab samples of river water at both  
1373 Baton Rouge and Belle Chasse for nitrate+nitrite (USGS P00631), (ammonia + ammonium)-N  
1374 (USGS P00608, total Kjeldahl N (ammonia + organic N; USGS P00623), and total N (USGS  
1375 P00602).

1376  
1377 Dissolved orthophosphate ( $\text{PO}_4^{3-}\text{-P}$ ) is typically determined through wet chemistry of grab  
1378 samples (USGS P00671), as is total P (USGS P00666). However, newer sensors that can detect  
1379 orthophosphate may be installed at Baton Rouge and/or Belle Chasse. However, because  
1380 orthophosphate adsorbs to clay particles in riverine water, it is necessary to use an acid  
1381 digestion to free orthophosphate from suspended sediments to better characterize  
1382 concentrations in the river. As well, total P in a sample of river water can be determined  
1383 through similar laboratory analyses.

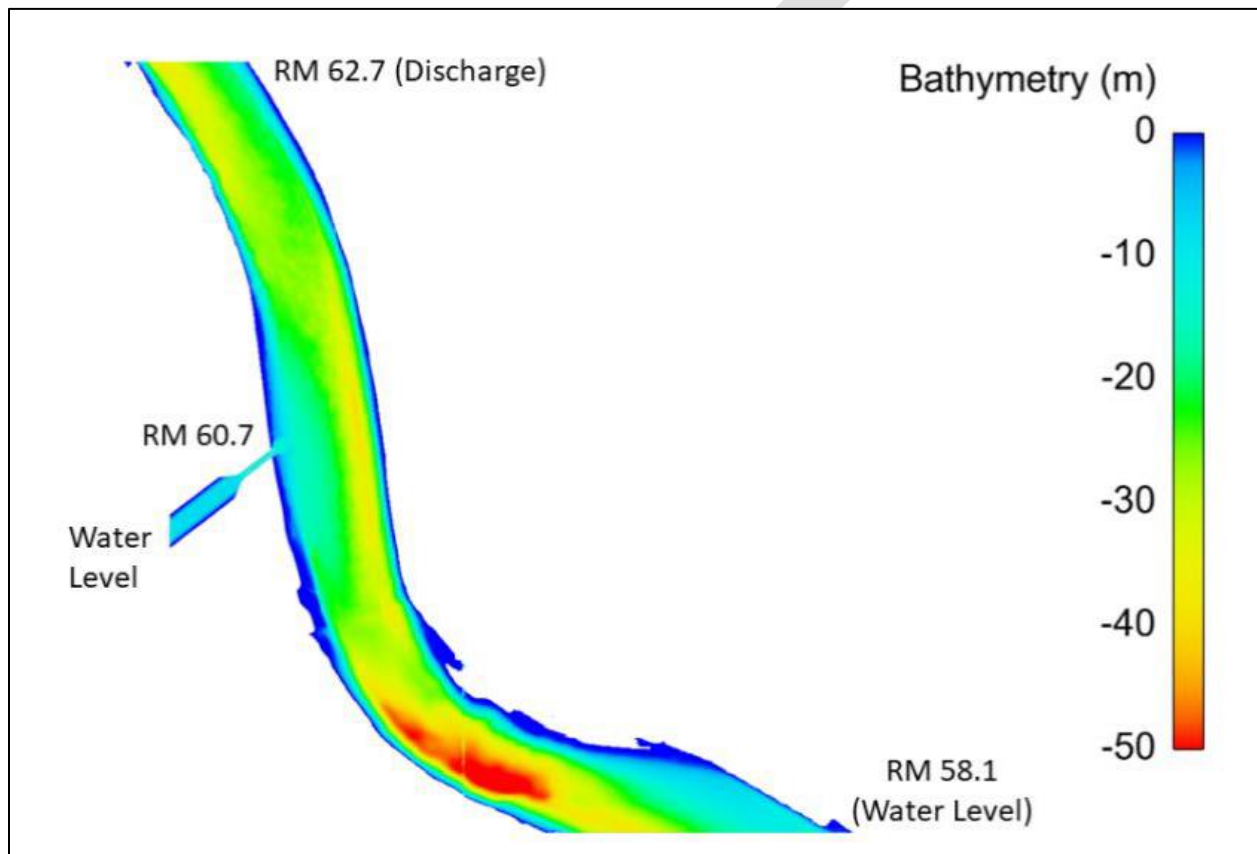
1384  
1385 Dissolved sulfate is likewise analyzed by USGS at the Baton Rouge gauge using the same grab  
1386 samples and respective analytical chemical methods (USGS P00945).

- 1387 ● Parties Responsible for Data Collection  
1388  
1389 Continuous sensor-based and discrete nutrient concentration sampling and analysis at the  
1390 Mississippi River Baton Rouge and Belle Chasse gauges: USGS

1391  
1392  
1393  
1394 3.7.1.1.4. Bathymetry of the Alliance South sand bar

- 1395 ● Rationale: Multi-beam bathymetric measurements will support estimations of sediment  
1396 consumption and replenishment, and thus the productivity and sustainability of the Alliance  
1397 South lateral sandbar as a sediment source for the project through calculations of the change in  
1398 volume of the Alliance South sand bar. The multi-beam bathymetry will also record the  
1399 morphology of the lateral bar and provide a calibration data source for the Deltf3D Outfall  
1400 Management Model.  
1401  
1402

- 1403 • Schedule: Planned annually during the pre-operations period and both before and after each  
1404 Project operational event for the first five years of post-construction monitoring. The Project  
1405 Operations Team will evaluate then what frequency of operations will be maintained.  
1406
- 1407 • Locations: The Alliance South sandbar (Figure 3.7-2; will be monitored routinely with high-  
1408 resolution velocity and bathymetric surveys along transects that were established for design  
1409 data collection and earlier studies. Transects were arranged to capture upstream and  
1410 downstream bar morphology changes. The monitoring of the bar dynamics during and after  
1411 annual operations will be essential to understanding stability of the sand-size sediment supply  
1412 through both diversion and replenishment of the lateral bar.  
1413



1414 **Figure 3.7-2.** The lateral bar near the River Mile 60.7 diversion intake (area of shallow bathymetry in front of the  
1415 diversion structure) will be monitored routinely with high-resolution velocity and bathymetric surveys along  
1416 transects that have been established for design data collection and earlier studies. Figure from (Moffat & Nichol,  
1417 2012)  
1418

- 1419
- 1420 • Methodology: During Project E&D, the multi-beam surveys will be conducted during two  
1421 discharge events and both before and after the flood season. The surveys during the flood  
1422 event should be coordinated with the cross-section sampling, which will occur when the  
1423 discharge at Belle Chasse is at least above 600,000 cfs. The PDT prefers that the other event  
1424 survey occurs near 1,000,000 cfs or at the flood event peak, and then on the falling limb at  
1425 850,000 cfs or 600,000 cfs, depending on the flood event and the data needs for  
1426 calibration/validation of the Delft Outfall Management Model.  
1427



1428 The flood season survey should be made before the rising limb of the first event reaches  
1429 450,000 cfs at Belle Chasse and one during a falling limb of the river discharge at the end of the  
1430 flood season, also below 450,000 cfs. These surveys should be carefully coordinated between  
1431 CPRA, USGS and the sediment and water quality testing laboratories and monitoring teams.  
1432

1433 The pre- and post-season surveys should cover the entire lateral bar, while the during-event  
1434 surveys would be concentrated within 750 meters upstream and 750 meters downstream of the  
1435 diversion sampling location. The event surveys will include the entire width of the river and be  
1436 centered on the monitoring cross-section station. These during event surveys are required for  
1437 tracking bed form movement and associated bedload transport. The bedload surveys shall be  
1438 taken in 500-meter sections within the river to ensure an area is collected within an  
1439 approximated 2-hour period. A 25-meter overlap between each 500-meter section is planned to  
1440 provide adequate linkage of the survey transects. At each sampling station survey, there should  
1441 be two surveys – one taken at the time of initial sediment sampling and the second survey  
1442 should be taken within approximately 24 hours.  
1443

1444 The rate and magnitude of change in the volume of the Alliance South sand bar will be  
1445 calculated as  
1446

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

$$\text{Magnitude of change} = \frac{(\text{Volume of the Alliance South sand bar at time } x+1) - (\text{Volume of the Alliance South sand bar at time } x)}{\text{Time between measurements.}} \quad \text{Eqn. 3}$$

- 1454 ● Parties Responsible for Data Collection
- 1455 ○ Repeated channel conditions surveys: USACE
- 1456 ○ Pre- and post-season surveys for at least the first five years of operations: CPRA
- 1457 contractor

1458

1459 3.7.1.1.5. Sedimentology of the Alliance South sand bar

1460

- 1461 ● Rationale: Sediment sampling of the Alliance sand bar will support estimations of the  
1462 sustainability of the sand bar as a coarse-grained sediment source for the project.  
1463
- 1464 ● Schedule: Planned for both pre-operations and post-construction monitoring.  
1465
- 1466 ● Locations: Sedimentology samples will be collected coincident with the *Bathymetry of the*  
1467 *Alliance South sand bar* (3.7.1.1.4).  
1468
- 1469 ● Methodology: Bed samples will be taken at each vertical station using a BM-54 sampler  
1470 (<https://water.usgs.gov/fisp/products/4103004.html>). These should be taken at the same time  
1471 as the sediment concentration samples and CTD casts. The BM54 sampler will typically take a  
1472 sample 3 inches deep into the sediment. Samples will be transported to the testing laboratory  
1473 where the grain size of the sediment and sand- and silt-size sediment volumes will be  
1474 determined. The PDT has coordinated with Mead Allison, who will be conducting a similar data  
1475 collection for the Mid-Breton Project, to assure that they will take a similar depth sample with

1476 the Shippek sampler (*sensu* Ramirez and Allison 2013) and thus provide consistency in  
1477 measurements.  
1478

1479 ● Parties Responsible for Data Collection

- 1480 ○ Pre- and post-operations sampling and sediment content analysis: CPRA contractor  
1481

1482 3.7.1.1.6. River bathymetry at and around the Project structure inlet  
1483

- 1484 ● Rationale: Repeated bathymetric surveys of the MR and the Project structure inlet are  
1485 necessary to support calculations of the rate and magnitude of change in river bathymetry at  
1486 the Project structure inlet to determine if bed scour/erosion or shoaling are occurring. Both  
1487 siltation and scour would limit Project operations, and would form the basis for AM actions.  
1488 Erosion has been seen at the mouth of the West Bay Sediment Diversion where it penetrates  
1489 the right descending bank of the river downstream of Venice, Louisiana (Brown et al., 2009), and  
1490 in the batture in front of Mardi Gras Pass on the left descending bank downstream of the  
1491 terminus of the MR&T levee (Lopez et al., 2014).  
1492

1493 Calculation of the rate and extent of change in the elevation of the MR bottom at the Project  
1494 inlet structure inlet will indicate if siltation or scour is occurring.  
1495

- 1496 ● Schedule: Planned annually during the pre-operations period and both before and after each  
1497 Project operational event for the first five years of post-construction monitoring. The Project  
1498 Operations Team will evaluate then what frequency to maintain operations going forward in  
1499 time. These surveys will be coordinated with the sampling multi-beam surveys and the pre- and  
1500 post-flood event surveys to include the intake structure and MR bottom contiguous to the  
1501 structure.  
1502

- 1503 ● Locations: Specifics will be coordinated with the event surveys – standard and reference cross  
1504 sections.  
1505

- 1506 ● Methodology: Boat-based multi-beam bathymetry on 50-foot centers at the structure inlet and  
1507 for 1,500 feet both upstream and downstream of the structure. Exact methodologies are  
1508 expected to be similar to those used by the USACE New Orleans District when they conducted a  
1509 multi-beam bathymetric survey from Mississippi River Mile (RM) 0 – 324 during July 2011 – June  
1510 2013. Data are available at <https://www.mvn.usace.army.mil/Missions/Engineering/Channel-Improvement-and-Stabilization-Program/2013MBMR/>.  
1511

1512  
1513 The rate and magnitude of change in river bathymetry will be calculated as  
1514

$$\begin{aligned} \text{Change rate} = & ((\text{River bathymetry at the Project structure inlet at time } x + 1) \\ & - (\text{River bathymetry at the Project structure inlet at time } x)) \\ & / (\text{Time between measurements}) \end{aligned}$$

Eqn. 4

1519  
1520 *Change magnitude*

$$\begin{aligned} = & (\text{River bathymetry at the Project structure inlet at time } x + 1) \\ & - (\text{River bathymetry at the Project structure inlet at time } x) \end{aligned}$$

Eqn. 5

- 1524 ● Parties Responsible for Data Collection: CPRA contractor

1525

1526 3.7.1.1.7. Topography/bathymetry of the Project Influence Area

1527

- 1528 ● Rationale: Repeated topographical/bathymetrical monitoring of the Project Influence Area will
- 1529 support calculations of the rate and magnitude of change in topography/bathymetry of the
- 1530 Project outfall area and ensure the viability of the Project to convey river water, sediment and
- 1531 nutrients into Barataria Basin. Calculation of the rate and magnitude of change in landscape
- 1532 elevations (topography and bathymetry) of the PIA will indicate if siltation or scour is occurring.

1533

- 1534 ● Schedule: Planned for both pre-operations and post-construction monitoring. Topography and
- 1535 bathymetry will be assayed once prior to the onset of Project operations, and then at years 5,
- 1536 10, 20, 30, 40 and 50 after the onset of Project operations. Light Detection and Ranging (LiDAR)
- 1537 surveys will be scheduled preferentially in winter to survey as much as possible a “leaf off”
- 1538 environment, but that may not always be possible.

1539

- 1540 ● Locations: The Basin-wide Model projected the extent of the PIA as shown in Figure 3.3-3. The
- 1541 actual extent of detailed receiving basin topographical and bathymetric monitoring may be
- 1542 modified as required based on the first five years of surveys.

1543

1544 Elevation surveys may also need to be conducted up to two times at up to two additional

1545 wetland areas. A conventionally restored wetland and an unrestored wetland, as described in

1546 Section 4.1.3, may be used to assess the relative performance of different marsh restoration

1547 treatments.

1548

- 1549 ● Methodology: Subaerial elevation surveys will require LiDAR and processing to reduce error
- 1550 associated with plant canopy. The bathymetric surveys may include traditional point survey and
- 1551 other instruments (fathometer, multi-beam) depending on the water depth and
- 1552 vertical/horizontal resolution required. CPRA expects that data collection will be similar to that
- 1553 used by USGS during collection of northern Gulf of Mexico combined bathymetric and
- 1554 topographic data within its Coastal National Elevation Database (CoNED), accessible at
- 1555 <https://www.usgs.gov/land-resources/eros/coned>

1556

1557 The rate and magnitude of change in topography/bathymetry of the Project delta development

1558 area will be calculated as

1559

$$1560 \text{Rate of change} = \frac{((\text{Topography/bathymetry of the Project delta development area at time } x+1) -$$
$$1561 (\text{Topography/bathymetry of the Project delta development area at time } x)) /$$
$$1562 (\text{Time between measurements})$$

Eqn. 6

1563

$$1564 \text{Magnitude of change} = ((\text{Topography/bathymetry of the Project delta development area at time}$$
$$1565 x+1) -$$
$$1566 (\text{Topography/bathymetry of the Project delta development area at time}$$
$$1567 x)$$

Eqn. 7

1568

- 1570 ● Parties Responsible for Data Collection: CPRA contractor

1571

1572 3.7.1.1.8. Bathymetries of canals in the Project Influence Area

1573

1574 ● Rationale: Repeated bathymetrical monitoring will support calculations of the rate and  
1575 magnitude of siltation or scour of the canals in the PIA and ensure the viability of commerce in  
1576 the region. CPRA has pledged in the draft Project Mitigation Report to maintain navigational  
1577 access of fastland communities to the basin, while those communities are viable, by promising  
1578 to adjust Project operations, conduct maintenance dredging on, or implement outfall  
1579 management measures that limit sediment aggradation in the Barataria Waterway and  
1580 Wilkinson Canal when it can be demonstrated that siltation in those waterways is due to Project  
1581 operations.

1582

1583 ● Schedule: Planned for both pre-operations and post-construction monitoring. Bathymetries will  
1584 be assayed twice prior to the onset of Project operations, and then after the completion of each  
1585 Project operational event beyond base flow, or annually if no operational events occur, to  
1586 determine any effects of Project base flows on canal bathymetries.

1587

1588 ● Locations: For the Barataria Bay Waterway, surveying from the Pen to the open water mouth at  
1589 Mud Lake. For Wilkinson Canal, surveying from the Myrtle Grove Marina to the open water  
1590 mouth at Barataria Bay. Note the spatial extents of the canal surveys may be expanded or  
1591 contracted depending on the results of repeated surveys and the determination of Project  
1592 effects.

1593

1594 ● Methodology: Methodology for the bathymetric surveys may include traditional point survey  
1595 and other instruments (fathometer, multi-beam sonar) depending on the water depth and  
1596 vertical/horizontal resolution required. Surveying of the Barataria Bay Waterway will be  
1597 conducted in coordination with USACE.

1598

1599 The rate and magnitude of change in bathymetry of the PIA will be calculated as

1600

1601 
$$\text{Rate of change} = \frac{(\text{Bathymetry of the Project Influence Area at time } x+1) -$$
  
1602 
$$(\text{Bathymetry of the Project Influence Area at time } x))}{$$
  
1603 
$$(\text{Time between measurements})} \qquad \text{Eqn. 8}$$

1604

1605 
$$\text{Magnitude of change} = (\text{Bathymetry of the Project Influence Area at time } x+1) -$$
  
1606 
$$(\text{Bathymetry of the Project Influence Area at time } x) \qquad \text{Eqn. 9}$$

1607

- 1608 ● Parties Responsible for Data Collection
- 1609 ○ CPRA contractor
  - 1610 ○ USACE

1611

1612 3.7.1.1.9. Water volume conveyed into Barataria Basin

1613

1614 ● Rationale: Measuring the discharge of water through the diversion structure will provide direct  
1615 estimates of riverine freshwater transfer into Barataria Basin and support estimations of  
1616 *Sediment:water in the flows conveyed into Barataria Basin* (3.7.1.2.2), *Sediment volume*  
1617 *conveyed into Barataria Basin* (3.7.1.2.3), and *Nutrient loads conveyed into Barataria Basin*  
1618 (3.7.1.2.4). As per the Project permit request submitted to USACE, Project discharge will be  
1619 capped at 75,000 cfs at *Mississippi River water discharges* (3.7.1.1.1) greater than or equal to

1620 1,000,000 cfs.

1621

1622 ● Schedule: Planned only for post-construction monitoring during the entire flood season each  
1623 year for the life of the Project.

1624

1625 ● Locations: Specifics locations within the conveyance channel will be identified by CPRA.

1626

1627 ● Methodology: At the entrance of the intake and the bar area, it is anticipated that an array of  
1628 velocity and turbidity instrumentation will be deployed. It is uncertain if sediment, water, and  
1629 nutrient capture is best monitored in the conveyance channel. The most advantageous  
1630 locations are under consideration by the PDT.

1631

1632 ● Parties Responsible for Data Collection: CPRA contractor

1633

1634 3.7.1.1.10. Sediment concentrations in the flows conveyed into Barataria Basin

1635

1636 ● Rationale: Measuring inorganic sediment concentrations in the diversion discharge will support  
1637 the calculation of *Sediment:water in the flows conveyed into Barataria Basin (3.7.1.2.2)* and  
1638 *Sediment volume conveyed into Barataria Basin (3.7.1.2.3)*.

1639

1640 ● Schedule: Planned only for post-construction monitoring during the entire flood season each  
1641 year for the life of the Project.

1642

1643 ● Locations: Sample locations will be the same as those developed for *Water volume conveyed*  
1644 *into Barataria Basin (3.7.1.1.9)*.

1645

1646 ● Methodology: See discussion under *Water volume conveyed into Barataria Basin (3.7.1.1.9)*.  
1647 Analyses of sediment samples taken from the conveyance channel, including calculations of  
1648 *Sediment:water in the flows conveyed into Barataria Basin (3.7.1.2.2)* and *Sediment volume*  
1649 *conveyed into Barataria Basin (3.7.1.2.3)*, will include measurement by primary grain size  
1650 (sand/silt/clay).

1651

1652 ● Parties Responsible for Data Collection: CPRA contractor

1653

1654 3.7.1.2. Multi-Parameter Calculations in Support of Objective 1

1655

1656 3.7.1.2.1. Mississippi River sediment load

1657

1658 ● Rationale: The intent of the Project is to capture a substantial portion of the Mississippi River's  
1659 sediment load for transport through the Project structure and into the receiving basin.

1660

1661 ● Schedule: Planned for both pre-operations and post-construction monitoring.

1662

1663 ● Locations: Sample locations will be the same as those developed for *Mississippi River water*  
1664 *discharge (3.7.1.1.1)* and *Mississippi River suspended sediment concentrations (3.7.1.1.2)*.

1665

- 1666 • Methodology:

$$1667 \quad \text{Mississippi River sediment load} = \text{Mississippi River water discharge (3.7.1.1.1)} \times$$

$$1668 \quad \text{Mississippi River suspended sediment concentrations (3.7.1.1.2)}$$

1670 **Eqn. 10**

1672 3.7.1.2.2. Sediment:water in the flows conveyed into Barataria Basin

- 1674 • Rationale: Based on extensive empirical data collection and numerical modeling, the Project is
- 1675 being designed to optimize the delivery of sediment into the Barataria Basin. Calculation of
- 1676 cumulative inorganic sediment:water is the fundamental metric of the efficiency of diversion
- 1677 sediment transport. Estimating the actual Project sediment:water through the calculations
- 1678 below is needed to confirm those design assumptions, or it could suggest opportunities for
- 1679 additional operational modifications to achieve subsequent improvements in sediment:water.
- 1680 These estimations will also be needed for subsequent numerical model refinement.

- 1682 • Schedule: Planned only for post-construction monitoring.

- 1684 • Locations: Depends on the specific monitoring locations developed for *Water volume conveyed*
- 1685 *into Barataria Basin (3.7.1.1.9)* and *Sediment concentrations in the flows conveyed into*
- 1686 *Barataria Basin (3.7.1.1.10)*

- 1688 • Methodology:

$$1690 \quad SWR = \frac{\left( \frac{\text{Sediment Concentrations in the flows conveyed into Barataria Basin 3.7.1.1.10}}{\text{Mississippi River suspended sediment concentrations (3.7.1.1.2)}} \right)}{\left( \frac{\text{Water volume conveyed into Barataria Basin (3.7.1.1.9)}}{\text{Mississippi River water discharge (3.7.1.1.1)}} \right)}$$

1691 **Eqn. 11**

1693 3.7.1.2.3. Sediment volume conveyed into Barataria Basin

- 1695 • Rationale: This calculation will establish estimates of the amount of inorganic sediment
- 1696 transported by the structure.

- 1698 • Schedule: Planned only for post-construction monitoring.

- 1700 • Locations: Same sampling stations identified for *Water volume conveyed into Barataria Basin*
- 1701 *(3.7.1.1.9)*, and *Sediment concentrations in the flows conveyed into Barataria Basin (3.7.1.1.10)*

- 1703 • Methodology:

$$1705 \quad \text{Sediment volume} = \text{Water volume conveyed into Barataria Basin (3.7.1.1.9)} \times$$

$$1706 \quad \text{Sediment concentrations in the flows conveyed into Barataria Basin}$$

$$1707 \quad \text{(3.7.1.1.10)}$$

1708 **Eqn. 12**

1710 3.7.1.2.4. Nutrient loads conveyed into Barataria Basin

1711

- 1712 ● Rationale: Nitrogen and phosphorus are the primary inorganic nutrients that support primary
- 1713 production in the estuarine emergent wetlands and open water bodies. Concerns exist that
- 1714 excess nutrient delivery to Barataria Basin could lead to phytoplankton blooms (see Section
- 1715 3.7.3.9), harmful algal blooms (3.7.3.10) and/or the development of low dissolved oxygen (see
- 1716 Section 3.7.3.7). This calculation will establish estimates of the amount of nutrients transported
- 1717 by the structure.

1718

- 1719 ● Schedule: Planned only for post-construction monitoring.

1720

- 1721 ● Locations: Same sampling stations identified for *Mississippi River nutrient concentrations*
- 1722 *(3.7.1.1.3)* and *Water volume conveyed into Barataria Basin (3.7.1.1.9)*

1723

- 1724 ● Methodology:

1725

$$1726 \quad N/P/S \text{ load} = \frac{\text{Water volume conveyed into Barataria Basin (3.7.1.1.9) *}}{\text{Mississippi River nutrient concentrations (3.7.1.1.3)}} \quad \text{Eqn. 13}$$

1727

1728

1729 **3.7.2. Objective #2: Reconnect and re-establish sustainable deltaic processes between**

1730 **the Mississippi River and the Barataria Basin**

1731

1732 3.7.2.1. Empirical Monitoring Parameters in Support of Objective 2

1733

1734 3.7.2.1.1. Water velocities at multiple locations in the Barataria Basin

1735

1736 ● Rationale: The fundamental objective of hydrography is to document changes to the horizontal

1737 and vertical movement of water within the Project area. This has bearing on changes to the

1738 physical environment as well as to the deposition of sediments and the zonation and

1739 persistence of wetland vegetation.

1740 ● Schedule: Planned for both pre-operations and post-construction monitoring.

1741

- 1742 ● Locations: Two velocity meters are currently being installed in Barataria Basin (Figure 3.7-3),
- 1743 with another four proposed. Project-specific velocity meter locations are still being determined.

1744

- 1745 ● Methodology: Use of real-time or continuous ADCPs to determine velocity of water movement,
- 1746 may be depth-averaged or point values

1747

1748

1749 ● Parties Responsible for Data Collection: CPRA contractor.

1750

1751 3.7.2.1.2. Frequency, depth and duration of inundation at multiple locations on the

1752 marsh in the Project Influence Area

1753

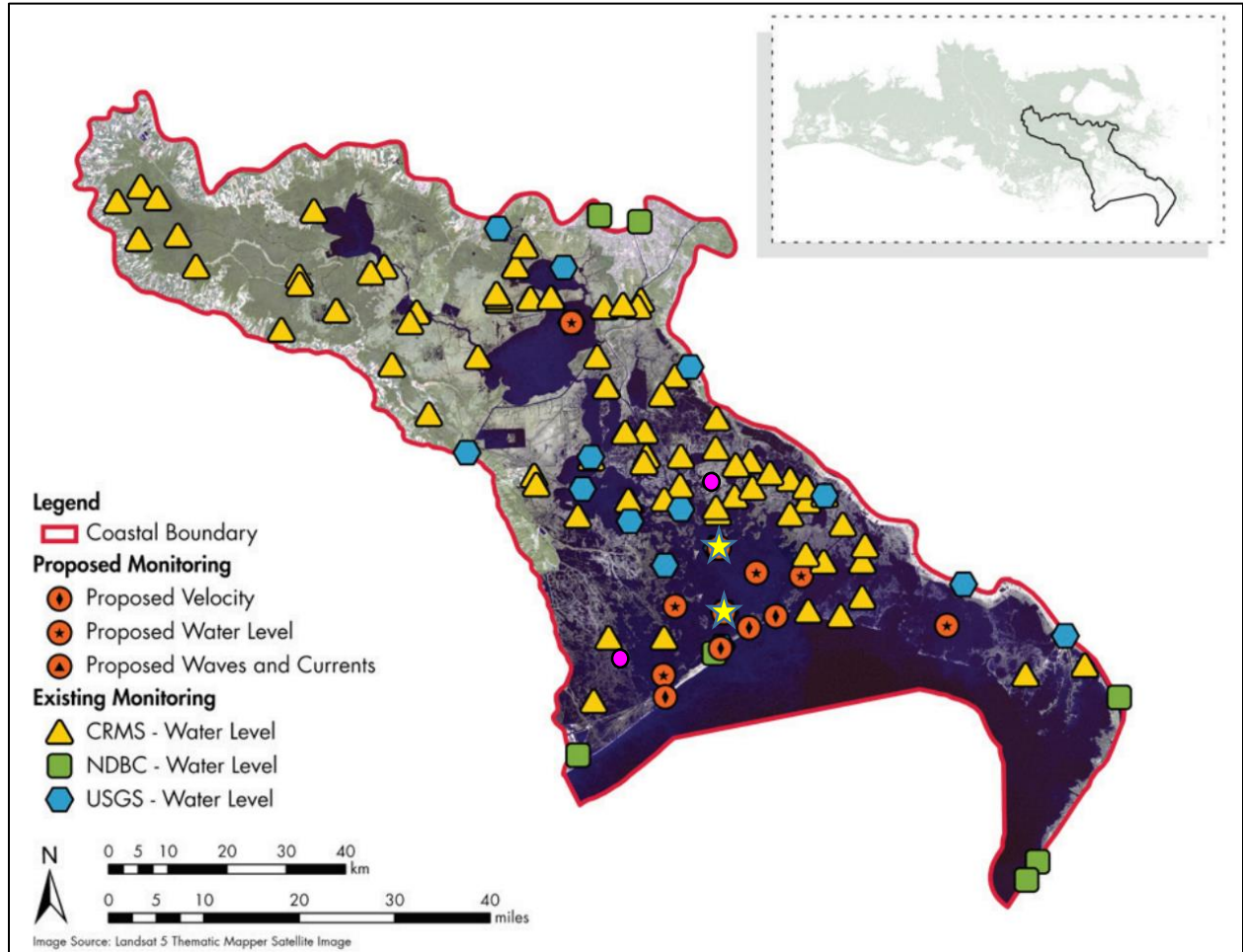
1754 ● Rationale: Measure the variability and patterns of water movement within the Project Influence

1755 Area and suitability for different types of habitats and organisms. Coastal water levels are

1756 important to understanding short term, high-intensity events that regulate organism access and

1757 materials exchange to and from the wetland surface. Long-term trends of optimal or prolonged

1758 inundation influence wetland plant productivity.  
 1759



1760  
 1761 **Figure 3.7-3.** Existing hydrologic sampling stations within the Barataria Basin. The approximate location of two  
 1762 stations that CPRA contracted USGS to install are shown with magenta circles. Two ADCPs are currently being  
 1763 installed at the locations shown with the yellow stars.  
 1764

- 1765 ● Schedule: Planned for continuous collection during both the pre-operations and post-  
 1766 construction monitoring phases.  
 1767
- 1768 ● Locations: Currently there are 65 CRMS-*Wetlands* water level gauges (56 shown in Figure 3.7-3)  
 1769 and 15 data collection platforms in Barataria Basin. CPRA proposes to install five new CRMS-  
 1770 *Wetlands* stations in the basin, in the immediate outfall area. Two will be installed during pre-  
 1771 operations monitoring in existing PIA marshes, while three will be installed in the PIA after the  
 1772 onset of operations results in the subaerial development of new wetlands.  
 1773
- 1774 ● Methodology: Empirical measurements of the height of the water level surface referenced to a  
 1775 geodetic or tidal datum will be made at the locations described above (Folse et al. 2020).  
 1776 Frequency, depth and duration of inundation will be calculated as  
 1777



1778 *Frequency of inundation = Number of days annually where water level exceeds marsh surface*  
1779 *elevation / 365 (366 for leap years)*  
1780 **Eqn. 14**

1781  
1782 *Depth of inundation = Water depths at multiple locations on the marsh in the Project*  
1783 *Influence Area – Marsh surface elevation*  
1784 **Eqn. 15**

1785  
1786 *Duration of inundation = Number of consecutive days where water level exceeds marsh*  
1787 *surface elevation*  
1788 **Eqn. 16**

- 1789 ● Parties Responsible for Data Collection: CPRA contractor.

1790

1791 3.7.2.1.3. Soil bulk density

1792

- 1793 ● Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent  
1794 wetland soil properties and sustainability in Barataria Basin. Soil bulk density is useful in  
1795 understanding the relative exposure of an area to fluvial or marine sediment sources, and for a  
1796 better understanding of the response of other soils parameters.

1797

- 1798 ● Schedule: Planned for both pre-operations and post-construction monitoring. Soils at existing  
1799 CRMS-*Wetland* stations within Barataria Basin are sampled every 10 years. Soils from CRMS-  
1800 *Wetlands* stations and new transect stations (below) in the PDDA will be sampled shortly prior  
1801 to the onset of Project operations, and every five years after the onset of Project operations.

1802

1803 Locations: Existing and five new CRMS-*Wetlands* stations in the PDDA (Figure 3.7-4). CPRA will  
1804 augment that sampling 15 points along three transects (five points per transect) radiating from  
1805 the Project outfall to encompass the Project delta development area. Exact transect locations  
1806 are will be determined by the Project AMT.

1807

- 1808 ● Methodology: Soil cores will be obtained with a push corer (Folse et al. 2020). Bulk density will  
1809 be determined for 4-cm depth increments within cores. Mass per unit volume of water and soil  
1810 particles on a dry and wet basis will be calculated.

1811

- 1812 ● Parties Responsible for Data Collection: CPRA contractor.

1813

1814 3.7.2.1.4. Soil organic matter content

1815

- 1816 ● Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent  
1817 wetland soil properties and sustainability in Barataria basin. Organic matter content of wetland  
1818 soils is a key determinant of soil development and quantifies organic contributions to soil  
1819 volume. Organic matter burial is especially important for maintaining soil elevation and a  
1820 positive feedback from plant productivity of existing wetlands. Carbon accumulation in  
1821 emergent wetlands is also an important ecosystem service of these communities.

1822

- 1823 ● Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be  
1824 sampled shortly prior to the onset of Project operations, and every five years thereafter.

1825

- 1826 ● Locations: Same sampling locations identified for *Soil bulk density* (3.7.2.1.3).
- 1827
- 1828 ● Methodology: Soil cores will be obtained with a push corer. Organic matter content will be
- 1829 determined by loss on ignition (LOI), wherein a soil sample is combusted at a temperature that
- 1830 burns off organic matter and retains mineral content. LOI will be determined for 4-cm depth
- 1831 increments within cores as per the existing CRMS methodology (Folse et al. 2020).
- 1832
- 1833 ● Parties Responsible for Data Collection: CPRA contractor.
- 1834



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

- 1835 ● Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent
- 1836 wetland soil properties and sustainability in Barataria Basin. Mineral content of wetland soils is
- 1837 a key determinants of soil development and are often used to describe the role of mineral
- 1838 contributions to soil volume.
- 1839
- 1840 ● Schedule: Planned for both pre-operations and post-construction monitoring. Soils will be
- 1841 sampled shortly prior to the onset of Project operations, and every five years thereafter.
- 1842
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- 1893
- 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 for both pre-operations and post-construction monitoring. Sampling sites will be visited twice annually.
  - 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).

1894 Rate of accretion is determined as the slope of repeated measurements of accretion over time  
1895 above feldspar marker horizons.  
1896

- 1897 ● Parties Responsible for Data Collection: CPRA contractor.

1898

1899 3.7.2.1.8. Soil strength

1900

- 1901 ● Rationale: Understand the spatial extent and magnitude of effect of the Project on emergent  
1902 wetland soil properties and sustainability in Barataria basin and enable identification of changes  
1903 and suitability for various types of habitats and organisms. Also, determine whether total  
1904 organic matter changes following diversion operation. Measures of soil strength may be  
1905 deemed important for understanding resistance to erosion.

1906

- 1907 ● Schedule: Planned for both pre-operations and post-construction monitoring.

1908

- 1909 ● Locations: See discussion of CRMS-*Wetland* and additional Project-specific stations under *Rate*  
1910 *of accretion above feldspar marker horizons* (3.7.2.1.7).

1911

- 1912 ● Methodology: Methodology for sampling soil strength will be identified after consultations with  
1913 the academic community (see discussion in Jafari et al. (2019). Both *in-situ* and laboratory  
1914 instruments are available for measuring the shear failure or ‘strength’ of soils, depending on  
1915 depth and soil type.

1916

- 1917 ● Parties Responsible for Data Collection: CPRA contractor.

1918

1919 3.7.2.1.9. Marsh surface elevation change rate in the Project Influence Area

1920

- 1921 ● Rationale: Understand trends of vertical soil elevation change rates within the project area in  
1922 relation to measured geodetic datums. Rod sediment erosion table (RSET) pin heights form the  
1923 basis for calculations of marsh surface elevation change.

1924

- 1925 ● Schedule: Planned for both pre-operations and post-construction monitoring. Marsh surface  
1926 elevation change will be calculated semi-annually, consistent with existing CRMS-*Wetlands*  
1927 protocols.

1928

- 1929 ● Locations: See discussion of CRMS-*Wetland* and additional Project-specific stations under *Rate*  
1930 *of accretion above feldspar marker horizons* (3.7.2.1.7).

1931

- 1932 ● Methodology: Installation of RSETs and measurement of average elevation of the marsh surface  
1933 will be as per the CRMS-*Wetlands* Standard Operating Procedures (Folse et al., 2020). The rate  
1934 of change of marsh surface elevation is determined as the slope of repeated measurements  
1935 over time of RSET pin heights.

1936

- 1937 ● Parties Responsible for Data Collection: CPRA contractor.

1938

1939 3.7.2.2. *Calculations in Support of Objective 2*

1940

1941 3.7.2.2.1. Sediment dispersal and retention on the emergent marsh surface

1942

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

1944

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

1947

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

1948

- 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 *Soil organic matter content (3.7.2.1.4)*.

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3.7.2.2.2. Soil organic matter density

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3.7.2.2.3. Soil mineral matter density

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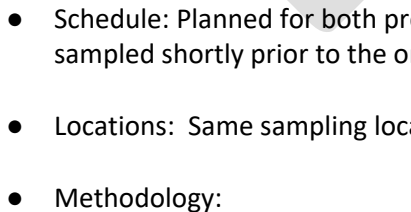
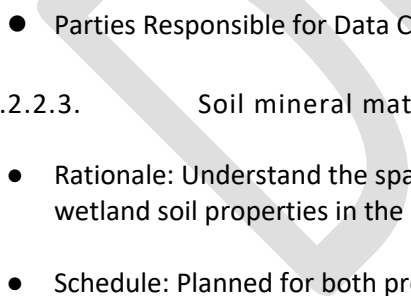
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$$\text{Mineral density} = \text{Soil bulk density (3.7.2.1.3)} - \text{Soil organic matter density (3.7.2.2.3)}$$

Eqn. 17

- 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. As a result, 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 for 2-3 measurements of the Project Influence Area pre-operations and every three-to-five 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

$$\text{Area of new delta formation} = (\text{Land and water extent within the Barataria Basin at time } x) - (\text{Land and water extent within the Barataria Basin prior to onset of operations})$$

Eqn. 18

- Parties Responsible for Data Collection: CPRA contractor.

**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: Planned for 2-3 measurements of the Project Influence Area pre-operations and every five years post-construction.
- Locations: Project Delta Development Area within the Barataria Basin (see Figure 3.3-2).

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- 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 3.8-5).
- 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 for both pre-operations and post-construction monitoring.
- Locations: Barataria Basin
- Methodology: Exact methods will be consistent with discussions of best practices outlined in Handley et al. (2018).
- Parties Responsible for Data Collection: 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.
- Locations: 65 CRMS-Wetlands and 5 new Project-specific stations (Figure 3.7-10)

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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).

- 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.

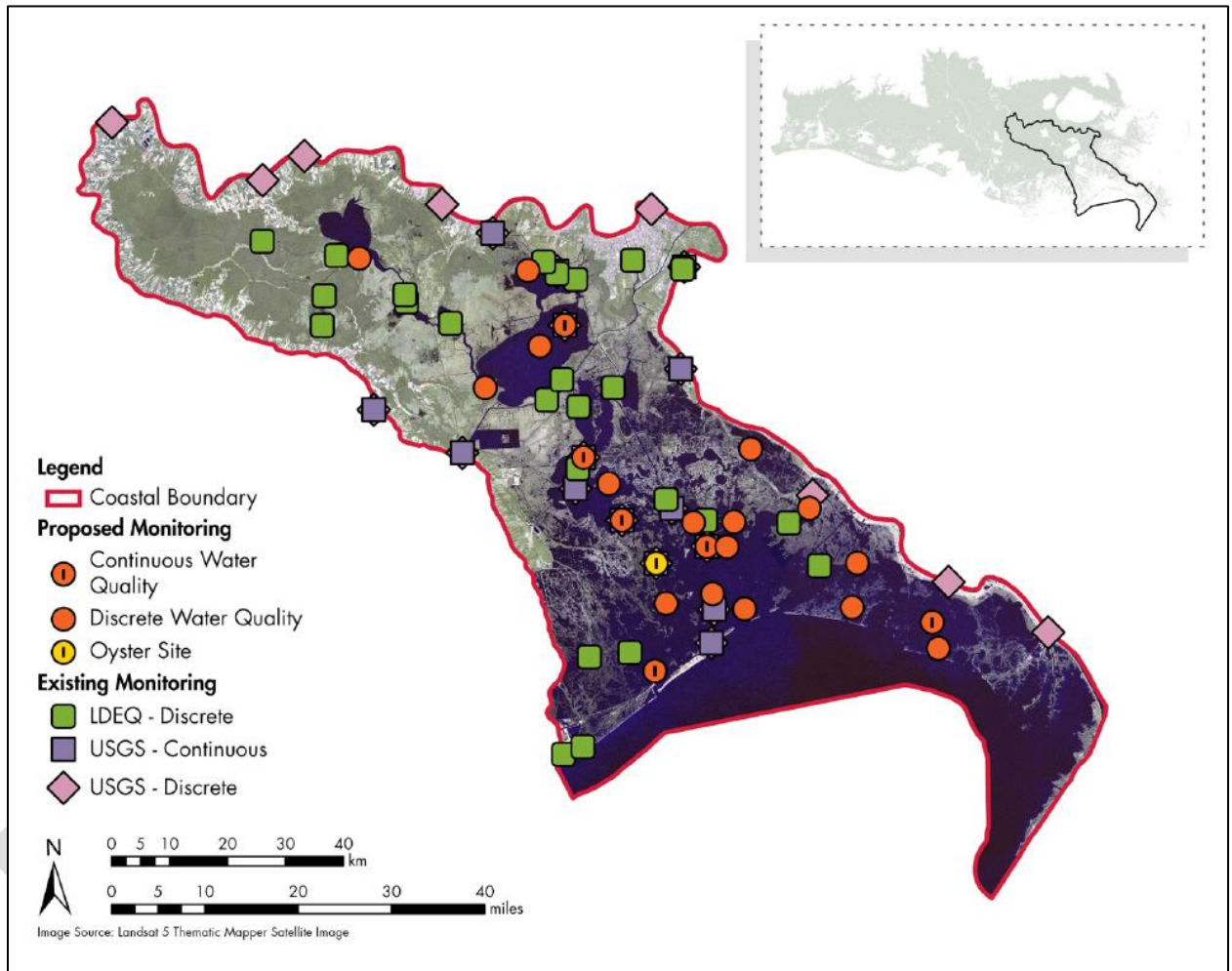
3.7.3.7. *Dissolved oxygen*

- 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 for both pre-operations and post-construction monitoring.
- Locations: 27 sampling stations currently in Barataria Basin: seven sampled continuously, 23 sampled monthly, since at least November 2015. See Figure 3.7-5.



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- 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.



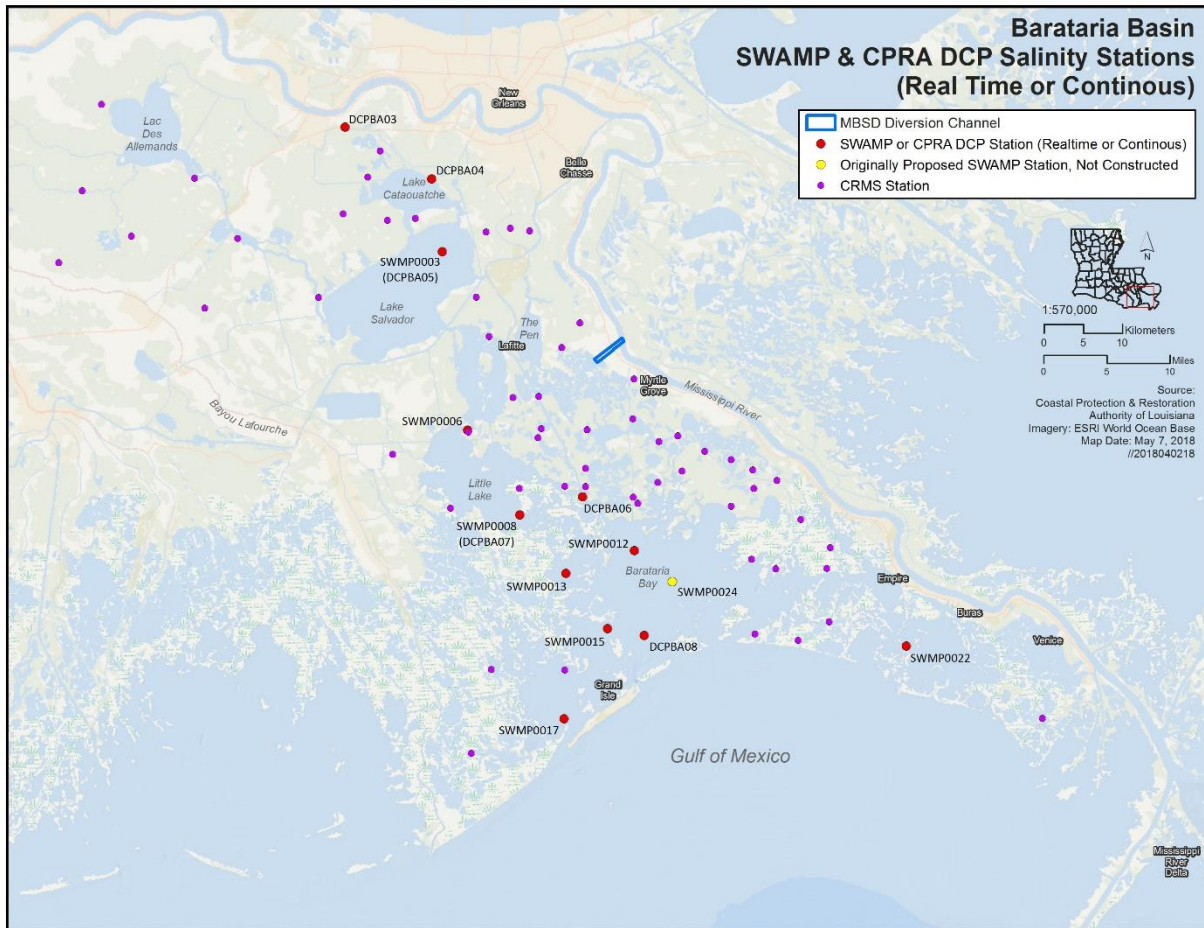
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**Figure 3.7-5.** Existing and proposed locations for SWAMP discrete and continuous water quality sampling in Barataria Basin. Figure from Water Institute for the Gulf (2019).

### 3.7.3.8. Salinity

- 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: 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.

- 2148 • Methodology: Concentration of dissolved ions or salts in water typically measured with  
2149 conductivity probes and may be reported in practical salinity units (PSU) or other (reference  
2150 SWAMP)  
2151
- 2152 • Parties Responsible for Data Collection: CPRA contractor.  
2153



2154  
2155 **Figure 3.7-6.** Existing locations for salinity sampling in Barataria Basin.

2156  
2157 3.7.3.9. *Chlorophyll a*

- 2158 • Rationale: *Chl a* is an indicator of the presence of water column primary production by  
2159 phytoplankton, and thus aids estimates of the total quantity of carbon produced by primary  
2160 producers.  
2161
- 2162 • Schedule: Planned for both pre-operations and post-construction monitoring. Sites are sampled  
2163 either continuously using *in situ* instruments (e.g., sondes) or discretely via boat-based grab  
2164 samples.  
2165
- 2166 • Locations: See discussion of discrete and continuous measurements under *Dissolved oxygen*  
2167 (3.7.3.7). The Project Management Team will also explore the viability of using aerial imagery  
2168 (e.g., satellite and/or low-altitude plane/drone-based imagery) to improve the spatial extent of  
2169

2170 *Chl a* observations.

2171

2172 ● Methodology: Concentration of *Chl a* in water, usually measured with fluorescence techniques  
2173 to indicate the biomass of phytoplankton (reference SWAMP). Sondes record measurements  
2174 every 30 minutes.

2175

2176 ● Parties Responsible for Data Collection: CPRA contractor.

2177

2178 3.7.3.10. *Phytoplankton Species Composition (including Harmful Cyanobacterial/Algal*  
2179 *Bloom Species)*

2180

2181 ● Rationale: Phytoplankton blooms are controlled by several factors, such as nutrient type and  
2182 loading rate, light availability, water residence time, temperature, and grazing by zooplankton  
2183 and benthic filter feeders (Boyer et al., 2009). In the event of an observed increase in  
2184 *Chlorophyll a* (3.7.3.9), determination of the cyanobacterial and/or eukaryotic algal species  
2185 present can provide an indication of the ecological effects of a bloom. As well, species  
2186 determination can inform whether known harmful cyanobacterial and/or algal bloom (HCAB)  
2187 species (e.g., *Mycrocystis aeruginosa*) are present, and whether follow-up sampling for  
2188 associated toxins is warranted.

2189

2190 ● Schedule: Planned for both pre-operations and post-construction monitoring. No regular  
2191 schedule. Activities would be dependent on observations of elevated *Chlorophyll a* (3.7.3.9).

2192

2193 ● Locations: Discrete sampling locations would be dependent on observations of elevated  
2194 *Chlorophyll a* (3.7.3.9).

2195

2196 ● Methodology: Samples would be taken at field locations of observed elevated *Chlorophyll a*  
2197 (3.7.3.9) for return to an analytical laboratory facility for species identification.

2198

2199 ● Parties Responsible for Data Collection: CPRA contractor.

2200

2201 3.7.3.11. *Harmful Cyanobacterial/Algal Bloom Toxins*

2202

2203 ● Rationale: A number of cyanobacterial and eukaryotic algal species are capable of producing  
2204 toxins that pose a risk to aquatic and human resources in the Barataria Basin.

2205

2206 ● Schedule: Planned for both pre-operations and post-construction monitoring. No regular  
2207 schedule. Activities would be dependent on observations of elevated *Chlorophyll a* (3.7.3.9)  
2208 that warrant follow-up surface water samples in the Barataria Basin for determination of  
2209 *Phytoplankton species composition* (3.7.3.10).

2210

2211 ● Locations: See discussion for *Phytoplankton species composition* (3.7.3.10).

2212

2213 ● Methodology: Water sample analysis for toxins associated with any harmful  
2214 cyanobacterial/algal species identified during *Phytoplankton species composition* (3.7.3.10)  
2215 sampling.

2216

- 2217 ● Parties Responsible for Data Collection: CPRA contractor.

2218

2219 3.7.3.12. *Nutrient constituents in Barataria Surface Waters*

2220

- 2221 ● Rationale: Nutrients stimulate the growth of aquatic primary producers. The primary limiting  
2222 nutrients often include nitrogen, phosphorus, and silicate. The types of nutrients and ratios in  
2223 Basin surface waters are subject to changes in MR concentrations (Turner & Rabalais, 1991) and  
2224 operations of existing and proposed siphons and diversion structures.

2225

- 2226 ● Schedule: Planned for both pre-operations and post-construction monitoring.

2227

- 2228 ● Locations: Same 27 stations described for *Dissolved oxygen* (3.7.3.7).

2229

- 2230 ● Methodology: Concentration of selected elements or molecules dissolved in water (reference  
2231 SWAMP). Measured as mass of nutrient per liter of sample.

2232

- 2233 ● Parties Responsible for Data Collection: CPRA contractor.

2234

2235 3.7.3.13. *Temperature of Barataria Surface Waters*

2236

- 2237 ● Rationale: Estuarine temperature affects the distribution, growth, and productivity of nekton  
2238 communities ( Minello et al., 2003; Zimmerman et al., 2000), vegetation community  
2239 composition (Pennings et al., 2005), and ultimately the functions and services that wetlands  
2240 provide (Odum, 1988).

2241

- 2242 ● Schedule: Planned for both pre-operations and post-construction monitoring.

2243

- 2244 ● Locations: Same 153 stations described for *Salinity* (3.7.3.8).

2245

- 2246 ● Methodology: Temperature will be measured with thermometers or thermocouples and will be  
2247 reported in degrees Centigrade.

2248

- 2249 ● Parties Responsible for Data Collection: CPRA contractor.

2250

2251 3.7.3.14. *Turbidity of Barataria Surface Waters*

2252

- 2253 ● Rationale: The turbidity of Barataria Basin surface waters influences both primary producers  
2254 (e.g., phytoplankton and SAV) and consumers (e.g., filter feeders and visual predators) in the  
2255 estuary. Numerical modeling of Project alternatives supports an expectation of short-term  
2256 increases in turbidity in Basin surface waters during Project operations.

2257

- 2258 ● Schedule: Planned for both pre-operations and post-construction monitoring.

2259

- 2260 ● Locations: Same 27 stations described for *Dissolved oxygen* (3.7.3.7).

2261

- 2262 ● Methodology: Optical (or other) measure of water clarity, which can be influenced by particles  
2263 or dissolved colored materials and may be reported in various turbidity units (reference

2264 SWAMP). Measured as Nephelometric Turbidity Units (NTUs)

2265

- Parties Responsible for Data Collection: CPRA contractor.

2267

2268 3.7.3.15. *Total suspended solids in Barataria Surface Waters*

2269

- 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.

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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.

2311  
2312       • Schedule: Planned for both pre-operations and once every five years after operations begin.

2313  
2314       • Locations: Will be identified following the onset of Project operations.

2315  
2316       • Methodology: A rapid assessment survey will identify the presence of invasive algae and  
2317       invertebrates (e.g., zebra mussel). A team of trained field samplers (scientists or trained  
2318       volunteers) will visit in-water structures (e.g., marinas) and other selected habitats within  
2319       Barataria Basin to observe, identify, and record estuarine algal and invertebrate organism  
2320       presence, abundance, and location. Samples will be collected for identification in a laboratory.

2321  
2322       • Parties Responsible for Data Collection: CPRA contractor.

2323  
2324   3.7.3.18.       *Nekton (Fish and Shellfish) Species Abundance and Composition/Assemblage*

2325  
2326       • Rationale: Documenting the distribution and abundance of important fish and invertebrate  
2327       species, within the project area allows for examination in trends of time (such as Catch per Unit  
2328       Effort) or in space and allows for the detection of new or increased presence and range shifts or  
2329       expansions, of aquatic invasive fishes and invertebrates.

2330  
2331       The objective of nekton community sampling is to document the population status of  
2332       commercially- and recreationally-important fish and invertebrate species, as well as,  
2333       representative guilds. Sampling is designed to: (1) evaluate patterns of distribution, (2) evaluate  
2334       changes in abundance and composition, and (3) evaluate habitat association patterns.

2335  
2336       To meet the monitoring objective for nekton community composition, sampling must be  
2337       effective at detecting changes in abundance of resident and transient species to fully capture  
2338       the diversity of species and their life stages. Several fisheries-independent gear types are used  
2339       by LDWF across the freshwater to marine gradient (Table 3.7-3), including: entanglement nets,  
2340       trawls, seine, and electrofishing. Collection of finfish and shellfish (shrimp, crab) using  
2341       standardized gear can be used as an indicator of relative abundance and can be used to develop  
2342       diversity indices and to quantify resource availability within estuarine habitats. Standardized  
2343       gear also targets specific size classes, which provides an opportunity to examine ecological  
2344       differences among life stages of a given species (Livingston, 1988). CPRA may additionally  
2345       perform analyses to evaluate food web changes (e.g., stable isotope analysis on nekton gut  
2346       contents).

2347  
2348       • Schedule: Planned for both pre-operations and post-construction monitoring. See Table 3.7-4  
2349       for discussion of sampling frequencies for fisheries-independent data collection. Data collection  
2350       for fisheries-dependent data collection is generally accomplished with creel surveys (weekly)  
2351       and trip-ticket and oyster boarding (both variable in terms of frequency and number of data  
2352       collection points).

2353  
2354       • Locations: See Figures 3.7-7 and 3.7-8.

2355  
2356       • Methodology: Individuals species sampling methods are as per LDWF 2018.

2357

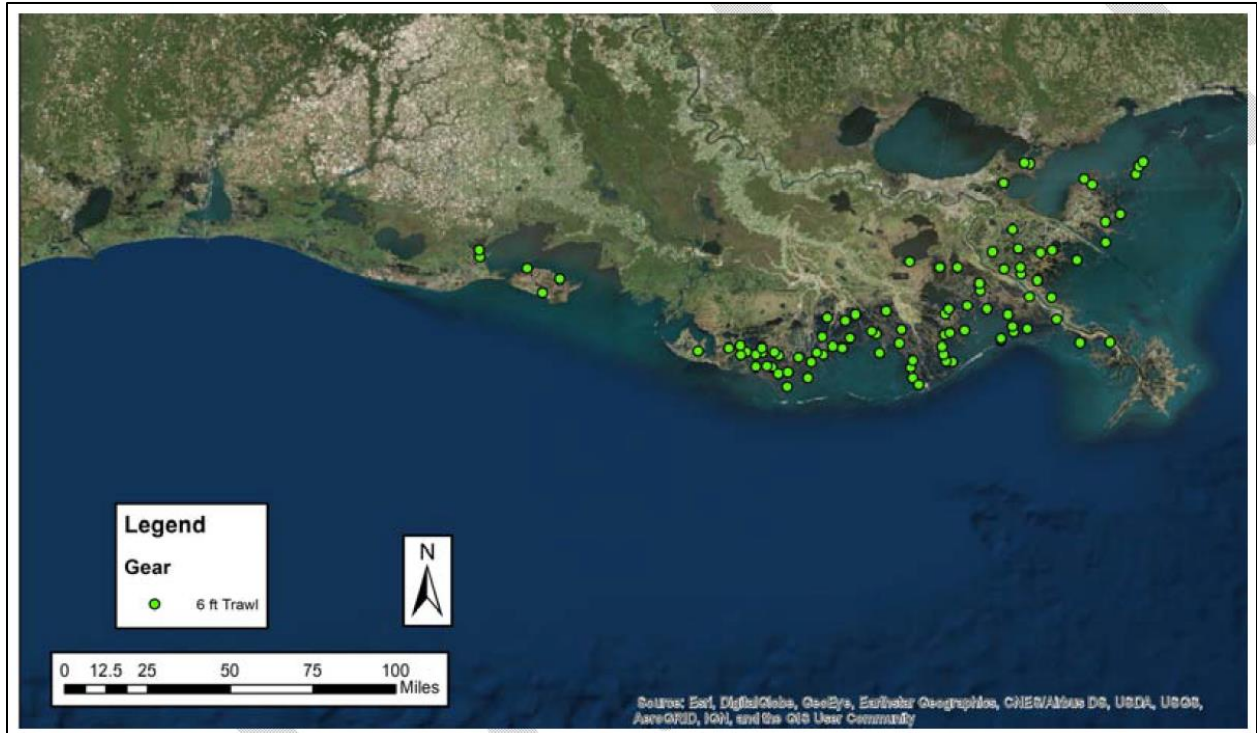
- Parties Responsible for Data Collection: CPRA contractor.

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

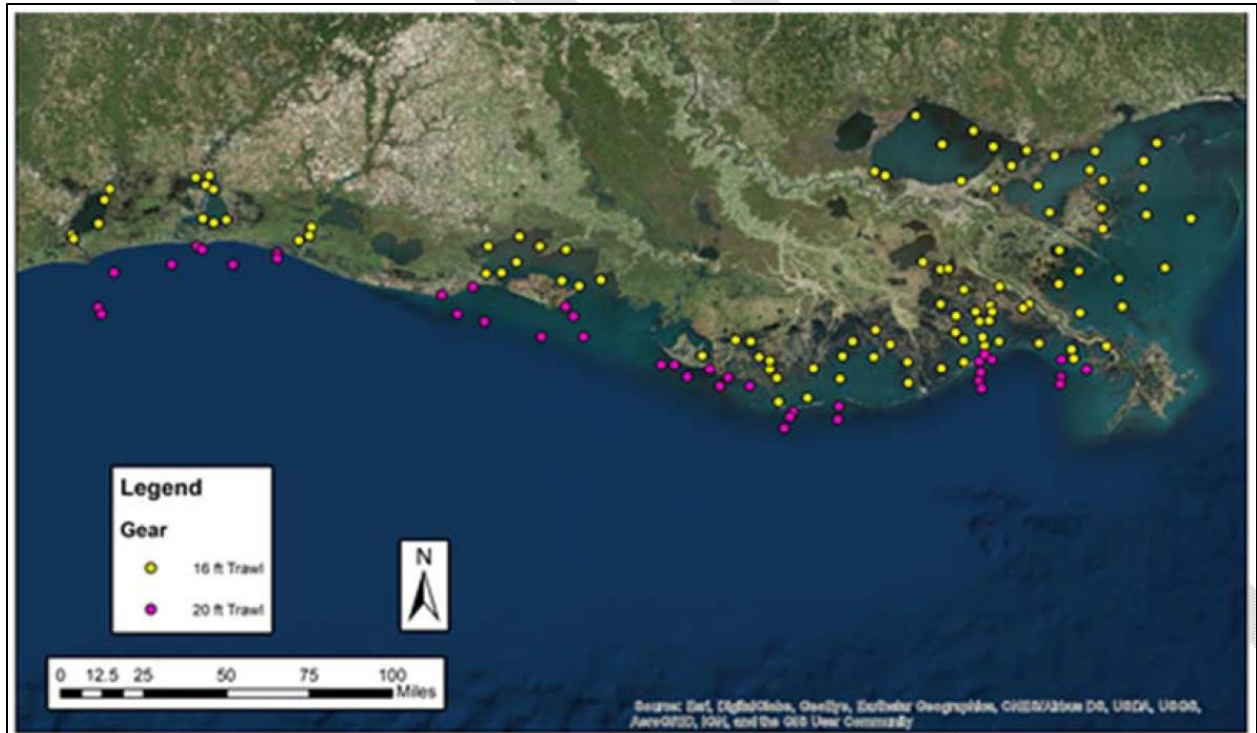
Scientific Name	Common Name	Gear Type
<i>Anchoa mitchilli</i>	Bay anchovy	Trawls
<i>Brevoortia patronus</i>	Gulf menhaden	Trawl/Gillnet
<i>Callinectes sapidus</i>	Blue crab	Trawl/Seine
<i>Cynoscion nebulosus</i>	Spotted seatrout	Gillnet/Trammel Net
<i>Farfantepenaeus aztecus</i>	Brown shrimp	Trawl/Seine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

**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



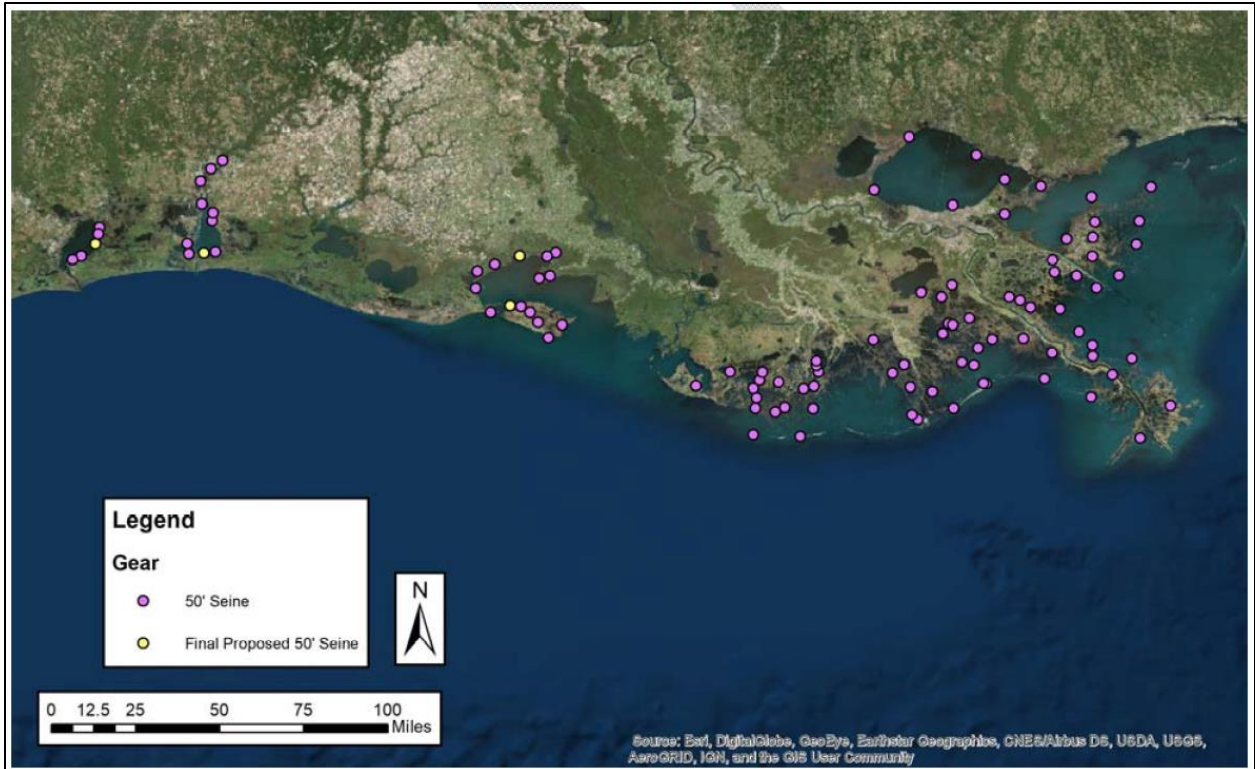
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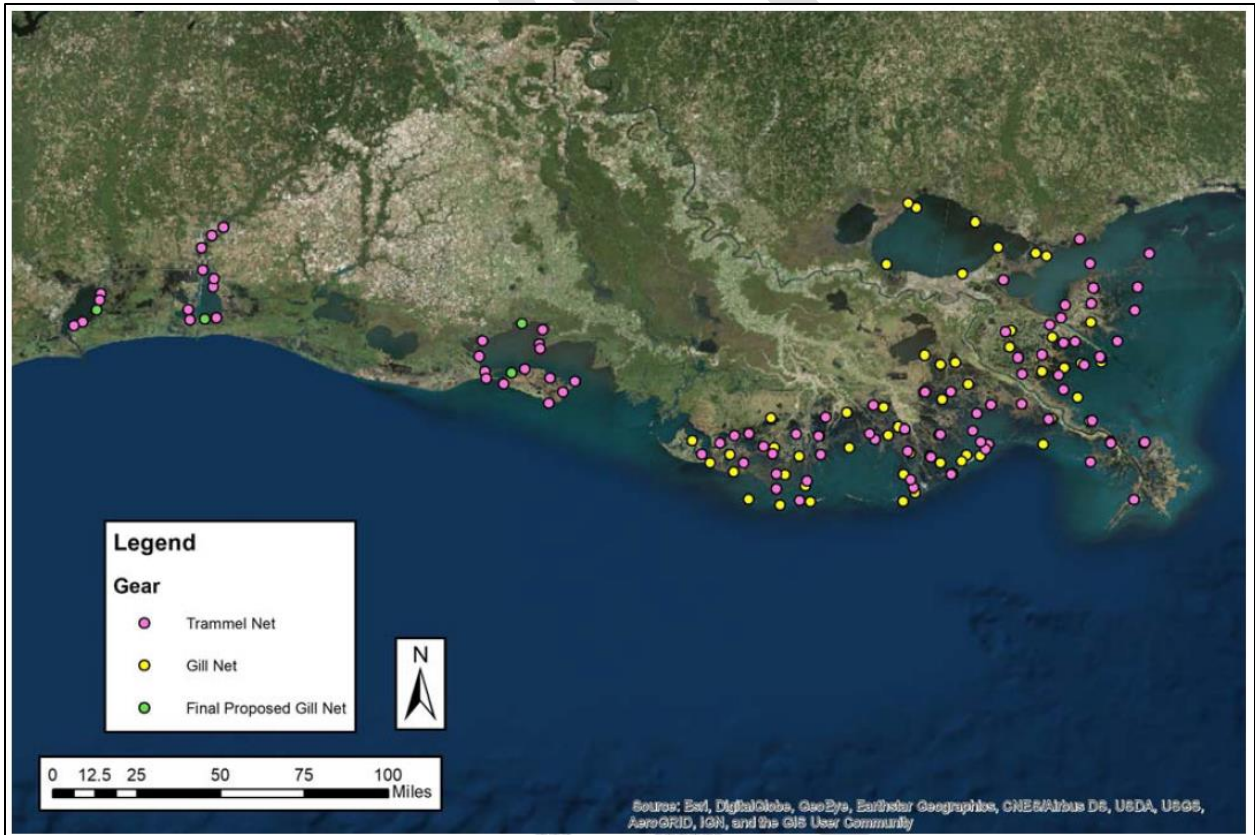
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**Figure 3.7-7.** Existing LDWF trawl locations for along the Louisiana coast. Shown are locations of 6-ft (top) and 16-ft and 20-ft trawls (bottom). Figures from CPRA & LDWF 2019.





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**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.

2374 3.7.3.19. *Atlantic Bottlenose Dolphins (Tursiops truncatus)*

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- 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.

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 in order 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 addresses 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 BBES dolphins from Project operations include a framework for coordinating during operations, and a post-operational commitment to evaluate the ability of diversion operations to be modified to meet project goals while reducing impacts to marine mammals.

- 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, a variety of methods may be used and results from the first five years of monitoring during operational years will guide scheduling or need for continuation for future years.
  - Pre-operations (five years): 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. Given the length of the time between past data collection efforts and project operations, this

- 2422 additional sampling is necessary. In addition, a single effort in any given year may not  
2423 be sufficient given inter- and intra-annual variability, seasonal habitat and potential  
2424 dolphin distribution changes in Barataria Basin. The plan below presents a reasonable  
2425 sampling design to capture both inter- and intra-annual variability.
- 2426     ▪ Enhanced stranding response and investigations (stranding rates, causes of  
2427       illness and death, standardized effort) as part of this MAM plan would be  
2428       ongoing beginning five years prior to operations.
  - 2429     ▪ Capture-Mark-Recapture (CMR) surveys (abundance, distribution, density) will  
2430       be conducted basin-wide.
  - 2431     ▪ Visual assessment surveys (skin health, body condition, reproductive follow-up)  
2432       will be performed.
  - 2433     ▪ Capture Release Health Assessment (CRHA) sessions will be conducted to  
2434       include animals captured in locations across the bay. Health data analyses will  
2435       include a variety of samples and procedures.
  - 2436     ▪ Tagging (movement and possibly salinity) will include approximately 90 animals  
2437       total from several areas across the bay.
  - 2438     ▪ Biopsies (for omics, hormones, fecundity, nutrition, contaminants, and disease)  
2439       and associated analyses will be done over different geographic areas during  
2440       years without a CRHA.
  - 2441     ▪ Prey data (quantity, quality, species) will be collected and analyzed seasonally  
2442       by the NRDA-funded FIMP, and from stranding samples. These data will be  
2443       shared with marine mammal experts.
  - 2444     ▪ These sensors may be paired with eDNA continuous sensors when possible.
  - 2445     ▪ Baseline dolphin prey and habitat (water quality) monitoring will be fulfilled  
2446       through other ongoing or planned resource monitoring. In the 5 years prior to  
2447       operations, whole fish samples representative of dolphin prey (10 per prey type)  
2448       will be collected, preserved and analyzed by calorimetry for evaluation of the  
2449       nutritional content of current pre-operations prey.
  - 2450     ○ Post-Construction (10 years): Post-construction monitoring will occur for up to ten  
2451       years beginning with the onset of Project operations. Annual review of the data  
2452       collected and results will inform planning for the next year studies.
    - 2453       ▪ Enhanced stranding response and investigations (stranding rates, causes of  
2454       illness and death, standardized effort, rapid response for live animals) as part of  
2455       this MAM plan would be ongoing in the BBES and adjacent coastal areas.
    - 2456       ▪ CMR surveys bay-wide (abundance, distribution, density) will be conducted  
2457       basin-wide periodically.
    - 2458       ▪ Visual assessment surveys (skin health, body condition, reproductive follow-up)  
2459       will be done via unmanned aircraft system (UAS; i.e., drone) and vessel-based  
2460       assessments.
    - 2461       ▪ CRHA (health status) will be done periodically across geographic areas.
    - 2462       ▪ Biopsies (omics, hormones, fecundity, nutrition, contaminants, and disease) will  
2463       be done during years without a CRHA.
    - 2464       ▪ Tagging (movement and salinity) will include approximately 140 animals total  
2465       over 10 years.
    - 2466       ▪ Prey data (quantity, quality, and calorimetry) will be collected and analyzed  
2467       seasonally by FIMP, and from stranding samples.
    - 2468

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- 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.
  - 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 core team will provide for an enhanced MMSN to establish baseline stranding information pre-operations. Support for stranding response personnel, active surveillance for strandings to determine mortality rates and for diagnostic analyses to determine causes of illness and death would be necessary. For instance, if strandings increase above the pre-operation level (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 is triggered.
    - 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 4.2-3). 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 CHRA 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.

- 2517 ○ If fisheries surveys indicate that the prey base has shifted, and dolphin body condition
- 2518 decreases, a bioenergetics study would occur.
- 2519 ○ Additionally, a monitoring lab and office will be established within an existing facility,
- 2520 with associated equipment (e.g., vessels, trailers, truck, freezer).
- 2521

- 2522 ● Parties Responsible for Data Collection
- 2523

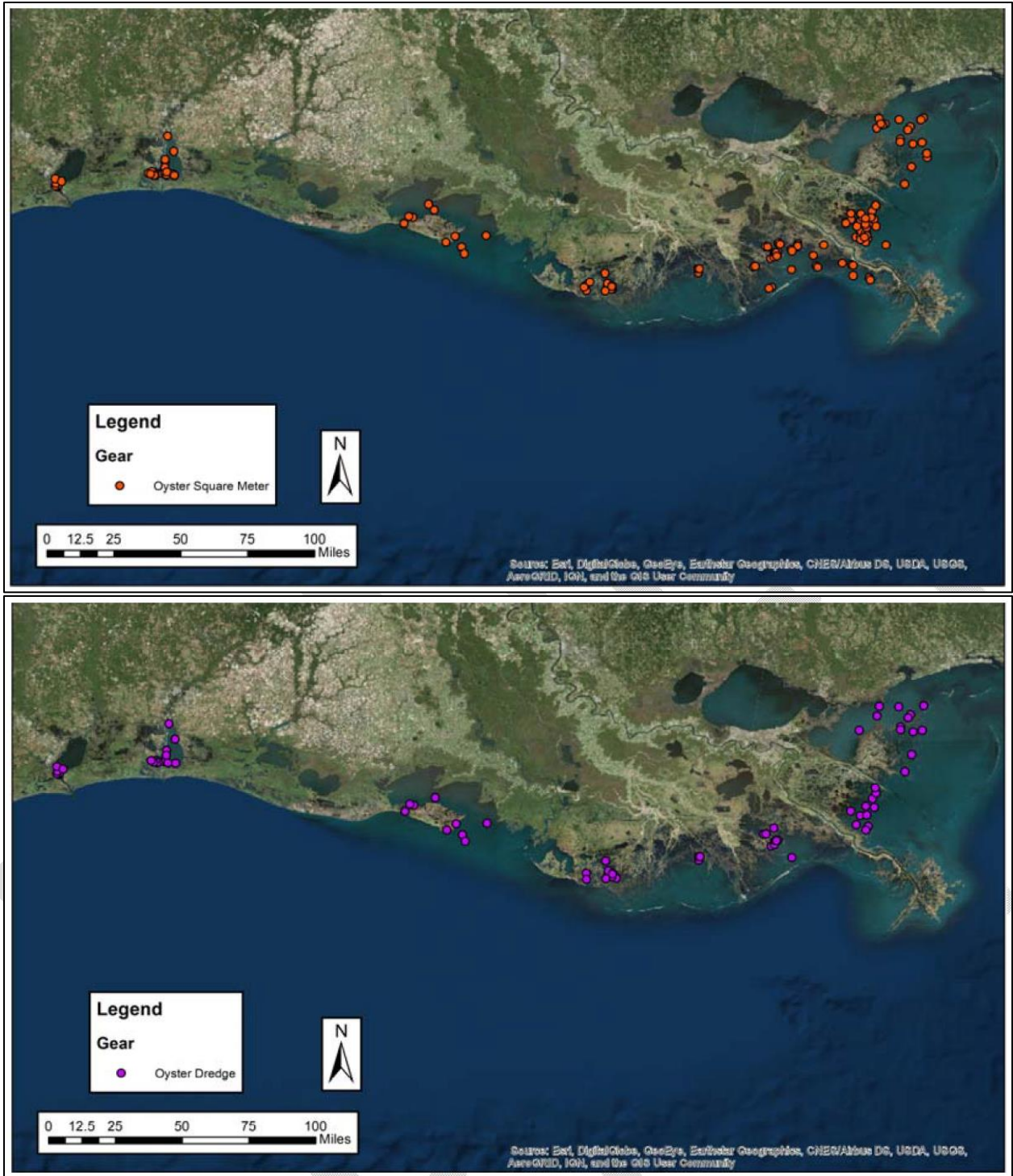
2524 A core monitoring team composed of federal, State, non-governmental organizations, and  
2525 academic institutions will be created and stationed in Barataria Bay to implement the  
2526 monitoring strategy for up to 15 years (five years pre-construction; 10 years post-construction).  
2527 The team will accomplish monitoring and response fieldwork, data analyses, tracking, sample  
2528 processing, necropsies, and surveys. It will also increase capacity, public awareness, and  
2529 education opportunities within Louisiana.

2530

2531 3.7.3.20. *Eastern Oysters (Crassostrea virginica)*

2532

- 2533 ● Rationale: Document oyster population dynamics and abundance to assess the status and
- 2534 trends of the resource within the project area. The distribution of oysters within an estuary is
- 2535 largely a function of salinity, freshwater input, depth, and substrate (Melancon et al., 1998),
- 2536 although sedimentation, coastal disturbances and overharvesting also control their distribution
- 2537 (Oyster Technical Task Force, 2012). Storm surge and wave action can also result in the
- 2538 destruction of oyster reefs, killing of spat and juvenile oysters, or displacement of oysters onto
- 2539 habitats that cannot support them (Banks et al., 2007).
- 2540
- 2541 ● Schedule: Planned for both pre-operations and post-construction monitoring. LDWF samples
- 2542 with at varying frequencies depending on the methodology and the time of year:
  - 2543 ○ Dredge:
    - 2544 ▪ Monthly , except for July
    - 2545 ▪ LDWF may also sample weekly in April and May in order to adaptively manage
    - 2546 the oyster fishery
  - 2547 ○ 1-m<sup>2</sup> quadrat:
    - 2548 ▪ Coast-wide annually between late June and early July
    - 2549 ▪ In the Barataria and Pontchartrain Basins only, twice annually in May-June and
    - 2550 September-October
- 2551
- 2552 ● Locations: 34 existing locations shown in Figure 3.7-9.
- 2553
- 2554 ● Methodology: The LDWF oyster-sampling plan uses square meter plots and dredge sampling to
- 2555 assess oyster density, abundance, and mortality. CPRA proposes to continue that monitoring at
- 2556 the current sampling spatial and temporal density (see Banks et al. 2016).
- 2557
- 2558 ● Parties Responsible for Data Collection: CPRA contractor.



**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.

2564 3.7.3.21. Wildlife  
2565

- 2566 ● Rationale: Document changes in selected wildlife abundance within the project area. The data  
2567 will support estimations of *Aquatic resource and terrestrial wildlife utilization of*  
2568 *created/restored habitat (3.7.3.22)*. The following wildlife species are priorities for Project  
2569 monitoring, as there were identified in the NRDA PDARP (DWH Trustees 2016) as having been  
2570 injured during the 2010 spill, were the subject of Project-effects estimation of habitat suitability  
2571 (via the use of HSIs), or were otherwise identified as priorities for continued monitoring by  
2572 Project partners.
  - 2573 ○ *Alligator mississippiensis* (American alligator),
  - 2574 ○ *Anas carolinensis* (green-winged teal),
  - 2575 ○ *Anas fulvigula* (mottled duck),
  - 2576 ○ *Mareca strepera* (gadwall), and
  - 2577 ○ *Pelecanus occidentalis* (brown pelican).
- 2578
- 2579 ● Schedule: Planned for both pre-operations and post-construction monitoring.
- 2580
- 2581 ● Locations: Survey locations for the species listed above will be consistent with existing LDWF  
2582 aerial surveys paths.
- 2583
- 2584 ● Methodology:
  - 2585 ○ LDWF conducts annual aerial surveys coast-wide to estimate the number of waterfowl  
2586 (Figure 3.7-10). The survey consists of 27 north-south transect lines from the Gulf  
2587 northward to U.S. Highway 90 that are one-quarter mile in width and vary in length  
2588 from 8 to 48 miles. Survey lines are spaced at 7.5-mile intervals in the southwest and at  
2589 15 miles in the southeast resulting in 3% and 1.5% sampling rates in the two areas,  
2590 respectively. A fixed wing aircraft is used for this inventory from an altitude of 125 feet  
2591 at approximately 100 mph. The number of ducks and type of waterfowl species are  
2592 recorded by habitat type on each survey line. The AMT will rely on the continuation of  
2593 those data-collection efforts, and will consult with LDWF staff to determine reasonable  
2594 approaches to estimate those relevant population estimates for the PIA.
  - 2595 ○ LDWF conducts nesting surveys for brown pelicans. The AMT will rely on the  
2596 continuation of those data-collection efforts, and will consult with LDWF staff to  
2597 determine reasonable approaches to estimate those relevant population estimates for  
2598 the PIA.
  - 2599 ○ LDWF also conducts annual aerial surveys coast-wide to estimate the number of  
2600 alligator nests, for purposes of setting the annual limits for the taking of eggs in support  
2601 of the alligator farming industry. The AMT will rely on the continuation of those data-  
2602 collection efforts, and will consult with LDWF staff to determine reasonable approaches  
2603 to estimate those relevant population estimates for the PIA.
  - 2604
- 2605 ● Parties Responsible for Data Collection: LDWF.
- 2606

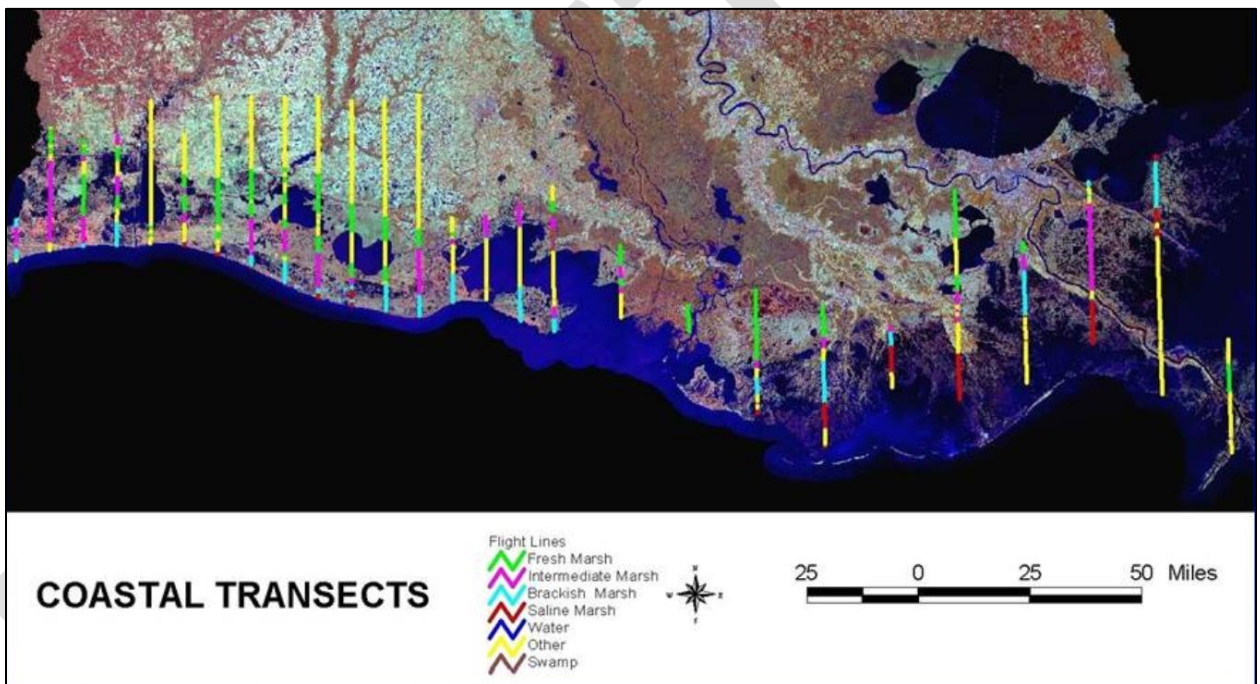
2607 3.7.3.22. *Aquatic resource and terrestrial wildlife utilization of created/restored habitat*

2608

2609 • Rationale: Estimate utilization of created or restored habitat by aquatic resources and terrestrial  
2610 wildlife. The DWH PDARP (DWH Trustees 2016) discussed several fish and wildlife species that  
2611 served as indicators of injury to the coastal vegetated marsh ecosystem caused by the 2010 spill  
2612 (though it is noted that these were not the only species for which Deepwater Horizon injuries  
2613 were documented):

- 2614 ○ *Fundulus grandis* (Gulf killifish),
- 2615 ○ *Cyprinodon variegatus* (sheepshead minnow),
- 2616 ○ *Palaemonetes pugio* (grass shrimp)
- 2617 ○ *Callinectes sapidus* (blue crab)
- 2618 ○ *Littorina irrorata* (marsh periwinkle), and
- 2619 ○ *Uca longisignalis* (Gulf marsh fiddler crab).

2620



2621

2622 **Figure 3.7-10.** Locations of coastal transects flown by LDWF for waterfowl population estimations.

2623 Transects are shown in relation to marsh type from 2001 (see Linscombe and Hartley (2011)). Figure

2624 courtesy of LDWF.

2625

2626 • Schedule: Planned to occur once pre-operations and every five years post-construction.

2627

2628 • Locations: Will include a mix of existing marsh sites within the PIA and newly-created marshes  
2629 in the PDDA, and in two additional wetland areas (a conventionally restored wetland and an  
2630 unrestored wetland) as described in Section 4.1.3, for purposes of assessing the relative  
2631 ecosystem function of different marsh restoration treatments.

2632



- 2633 ● Methodology:
- 2634 ○ Entrapment gears will be used to sample nekton such as *Gulf killifish* and grass shrimp in
- 2635 the tidal creeks, marsh and at the marsh edge.
- 2636 ○ Data from *Nekton (Fish and Shellfish) Species Abundance and Composition/Assemblage*
- 2637 (3.7.3.18), *Eastern Oysters* (3.8.3.20), and *Wildlife* (3.7.3.21) surveys will be combined
- 2638 with data collection at historically-occurring emergent wetlands within the Project
- 2639 Influence Area and newly-created emergent wetlands in the Project delta development
- 2640 area to provide an estimate of wildlife utilization.
- 2641 ○ *Gulf marsh fiddler crabs* will be surveyed non-destructively, through either burrow
- 2642 counts or visual counts of individual crabs (see discussion in Miller (no date)).
- 2643 ○ Marsh periwinkles will be sampled through visual counts.
- 2644
- 2645 ● Parties Responsible for Data Collection: CPRA contractor.
- 2646

### 2647 3.7.3.23. *Socio-economic Data*

2648

2649 At this time, CPRA is proposing to rely on the Human Dimensions data collection in Barataria Basin

2650 outlined in the SWAMP implementation plan (Hijuelos and Hemmerling, 2016;

2651 <https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=11464>). To summarize the proposed

2652 information outlined in Table C:1 therein, the categories (*in italics*) and variables proposed by Hijuelos

2653 and Hemmerling (2016) are

2654

- 2655 ● *Population and Demographics*
- 2656 ○ Number of Households
- 2657 ○ Total Population
- 2658 ○ Race and Ethnicity
- 2659 ● *Housing and Community Characteristics*
- 2660 ○ Residential Stability
- 2661 ○ Home Ownership
- 2662 ○ Residential Occupancy Rates
- 2663 ○ Property Values
- 2664 ● *Economy and Employment*
- 2665 ○ Economic Development
- 2666 ○ Income Levels
- 2667 ○ Poverty Rates
- 2668 ○ Unemployment Levels
- 2669 ● *Ecosystem Dependency*
- 2670 ○ Nature Resource Extraction (agriculture and forestry, fisheries landings, oil & gas
- 2671 production)
- 2672 ○ Cultural and Traditional Uses of Natural Resources
- 2673 ○ Natural Resource-based Employment (agriculture, forestry, fishing and hunting, and oil
- 2674 & gas)
- 2675 ○ Tourism, Commercial and Recreational Use of Natural Resources (e.g., number of
- 2676 recreational fishing and hunting licenses, number of recreational trips to the area)
- 2677

- 2678 • *Residential Properties Protection*
- 2679 ○ Residential Risk Reduction
- 2680 ○ Households Receiving Structural Protection
- 2681 ○ Residential Properties Receiving Nonstructural Protection
- 2682 • *Critical Infrastructure and Essential Services Protection*
- 2683 ○ Risk Reduction for Critical Facilities
- 2684 ○ Miles of Levees Created and Maintained
- 2685 ○ Number of Critical Facilities Protected by Levees
- 2686 ○ Public and Commercial Properties Receiving Nonstructural Protection
- 2687
- 2688 • Parties Responsible for Data Collection: Most of these parameters are collected and archived by
- 2689 the US Census Bureau or other federal agencies. CPRA or its contractor will obtain and analyze
- 2690 the federal data.
- 2691

### 2692 **3.7.4. Compliance Monitoring**

2693

2694 The purpose of compliance monitoring is to document the ability of those managing the Project to meet

2695 permitting requirements. ***This placeholder exists for descriptions of the collection of compliance data.***

2696 ***If, and if so when, the Project permit is approved and issued and those requirements are identified, the***

2697 ***corresponding details will be developed.***

2698

#### 2699 **3.7.4.1. National Historic Preservation Act, Section 106 Monitoring Requirements**

- 2700
- 2701 • Rationale: In compliance with Stipulation X. Monitoring Plan of the Programmatic Agreement
- 2702 among USACE, the State Historic Preservation Officer, the Advisory Council on Historic
- 2703 Preservation, and CPRA, CPRA will monitor the effects of the diversion on archaeological sites
- 2704 within the Operations Impact Area of Potential Effect.
- 2705
- 2706 • Schedule: Planned to occur once pre-operations and annually, after the cessation of operational
- 2707 flows and return to base flow, for the first ten years after the onset of Project operations.
- 2708
- 2709 • Locations: Documented historical sites in the Project Influence Area.
- 2710
- 2711 • Methodology: CPRA will use a team of Secretary of the Interior Qualified Archaeologists to
- 2712 conduct a one-day reconnaissance of the PIA by boat. This reconnaissance team will take
- 2713 photographs and document visible changes to the landscape, with the particular attention to
- 2714 any evidence of previously undiscovered cultural resources and the appearance of human
- 2715 remains at known archaeological sites. If the reconnaissance team locates an apparent cultural
- 2716 resource or human remains, CPRA will notify all Signatories to this Agreement within three days.
- 2717 A report documenting the results of the annual survey will be provided to all consulting parties
- 2718 with 30 days after completion of the survey.
- 2719
- 2720 • Parties Responsible for Data Collection
- 2721 ○ CPRA
- 2722 ○ Contracted team of Secretary of the Interior Qualified Archaeologists
- 2723

2724 **4. EVALUATION AND PROJECT-LEVEL DECISIONS FOR CONDUCTING MANAGEMENT ACTIONS**

2725  
 2726 Evaluation in the context of the MBSD Project MAM Plan refers to the consideration of data collected  
 2727 from the monitoring protocols outlined in Section 2. Those data will inform future Project management  
 2728 decisions aimed at improving Project effectiveness and limiting ecological and/or human impacts when  
 2729 possible. This section describes the general types and anticipated frequency of evaluations that will  
 2730 ultimately inform management actions, such as operations refinements and outfall management  
 2731 measures, changes to monitoring protocols, and refinements to modeling assumptions. Table 4-1  
 2732 outlines the general classes of evaluations that correspond to the Project objectives that are described  
 2733 in detail in Section 1.

2734  
 2735 **Table 4-1.** A description of how evaluation will support the fundamental and secondary objectives.

<b>Types of Monitoring (Section)</b>	<b>Fulfills:</b>	<b>Overarching Questions Linking Evaluation to Decision-making</b>
<i>Effectiveness</i> (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?
<i>Compliance</i> (Section 3.8)	Resource management and permit conditions	How can Project components and/or operations be optimized to balance Project objectives and impacts?

2736  
 2737 Decisions on Project management actions, including the development and amendment of annual  
 2738 Operations Plans, will be made based on evaluation of the Project monitoring data. The basis for  
 2739 initiation of Project operations is outlined in Section 4.2 of the OMRR&R main report. The OMT will  
 2740 work with the AMT and other adaptive management partners to decide on continuation, alteration or  
 2741 discontinuation of operations (and subsequent amendments to the Annual Operations Plans) and/or the  
 2742 need for outfall management actions or other management responses during individual structure  
 2743 openings (events) and on annual and multi-year cycles as outlined in Section 5.

2744  
 2745 It is important to note that while Project alternatives modeling informs expectation of biophysical  
 2746 responses to Project operations, it isn't possible to know for certain prior to the onset of Project  
 2747 operations what the monitoring data will show, and thus what specific changes in Project operations or  
 2748 outfall management actions will be necessary. In the initial drafting of this section the focus has been to  
 2749 provide some considerations of the response to the Project Effectiveness data (Table 4-1), especially the  
 2750 efficiency by which the Project captures sediment from the MR and transports that sediment through  
 2751 the conveyance channel and into the Project receiving basin. CPRA expects these data will underpin the  
 2752 immediate needs and opportunities for adaptive management decision making.

2753  
 2754 To date, CPRA and LA TIG partners have proposed categorizing the monitoring parameters and  
 2755 evaluations into four categories. These categories reflect how the monitoring data would be evaluated,  
 2756 and whether the data evaluations would warrant or trigger considerations of some type of adaptive  
 2757 management action such as a change in operations or the implementation of outfall management.  
 2758 Those four categories are:

2759

- 2760 • Range: Data for these parameters will be evaluated with the goal of maintaining observations  
2761 within a range of values based on documented historical and/or current variability, as well as  
2762 scientific understandings of the parameter. Adaptive management actions will be considered if  
2763 values were observed outside the range for a particular parameter.
- 2764 • Presence/Absence: Data for these parameters will be evaluated in the binary of parameter  
2765 occurrence or absence. Adaptive management actions will be considered if values occurred in  
2766 the undesirable half of the binary (i.e., absent when presence is desired, or vice-versa).
- 2767 • Trend: Data for these parameters will be evaluated as a progression of values in time and space.  
2768 Adaptive management actions will be considered if the expected or desired trend (at least in  
2769 part informed by Project alternative numerical modeling) does not occur or reverses from  
2770 historical patterns.
- 2771 • Context: Data for these parameters would be collected and analyzed due to broader interests in  
2772 the values and trends. However, at this point, we do not anticipate data observations for these  
2773 parameters triggering any considerations of adaptive management actions.

2774  
2775 Initial categorization of each monitored parameter described in Section 3 is outlined in the tables below,  
2776 with an emphasis on the term initial. Consistent with the idea of Project adaptive management, it is  
2777 plausible that there may be changes in categorization of monitored parameters over time, as additional  
2778 observations are made and data collected.

2779  
2780 The authors also acknowledge that these bins may be artificially discrete. For example, a parameter  
2781 might be assigned to be evaluated within a Range of values, but repeated observations of a Trend of  
2782 values increasing unabated towards the maximum “acceptable” value within that Range might  
2783 realistically trigger adaptive management considerations before values are observed exceeding that  
2784 maximum.

#### 2785 2786 2787 **4.1. Evaluation of Project Effectiveness Monitoring Data**

2788  
2789 There will be extensive monitoring of the Mississippi River, conveyance structure and Barataria Basin to  
2790 inform Project effectiveness and document natural and human community response, as outlined in  
2791 Section 3. Evaluation and decision making should be tempered by expected and empirical outcomes  
2792 and the disparate timescales over which meaningful and discernable trends are exhibited by the  
2793 resource or landscape. For example, the hydrologic impacts of the Project on basin habitats will be  
2794 sudden and widespread; however, the emergence of new land area or plant community changes may  
2795 experience various lag effects. There should be caution against premature evaluations on processes that  
2796 require an accumulation of interacting processes over time; such an approach avoids cross-scale issues  
2797 common to some large-scale restoration projects (Walters 1997). It is envisioned that peer review and  
2798 collaborative analysis approaches will converge on accepted time scales for certain resource  
2799 evaluations, especially as they pertain to further constraining an operation regime designed to meet the  
2800 primary Project objectives.

2801

2802 **4.1.1. Evaluation of Monitoring Data in Support of Project Objective 1: Deliver**  
2803 **Freshwater, Sediment, and Nutrients to Barataria Bay through a Large-Scale**  
2804 **Sediment Diversion from the Mississippi River**  
2805

2806 The overt, empirical basis for Project structure operations, at least in the initial years, will be continuous  
2807 monitoring of *Mississippi River water discharge* (3.7.1.1.1). Additionally, early in Project operations,  
2808 *Mississippi River suspended sediment concentrations* (3.7.1.1.2), *Water volume conveyed into Barataria*  
2809 *Basin* (3.7.1.1.9) and *Sediment concentrations in the flows conveyed into Barataria Basin* (3.7.1.1.10) will  
2810 be collected and analyzed immediately, as they will provide the technical rationale for confirmation and  
2811 potential changes in operations to optimize *Sediment:water in the flows conveyed into Barataria basin*  
2812 (Section 3.7.1.2.2).  
2813

2814 Longer-term plans for the specific time intervals to conduct evaluations have not been determined.  
2815 Measurements and surveys of each operational event could occur at higher frequencies during early  
2816 operations, for example, to evaluate the sediment transport performance of all the conveyance  
2817 features. As learning increases, the evaluations may shift from event-based to periodic (e.g., annual)  
2818 intervals to inform operation decisions. However, it is not possible in advance of Project operations to  
2819 predict how quickly Project managers will learn from each operational event. A performance metric  
2820 such as *Sediment: water in the flows conveyed into Barataria basin* (Section 3.7.1.2.2) may initially be  
2821 studied on multiple events within a year, but as river discharge and sediment availability relationships  
2822 improve, evaluations may be limited to the water year.  
2823

2824 Equally important is the determination of the extent to which Project operational flows are leading to  
2825 changes in *Topography/bathymetry of the Project outfall area* (3.7.1.1.7), especially erosion of the  
2826 native soils and sediments in the outfall area. Erosion may exceed deposition at some specific locations,  
2827 especially immediately after operations commence. Project managers will need to make those  
2828 assessments quickly and determine whether erosion and deposition patterns are within or exceed  
2829 expectations, and whether immediate adaptive management of operations is warranted.  
2830

2831 **4.1.2. Evaluation of Monitoring Data in Support of Project Objective 2: Reconnect and**  
2832 **Re-establish Sustainable Deltaic Processes between the MR and the Barataria**  
2833 **Basin**  
2834

2835 The parameters listed in Table 4.1-2 and Section 3.7.2 are proposed to support Objective 2 by informing  
2836 how the Project would reconnect the Mississippi River to the Barataria Basin and re-establish delta  
2837 building in the Basin. Objective 2 is explicitly centered on the movement of water and sediment through  
2838 the Basin and the response of soil-building processes; specifically, the repeated addition of riverine  
2839 mineral sediments to Basin wetland soils and the resulting increase in marsh soil surface elevation that  
2840 help those marshes be sustainable intertidal habitats in the face of relative SLR.  
2841

2842 *Water velocities at multiple locations in the Project Influence Area* (3.7.2.1.1) during both Project base  
2843 flows and operational events will be followed to determine whether Project flows result in broader  
2844 erosion of existing marsh or open water bottoms than the Project alternatives numerical modeling  
2845 suggested. Excessive erosion would reduce the overall goal of building and maintaining emergent  
2846 wetland in the Basin. Note that the focus of this monitoring would be outside of the immediate Project  
2847 outfall area. For areas most proximal to the discharge of the Project, numerical modeling has projected  
2848 the scouring of some existing marsh and subaqueous water bottoms. This phenomenon is necessary for

2849 the Project flows to build the distributary network in the receiving area needed to distribute freshwater,  
2850 nutrients and sediments into the Basin.

2851

2852 Likewise, Project alternatives modeling has projected that *Frequency, depth and duration of inundation*  
2853 *at multiple locations on the marsh in the Project Influence Area (3.7.2.1.2)* will increase during Project  
2854 operations. The Project partners will monitor this parameter to determine if, and if so the extent to  
2855 which, Project operations will result in inundation patterns that are limiting subaerial wetlands in the  
2856 PIA. This limitation, if present, could result from excessive water levels physically inundating wetland  
2857 surfaces, and/or the imposition of an inundation stress on emergent wetland vegetation. Currently the  
2858 available science informing what inundation patterns are either optimal for or detrimental to marsh  
2859 vegetation growth is inexact, and hinders establishing firm limits. As a result, no explicit thresholds in  
2860 inundation have been established *a priori*, and instead the intention is to monitor this parameter to see  
2861 whether an increasing trend in inundation results over time from Project operations. While the Project  
2862 Operations and Adaptive Management Teams await scientific advances and Project-specific data to  
2863 inform eventual thresholds on optimal versus detrimental inundation to specific plant species, a  
2864 consistent increase in inundation would be more broadly recognized as undesirable.

2865

2866 The hydrologic flows resulting from Project operations are ultimately what will transport the mineral  
2867 sediments in diverted Mississippi River flows (Objective 1) into the Barataria Basin and distribute those  
2868 sediments into open waterbodies and onto the marsh surface. The two remaining parameters proposed  
2869 as adaptive management triggers in Table 4.1-2 reflect the fate and effect of those sediments.

2870

2871 Most central to the overall intention of the Project, and thus the determination of Project success and  
2872 effects, is the effect of diverted freshwater, nutrients and sediments on the *Marsh surface elevation*  
2873 *change rate in the Project Influence Area (3.7.2.1.9)*, as measured at CRMS-Wetlands sites. The Project  
2874 is intended to create and sustain emergent marshes in the Basin indirectly by stimulating plant growth  
2875 that will contribute organic matter to the marsh soil profile, and by directly transporting mineral  
2876 sediments onto the marsh surface and into the soil profile. Both of these processes would be  
2877 manifested by increases in marsh surface elevation over time, with sustainability defined as rates of  
2878 increase exceeding local estimates of RSLR and thus sustaining subaerial emergent marsh. Observations  
2879 of declines in marsh surface elevation, especially at CRMS-Wetlands sites that currently demonstrate  
2880 other elevation change patterns, would suggest either limitations in diverted material flows to the  
2881 marsh or that Project operations are imposing other stresses on the wetlands.

2882

2883 Similarly, calculations of *Sediment dispersal and retention on the emergent marsh surface in the Project*  
2884 *Influence Area (3.7.2.2.1)* will elucidate Project success by determining patterns of mineral sediment  
2885 distribution onto, and into the soil matrix of, the wetlands in the PIA. This parameter will be an  
2886 important one for the Project Operations and Adaptive Management Teams to monitor because unlike  
2887 the well-recognized benefits of filling open water bottoms with sediment and establishing new  
2888 emergent wetlands, the available science suggests that there is a “Goldilocks” optimum to the benefits  
2889 of dispersed sediments to intact marshes. Too few sediments transported to the marsh surface may not  
2890 stimulate plant growth and maintain *Marsh surface elevation change rate in the Project Influence Area*,  
2891 while too great a sediment delivery can impose lethal physical stresses to the native vegetation and lead  
2892 to mineral lenses in the soil profile that hinder future marsh growth. It would be up to Project managers  
2893 to weigh the costs and benefits of observed short-term sediment depositional patterns to the long-term  
2894 goals of the Project.

2895

2896 CPRA has proposed that a number of soil development parameters be relegated for now as Context  
2897 variables; i.e., parameters for which data will be collected, but which at this time are not being identified  
2898 as representing overt triggers for adaptive management consideration (see Section 4.2). As proposed, if  
2899 there are issues noted with the soil-related triggers above, these parameters will be more fully  
2900 investigated to determine why issues were identified.

2901

2902 **4.1.3. Evaluation of Monitoring Data in Support of Project Objective 3: Create, restore,**  
2903 **and sustain wetlands and associated ecosystem services**

2904

2905 If the processes represented by the monitoring parameters designated in support of Objective 2  
2906 represent the secondary effects on Barataria Basin hydrology and soils of diverted Mississippi River  
2907 freshwater, nutrients and sediments, then Objective 3, and the parameters intended to support the  
2908 evaluations of meeting Objective 3 (Section 3.7.3) and the needs for adaptive management actions  
2909 (Table 4.1-3), are the tertiary effects of the diverted flows, and are the primary goal of and need for this  
2910 project. The proposed Objective 3 parameters are specifically concerned with the actual development  
2911 of new wetlands resulting from sediment dispersal into the Basin, changes in water quality, and the  
2912 response of living resources (plant, animal and human) to the diverted freshwater, nutrients and  
2913 sediments.

2914

2915 As defined by Objective 3, *Land and water extent/Area of new delta formation* (3.7.3.1) and *Emergent*  
2916 *wetland area* (3.7.3.2) would be priority parameters for mid-term consideration. These two parameters  
2917 specifically follow the Objective 2 observations of dispersal of materials by the Project, and whether  
2918 those material flows are resulting in new or sustained emergent wetlands within the Basin. This report  
2919 has discussed earlier why the projections of wetland loss and gain from numerical modeling are  
2920 inappropriate as temporal benchmarks of Project performance. However, the modeling can provide an  
2921 order-of-magnitude estimate of what land gain and loss could be expected if the Project were to be  
2922 operated over a particular time period under conditions (river discharge, operational frequency,  
2923 sediment content, etc.) similar to those modeled. Those evaluations cannot be made *a priori*, and so  
2924 will need to wait on both actual operations and the expected frequency of land/water data collection.  
2925 That said, land building or land-loss that is anomalous to the model's order-of-magnitude projections  
2926 are expected to trigger closer looks at other variables (e.g., those described under Objective 2) that  
2927 might provide an explanation for why.

2928

2929 To quantify the restoration benefits of the marsh that develops in the diversion outfall area, a Before-  
2930 After-Control-Impact study will be established. Ecosystem function in the created marsh will be  
2931 compared to the pre-construction existing condition using the following datasets: *Land and water extent*  
2932 *(3.7.3.1)*, *Emergent wetland area* (3.7.3.2), *Vegetation Cover, Abundance, and Height* (3.7.3.3), *Emergent*  
2933 *and submerged vegetation community type* (3.7.3.5), *Emergent vegetation biomass in the Project area*  
2934 *(3.7.3.6)*, *Topography/bathymetry of the Project delta development area* (3.7.1.1.7), *Lower trophic level*  
2935 *organisms* (3.7.3.16), *Nekton species abundance and composition/assembly* (3.7.3.18), and *Aquatic*  
2936 *resource and terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22).

2937

2938 To compare the wetland function of a marsh built by a sediment diversion to that of a marsh built by  
2939 conventional wetland restoration (marsh creation from dredged sediments), a study will be established  
2940 to compare three types of wetland treatments. MAM partners will develop the experimental design for  
2941 the study once the study goals and objectives are finalized. Assessment will rely heavily on the data  
2942 collection that was otherwise established for this Project, planned coast-wide LiDAR surveys, existing  
2943 CRMS-Wetlands stations (for unrestored marsh), and pre- and post-construction sampling from a

2944 conventionally-restored marsh. Wetland function will be evaluated using the same parameters listed in  
2945 the paragraph above.

2946  
2947 Regarding water quality parameters, the adaptive management focus would be on the response of  
2948 *Dissolved oxygen* (3.7.3.7) and *Salinity* (3.7.3.8), as these are expected to drive many of the biological  
2949 responses described below in the Basin, as well as fundamentally defining the ability of Project  
2950 operations to still retain a functional estuary, from a *Salinity* standpoint. On that latter point, while  
2951 Project alternatives numerical modeling does project that salinities will freshen substantially during  
2952 Project operations beyond base flows, the same modeling projects a rapid return to a full range of  
2953 estuarine salinities in the Basin once base flows are reinstated. Observations of freshwater salinities  
2954 that persist throughout the Basin even after Project operations cease would trigger adaptive  
2955 management considerations.

2956  
2957 Concerns have been expressed about the potential for Project operations to result in the development  
2958 of phytoplankton blooms, and especially HCABs). A phased adaptive management approach is proposed  
2959 here to monitor for that potential. In lieu of institutionalizing comprehensive water quality monitoring  
2960 for HCABs and HCAB toxins, the Project partners propose to systematically monitor *Chlorophyll a*  
2961 (3.7.3.9) using *in situ* sondes and possibly remote sensing. Observations of anomalously large-scale  
2962 (spatially) and/or rapid (temporally) increase in *Chl a* during or after Project operational events under  
2963 this approach would trigger follow-on boat-based sampling of the waters in question for determination  
2964 in the lab of *Phytoplankton species composition* (3.7.3.10), to determine if HCAB species are present in  
2965 the assumed phytoplankton bloom, and for *Harmful algal bloom toxins* (3.7.3.11) to determine toxin  
2966 presence/absence if HCAB species are present. It is anticipated at this time that only the presence of  
2967 *Harmful algal bloom toxins* would trigger consideration of adaptive management actions.

2968  
2969 The proposal described above for a Presence/Absence approach to evaluating *Salinity* data is similar to  
2970 the proposal for evaluating a number of living resources; namely, *Submerged aquatic vegetation area*  
2971 (3.7.3.4), *Emergent and submerged vegetation community type* (3.7.3.5), *Nekton species abundance and*  
2972 *composition/assembly* (3.7.3.18), and *Aquatic resource and terrestrial wildlife utilization of habitat in*  
2973 *the Project Influence Area* (3.7.3.22). The reason for this proposal is the same as described earlier as  
2974 well. We expect, from the results of the Project alternatives numerical modeling, that Project  
2975 operations will result in some persistent and some temporary changes in the salinity structure of the  
2976 estuary, including localized salinity decreases (especially closer to the Project outfall). Living resource  
2977 distributions are expected to likewise change, at least in so far as that described by the Basin-wide  
2978 Model (for vegetation) and model outputs for fish and wildlife. No adaptive management  
2979 considerations are proposed in the event that there are not persistent and large-scale changes in  
2980 estuarine species distributions throughout the Basin as a whole; i.e., that Project operations do not  
2981 result in major and widespread Basin-wide losses of estuarine plants and animals. Explicit in this  
2982 proposal is the idea that localized estuarine species losses where salinities decrease would not trigger  
2983 AM considerations.

2984  
2985 The project may cause a change in the occurrence of invasive species. The new or increased occurrence  
2986 of invasive nekton species (*Nekton species abundance and composition/assembly* (3.7.3.18)) or  
2987 invasive aquatic invertebrate or algal species (*Aquatic Invasive (Algae and Invertebrate) Species*) would  
2988 trigger an adaptive management action to control species that are deemed as a threat to ecosystem  
2989 function. The new or increased occurrence of invasive vegetation species (*Emergent and submerged*  
2990 *vegetation community type* (3.7.3.5)) would be noted as a sign of changing conditions, and would  
2991 provide context, but would not trigger an adaptive management action.



2992  
2993 The exception to this Presence/Absence consideration of living resources data would be for  
2994 consideration of *Emergent vegetation biomass in the Project Influence Area* (3.7.3.6), measure at the  
2995 existing and proposed CRMS-*Wetlands* stations. As mentioned earlier, Project effects numerical  
2996 modeling projects localized increases in *Marsh surface elevation change rate in the Project Influence*  
2997 *Area* (3.7.2.1.9) during Project operations. It is uncertain how exactly emergent plant biomass will  
2998 respond to the environmental changes resulting from Project operations, but currently the proposed  
2999 approach around this variable is to consider some kind of adaptive management action if there are  
3000 repeated, consistent year-over-year decreases in emergent plant biomass.

3001  
3002 To evaluate changes in the Barataria Basin food web, multiple datasets will be used. Changes in  
3003 community assemblage over time will be clarified through *Nekton species abundance and*  
3004 *composition/assemblage* (3.7.3.18) and in *Lower Trophic Level Organisms* (Section 3.7.3.16). Questions  
3005 about changes in the biodiversity of the aquatic food web, the food web links, and the benthic: pelagic  
3006 ratios (biomass and productivity, including interannual and seasonal variability) over time will be  
3007 explored through the use of ecosystem models refined and run as described in Section 1.5 and by  
3008 incorporating additional information collected as described in *Lower Trophic Level Organisms* (Section  
3009 3.7.3.16) *Nekton species abundance and composition/assemblage* (3.7.3.18), and *Aquatic resource and*  
3010 *terrestrial wildlife utilization of habitat in the Project Influence Area* (3.7.3.22). Refined models will also  
3011 be used to qualify the ecosystem benefits of the Project; test and understand ongoing and potential  
3012 future changes resulting from management actions to existing conditions; statistically relate  
3013 environmental condition variability to food web responses; improve predictive capabilities.

3014  
3015

#### 3016 **4.2. Evaluation of Context Variables**

3017  
3018 Comprehensive evaluation of all monitored parameters is anticipated to occur at every five years (see  
3019 5.2.3). Some of these variables will be monitored due to substantial interest in changes in value, but we  
3020 do not anticipate the data serving as triggers for adaptive management at this time (although consistent  
3021 with the idea of adaptive management, those parameter classifications/considerations could change in  
3022 the future); and are thus classified as Context variables. Other variables listed below are not proposed  
3023 in themselves as potential triggers for adaptive management, but may contribute to calculations of  
3024 other variables that are presented above as adaptive management triggers.

3025  
3026 However, it is not that these parameters would not inform adaptive management considerations. In  
3027 fact, when observations of the more actionable parameters described in Section 4.1 trigger adaptive  
3028 management consideration, it is entirely likely that related or contributing parameter data will also be  
3029 analyzed to help inform decision making on the best course of action. For instance, if consideration of  
3030 an adaptive management action is triggered based on observations of *Sediment dispersal and retention*  
3031 *on the emergent marsh surface in the Project Influence Area* (3.7.2.2.2) below the desired range of  
3032 values, the Adaptive Management Team would likely examine *Soil mineral matter density* (3.7.2.2.4) or  
3033 *Rate of accretion above feldspar marker horizons* (3.7.2.1.7) to help inform why dispersal may be  
3034 insufficient.

3035

3036 Parameters proposed for classification as Context variables are

3037

- 3038 • Mississippi River nutrient concentrations (3.7.1.1.3)
- 3039 • Sedimentology of the Alliance South sand bar (3.7.1.1.5),
- 3040 • Sediment concentrations in the flows conveyed into Barataria Basin (3.7.1.1.10),
- 3041 • Mississippi River sediment load (3.7.1.2.1),
- 3042 • Sediment volume conveyed into Barataria Basin (3.7.1.2.3),
- 3043 • Nutrient loads conveyed into Barataria Basin (3.7.1.2.4),
- 3044 • Soil bulk density (3.7.2.1.3),
- 3045 • Loss of soil organic matter on ignition (3.7.2.1.4),
- 3046 • Soil mineral matter grain size (3.7.2.1.5),
- 3047 • Soil total nutrients (3.7.2.1.6),
- 3048 • Rate of accretion above feldspar marker horizons (3.7.2.1.7),
- 3049 • Soil strength (3.7.2.1.8),
- 3050 • Soil organic matter density (3.7.2.2.3),
- 3051 • Soil mineral matter density (3.7.2.2.4),
- 3052 • Nutrient constituents in Barataria surface waters (3.7.3.12),
- 3053 • Temperature of Barataria surface waters (3.7.3.13),
- 3054 • Turbidity of Barataria surface waters (3.7.3.14),
- 3055 • Total suspended solids in Barataria surface waters (3.7.3.15),
- 3056 • Lower Trophic Level Organisms (3.6.3.16)
- 3057 • Wildlife (3.7.3.21), and
- 3058 • Socio-economic data (3.7.3.23).

3059

3060

#### 3061 **4.3. Evaluation of Compliance Monitoring Data**

3062

3063 *This placeholder exists for descriptions of the evaluation of compliance data. If the Project permit is*  
3064 *approved and issued identifying those requirements, the corresponding details will be developed*  
3065 *accordingly.*

3066

##### 3067 **4.3.1. National Historic Preservation Act, Section 106 Findings**

3068

3069 *Details and a matching table will be developed if, and if so when, the Project permit is issued.*

3070

3071  
3072

**Table 4.2-1.** 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	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 <i>Mississippi River water discharge</i> (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, bi-annually 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, bi-annually thereafter	Trend	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.	Outfall management actions
Bathymetry of canals in the Project Influence Area (3.7.1.1.8)	Pre-operations: Twice prior to onset of operations Post-construction: After each operational event beyond base flow, or annually if no operations in a particular year	Range	Magnitude or rate of deposition in the Barataria Waterway and Wilkinson Canal that limit boat traffic in those waterways.	Conduct maintenance dredging of the canals to address impacts from the Project, or Implement outfall management measures to limit the loss of sediments to the canals
Water volume conveyed into Barataria Basin (3.7.1.1.9)	Post-construction: Continuous	Presence/ Absence	As per the Project permit request, operational discharge will not exceed 75,000 cfs when <i>Mississippi River water discharge</i> (3.7.1.1.1) is at or above 1,000,000 cfs.	Adjust the extent that the Project structure is opened between operational and base flows to maintain proposed operational and base flow discharges.
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.	Adjust timing of Project operational flows in relation to river discharge and suspended sediment concentration
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.

3073

3074 **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  
 3075 management action.

Parameter/Calculation	Frequency of Evaluation	Category	Observations Triggering Adaptive Management Consideration	Examples of Potential Adaptive Management Actions
Water velocities at multiple locations in the Barataria Basin (3.7.2.1.1)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Presence/Absence	Observed water velocities causing unanticipated erosion (based on numerical and physical modeling) in the Project Influence Area, outside the immediate receiving basin.	Outfall 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 extent that the Project structure is opened between operational and base flows 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

3076

3077 **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  
 3078 trigger adaptive management action.

Parameter/Calculation	Frequency of Evaluation	Category	Observations Triggering Adaptive Management Consideration	Examples of Potential Adaptive Management Actions
Land and water extent / Area of new delta formation (3.7.3.1)	Limited analysis dependent on frequency of data collection, comprehensive analysis every five 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)	Limited analysis dependent on frequency of data collection, comprehensive analysis every five 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 dependent on frequency of data collection, 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 management actions ; changes in diversion operations timing or volume.
Dissolved Oxygen (3.7.3.7)	Pre-operations: Continuous Post-construction: Continuous , 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 <sub>2</sub> < 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 (3.7.3.8)	Pre-operations: Continuous Post-construction: Continuous , 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 (3.7.3.9)	Pre-operations: Continuous (sondes), periodic if remote sensing used Post-construction: Continuous (sondes), periodic if remote sensing used	Trend	Increase in chlorophyll concentrations suggestive of a harmful algal bloom would trigger follow-up discrete sampling for <i>Phytoplankton species composition</i> (3.7.3.10)	Outfall management actions
Phytoplankton species composition (3.7.3.10)	Pre-operations: Discrete sampling only Post-construction: Discrete sampling only	Presence/Absence	Presence of cyanobacterial and/or eukaryotic algal species associated with harmful algal blooms would trigger analysis of discrete samples from 3.7.3.9 for <i>Harmful algal bloom toxins</i> (3.7.3.10)	Outfall management actions
Harmful algal bloom toxins (3.7.3.11)	Pre-operations: Discrete sampling only Post-construction: Discrete sampling only	Presence/Absence	Presence of cyanobacterial and/or eukaryotic algal bloom toxins could trigger consideration of a receiving basin adaptive management action	Outfall management actions
Aquatic Invasive (Algae and Invertebrate) Species (3.7.3.17)	Pre-operations: Once Post-operations: 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.

3079 **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  
 3080 that would trigger adaptive management action.

Parameter/Calculation	Frequency of Evaluation	Category	Observations Triggering Adaptive Management Consideration	Adaptive Management Actions to Consider
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 ( <i>Tursiops truncatus</i> ) (3.7.3.19)	Variable depending on specific parameters	Range	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.	Project optimization
Eastern Oysters ( <i>Crassostrea virginica</i> ) (3.7.3.20)	Limited analysis annually, comprehensive analysis every five years after the onset of Project operations	Range	Persistent decline in parameter values that suggests the loss of a viable population in the Basin or current seed grounds 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

3081

3082 **5. MONITORING AND ADAPTIVE MANAGEMENT SCHEDULE**

3083

3084 **5.1. Project Monitoring Schedule**

3085

3086 **5.1.1. Pre-operational Monitoring**

3087

3088 The Pre-operations Monitoring Plan introduced in Section 3 are currently being planned as up to a five-  
3089 year effort (no less than three), to establish a robust baseline condition within the Project receiving area  
3090 and the larger Barataria Basin while the Project undergoes E&D and construction. Critical in that  
3091 baseline monitoring will also be clarifying spatial variability in the data, as well as inherent temporal  
3092 trends in the data that might refine considerations of when to undertake adaptive management action.

3093

3094 **5.1.2. Post-operational Monitoring**

3095

3096 Given the intended 50-year life of the Project that is guiding Project E&D, at least some of the attributes  
3097 outlined in Section 3 will be collected for that entire time. However, the planned length of monitoring  
3098 for all attributes will ultimately depend on evaluation of the early datasets for responsiveness and  
3099 variability.

3100

3101

3102 **5.2. Timeline of Adaptive Management Decision-Making and Implementation**

3103

3104 The overall timeline of adaptive management will include activities that take place during individual  
3105 structure openings (events), annually, as well as activities occurring on a five-year planning cycle that  
3106 will more comprehensively consider and integrate data across a longer cycle. Periods for evaluation of  
3107 whether each adaptive management trigger has been met vary by parameter; see section 4 for details.

3108

3109 **5.2.1. Event Timeline**

3110

3111 Evaluation and decision-making at the level of individual structure openings will occur as discussed in  
3112 Section 4. Decisions made during individual events will be memorialized in the annual and multi-year  
3113 reporting described below.

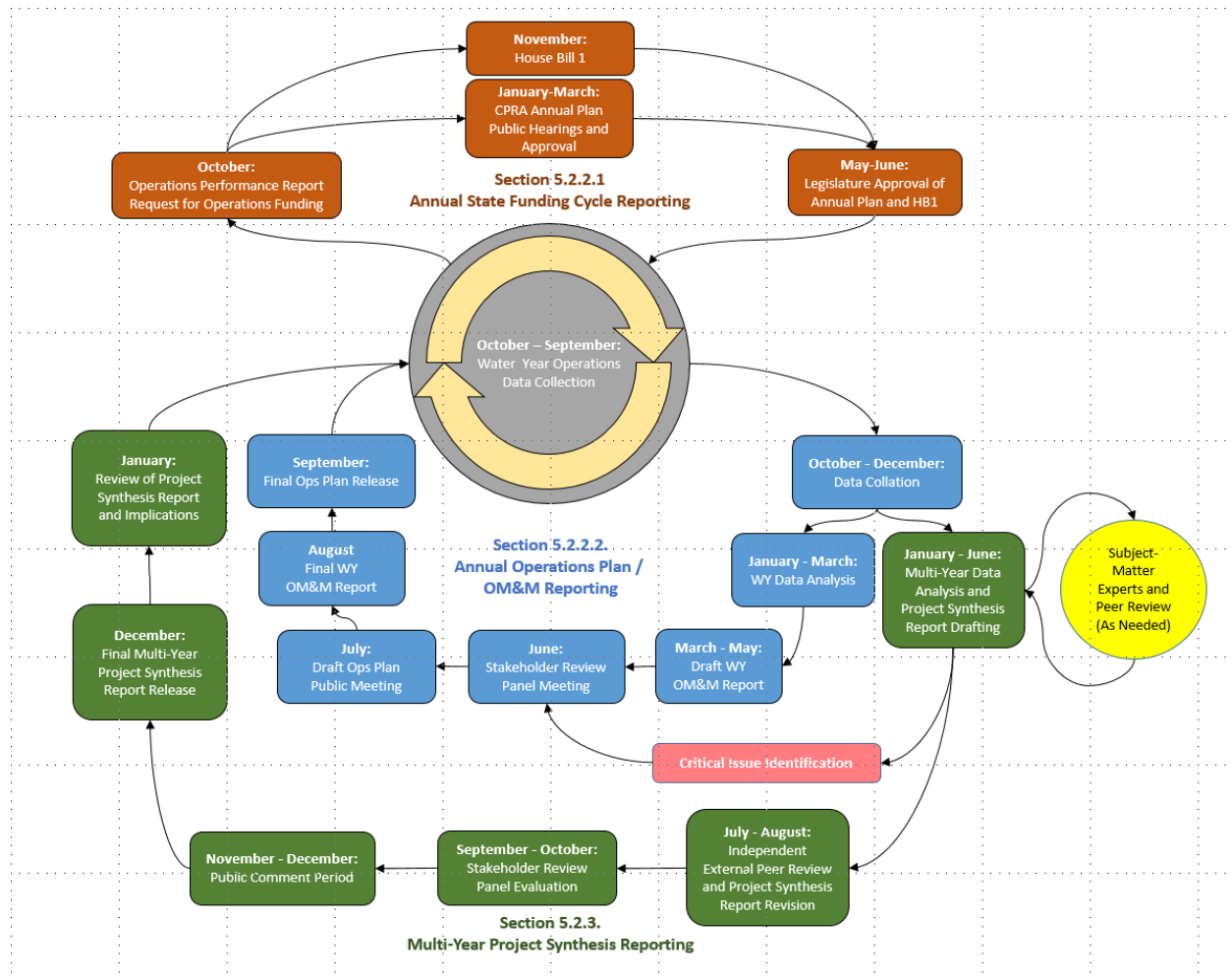
3114

3115 **5.2.2. Annual Timeline**

3116

3117 Figure 5.2-1 proposes two categories of actions that would occur on an annual basis. The top of the  
3118 figure illustrates a more expedited consideration of a limited set of operations performance data from  
3119 the Water Year (WY) operations that ends on September 30, to provide CPRA with a rapid summary of  
3120 the past year's Project operations and to support annual State funding requests for continued  
3121 operations during the upcoming State Fiscal Year. In contrast, the bottom of the figure illustrates the  
3122 consideration of a more comprehensive set of WY operations data that underpins the development of  
3123 annual Operations, Maintenance and Monitoring (OM&M) Reports and the formal Operations Plan.  
3124 Both sets of actions center on the annual management of the Project by the Operations Management  
3125 Team and continuous collection of the data outlined in Section 3.

3126



3127  
3128 **Figure 5.2-1.** Idealized timeline of Annual Cycle Adaptive Management Activities discussed in Section 5.2.2 and the  
3129 Multi-year Project data evaluations discussed in Section 5.2.3. The steps illustrated in the orange boxes are  
3130 discussed in Section 5.2.2.1. The steps illustrated in the blue boxes are discussed in Section 5.2.2.2. The steps  
3131 illustrated in the green boxes are discussed in Section 5.2.3.

3132  
3133 **5.2.2.1. State Funding Cycle Reporting**

- 3134
- 3135 • **October**
  - 3136 ○ Immediately following the end of the WY, the Data Management Team (DMT) and OMT
  - 3137 will work to develop an Operations Performance Report to underpin upcoming State
  - 3138 Fiscal Year funding requests.
- 3139 • **November**
  - 3140 ○ CPRA will submit the upcoming State Fiscal Year project operations funding request to
  - 3141 the State’s Division of Administration for inclusion in the draft of House Bill 1.
- 3142 • **January - March**
  - 3143 ○ The upcoming State Fiscal Year Project operations funding request will be included in
  - 3144 the draft of CPRA’s Annual Plan, which CPRA submits annually for a 3 year-budget
  - 3145 outlook. Typically, CPRA releases the draft Annual Plan for public comment in January
  - 3146 for the upcoming fiscal year, with CPRA Board vote for approval of the Annual Plan
  - 3147 occurring during the last Board meeting prior to the beginning of the annual Session of



3148 the Legislature. Following approval by the Board, CPRA submits the Annual Plan to the  
3149 Legislature for consideration.

3150 • May-June

- 3151 ○ Typically, the Legislature votes on both House Bill 1 and the CPRA Annual Plan late in the  
3152 annual Legislative session. Both bills must pass the Legislature to appropriate Project  
3153 operational funds in the next State Fiscal Year starting on July 1.

3154

3155 **5.2.2.2. Annual Operations Plan / OM&M Reporting**

3156

3157 *The following idealized annual timeline may be adjusted to allow the Annual Operations Plan to be*  
3158 *included in CPRA's Annual Plan and aligned with the State's funding cycle.*

3159

3160 • October to December, Year

- 3161 ○ Data collection will largely follow a WY schedule, but due to the nature of some data  
3162 collection/analysis, the WY data inventory will likely not be complete until the end of  
3163 the calendar year.

3164 • January – March

- 3165 ○ Analysis of the WY data by the Data Management and Analysis Team

3166 • March – June

- 3167 ○ Preparation of the draft WY OM&M Report

3168 • June: Stakeholder Review Panel Meeting

- 3169 ○ CPRA will solicit input and perspectives from stakeholders on the information contained  
3170 within the draft OM&M report and the proposed Operations Plan for the upcoming WY.  
3171 ○ CPRA may convene additional meetings throughout the year as deemed appropriate  
3172 and/or necessary.

3173 • July: Public Meeting - General Comments, Draft Operations Plan

- 3174 ○ CPRA will present the draft Operations Plan for the upcoming year, to gather input for  
3175 possible incorporation into that plan, and to consider possible items to be evaluated and  
3176 or addressed in an OM&M or Adaptive Management report

3177 • August

- 3178 ○ Completion and release of previous WY OM&M Report, prior to the release of the draft  
3179 operations plan. WY Project data will be uploaded to the Diver data server (Section 6).

3180 • September: Final Operations Plan

- 3181 ○ Completion and public release of the upcoming WY Operations Plan, prior to October  
3182 implementation.

3183

3184 **5.2.3. Multi-year Project Synthesis Reporting**

3185

3186 In addition to the annual timeline of adaptive management activities, additional review and  
3187 comprehensive synthesis of monitoring data and evaluation of management options will occur at five-  
3188 year intervals, allowing for the consideration and evaluation of multiple years of monitoring data and  
3189 assess processes on a longer time scale.

3190

3191 The comprehensive data syntheses will be based on multiple years-worth of Project Effectiveness  
3192 evaluations (Section 4) and other data. The syntheses will be developed consistent with processes used  
3193 to conduct other comprehensive data reviews.

3194

3195 5.2.3.1. *October-December: Data Collation*

3196

3197 The DMT will collate multi-year data in the last quarter of the Calendar Year following the end of a  
3198 particular WY, with the same rationale as described in Section 5.2.2.2 above.

3199

3200 5.2.3.2. *January-June: Data Analysis and Project Synthesis Report Drafting*

3201

3202 The AMT will lead the analysis of the multi-year datasets and the drafting of the Multi-year MAM  
3203 Report, in coordination with the OMT. Given the nature of the data, CPRA expects to conduct analyses  
3204 using a mix of AMT members directly and outside contractors as needed. Note that any serious issues  
3205 initially identified during this analysis/synthesis could be addressed by the AMT and PMT outside of the  
3206 rest of the review and communication process below, and brought to the attention of the Stakeholder  
3207 Review Panel during their June meeting (5.2.2.2).

3208

3209 5.2.3.3. *July-August: External Peer Review and Revision*

3210

3211 The AMT will coordinate an external peer review of the draft Multi-year MAM Report. The Team will  
3212 develop the protocols for the external review in coordination with the Stakeholder Review Panel to  
3213 ensure an objective process. This draft schedule assumes a 45-day review of the draft report, after  
3214 which the AMT and any relevant contractors will revise the report based on the reviews received.

3215

3216 5.2.3.4. *September-October: Stakeholder Review Panel Evaluation*

3217

3218 The AMT will work with the OMT to present the revised draft Multi-year MAM Report to the  
3219 Stakeholder Review Panel and solicit a review and comments from the Panel. CPRA will conduct this  
3220 presentation as an in-person meeting or a web seminar with the Panel members. The Panel will have  
3221 four weeks to review the report, after which time the AMT and its contractors will revise the document  
3222 into a final draft report based on the reviews received.

3223

3224 5.2.3.5. *November-December: Public Comment Period*

3225

3226 The AMT will coordinate with the OMT to make the revised draft Multi-year MAM Report available for a  
3227 30-day public comment period on the final draft report, after which the Adaptive Management Team  
3228 and any relevant contractors will revise the report based on the reviews received. CPRA will then  
3229 publicly release the final report.

3230

3231 5.2.3.6. *January: Review of Project Synthesis Report Implications*

3232

3233 The AMT and OMT will review the Multi-year MAM Report for implications to Project operations and/or  
3234 additional management actions. Recommendations based on that review will be made to the CPRA  
3235 Executive Team, and if adopted will be discussed at the next Annual Cycle Stakeholder Review Meeting  
3236 and Public Meetings.

3237

3238 **6. DATA MANAGEMENT**

3239  
3240 **6.1. Data Description**

3241  
3242 Data collected as part of this Project will occur via site visits, field surveys, *in situ* continuous recorder  
3243 devices, and remote sensing. As discussed in Section 3, data types include hydrologic (e.g., water level,  
3244 water velocity), bathymetric/topographic (e.g., land/water area, elevations, accretion), geotechnical  
3245 (e.g., soil characteristics), geophysical (e.g., sidescan sonar), chemical (e.g., salinity, water quality),  
3246 biological (e.g., fish, invertebrates, wildlife, vegetation), and geospatial (e.g., vector, raster, aerial and  
3247 satellite imagery). A substantial amount of data will be collected via existing programs, including those  
3248 coordinated by CPRA (e.g., CRMS, BICM, SWAMP) as well as other agencies (e.g., LDWF, LDEQ, USGS,  
3249 NOAA). Additional data collection will occur from targeted project-specific monitoring and research. The  
3250 timing and frequency of data collection varies by parameter, ranging from continuous sampling (e.g.,  
3251 water level), to biannual or annual (e.g., biological surveys), to every few years (e.g., land change).

3252  
3253 To the extent practicable, data collection will follow relevant standard operating procedures (SOPs).  
3254 These include, but are not limited to

- 3255
- 3256 • A Standard Operating Procedures Manual for the CRMS – *Wetlands* (Folse et al., 2020).
  - 3257 • Standard Operating Procedures for Geo-scientific Data Management, Louisiana Sand Resources  
3258 Database (Khalil et al., 2016)
  - 3259 • A Contractor’s Guide to the Standards of Practice For CPRA Contractors Performing GPS Surveys  
3260 and Determining GPS Derived Orthometric Heights within the Louisiana Coastal Zone (CPRA,  
3261 2016)
  - 3262 • Coast-wide and Barataria Basin Monitoring Plans for Louisiana’s SWAMP (Hijuelos and  
3263 Hemmerling, 2015)
- 3264

3265 Electronic data files will follow the file naming convention used by CPRA’s Coastal Information  
3266 Management System (CIMS) as outlined in Appendix 4 of Khalil et al. (2016). Metadata will be developed  
3267 for project data, and to the extent practicable will follow Federal Geographic Data Committee and  
3268 International Organization for Standardization standards.

3269  
3270  
3271 **6.2. Data Review and Clearance**

3272  
3273 All data collected as part of the Project will undergo proper QA/QC, review, and clearance procedures  
3274 consistent with the guidelines developed by the NRDA Cross-TIG Monitoring and Adaptive Management  
3275 work group (<https://www.gulfspillrestoration.noaa.gov/project?id=71>). CPRA’s DMT will be responsible  
3276 for data stewardship following CPRA’s documented policies, SOPs, data conventions, and QA/QC  
3277 procedures (e.g., Folse et al., 2020; Khalil et al., 2015; CPRA, 2016; CPRA, 2017). Data integrity will be  
3278 checked with detailed and complex QA/QC software routines prior to input into the database, and  
3279 additional automated routines when input into the database. CPRA staff and contractors who collect  
3280 and input data into the database may also provide feedback on data quality and software routines to  
3281 the DMT. Following data QA/QC, CPRA will give the other TIG members time to review the data before  
3282 publishing on a public site.

3283  
3284

3285 **6.3. Data Storage and Accessibility**

3286  
3287 All data collected and analyzed as part of this project will be stored on either CPRA’s CIMS website  
3288 (<https://cims.coastal.louisiana.gov/default.aspx>) and/or the NOAA’s Data Integration, Visualization,  
3289 Exploration, and Reporting (DIVER) tool. CPRA will submit Project data to CIMS and/or DIVER as soon as  
3290 possible and no more than one year from when data are collected. NOAA will provide a link to CIMS in  
3291 the DIVER Restoration Portal.

3292  
3293 CIMS is the official repository for environmental, modeling, and monitoring data for restoration projects  
3294 undertaken by the state, as well as programmatic data collected by CRMS and BICM. CIMS combines a  
3295 network of webpages hosted by CPRA, a GIS database, and a relational tabular database into one public-  
3296 facing, GIS-integrated system capable of data visualizations and data delivery. Data preservation of the  
3297 CIMS database/application suite is largely done through regular tape back-up and/or cloud storage for  
3298 disaster recovery and continuation of service. All data and documents in the CIMS database/application  
3299 suite are publicly available will continue to be available in perpetuity and/or for the life of the agency.

3300  
3301 DIVER serves as the public NOAA repository for data related to the DWH Trustees' NRDA efforts. To  
3302 provide additional context to the NRDA data, the site also includes historical (pre-2010) contaminant  
3303 chemistry data for the onshore area of the Gulf of Mexico, as well as contaminant chemistry data  
3304 collected during the response efforts and by the responsible party, British Petroleum. These data are  
3305 available to the public and are accessed through a query and mapping interface called DIVER Explorer.  
3306 Categories of Trustee NRDA data in DIVER include:

- 3307  
3308
  - photographs of the emergency response, the oiled animals, plants, fish, and beaches;
  - 3309 • telemetry information collected from remote sensing devices such as transmitter data from  
3310 animal monitoring;
  - 3311 • field observations such as notes about the condition of animals found in the spill and extent of  
3312 oiling in marshes;
  - 3313 • instrument data such as water temperatures and salinity collected during the spill; and
  - 3314 • sample results of laboratory analysis on tissue, sediment, oil, and water.

3315  
3316 CPRA and NOAA are discussing ways to establish links between the two systems or at least ways to point  
3317 to NRDA project data stored in each system, so CIMS users can easily find relevant data stored in DIVER  
3318 and vice versa.

3319  
3320  
3321 **6.4. Data Sharing**

3322  
3323 Data will be made publicly available, in accordance with the Federal Open Data Policy, through either  
3324 the CIMS Data Portal (<https://cims.coastal.louisiana.gov/>) and/or the DIVER Explorer  
3325 (<https://www.diver.orr.noaa.gov>) within one year of data collection. In the event of a public records  
3326 request related to data and information on a project that is not already publicly available, the Trustee to  
3327 whom the request is addressed will provide notice, and an opportunity to comment or object, to the  
3328 other LA TIG Trustees prior to releasing any project data that is the subject of the request.

3329  
3330 Any data that is protected from public disclosure under federal and state law (e.g., personally  
3331 identifiable information under the Privacy Act or observer information collected under Magnuson-  
3332 Stevens Fishery Conservation and Management Act will not be publicly distributed.

3333 **7. REPORTING**

3334

3335 **7.1. DIVER Restoration Portal Reporting**

3336

3337 Once finalized, this MAM Plan will be uploaded to the DIVER Restoration Portal and made publicly  
3338 available through the DIVER Explorer (<https://www.diver.orr.noaa.gov/>) and Trustee Council website  
3339 (<https://www.gulfspillrestoration.noaa.gov/>). CPRA will also upload future revisions of the MAM Plan to  
3340 the DIVER Restoration Portal following development and approval by the LA TIG, following discussions  
3341 between CPRA and the TIG about the magnitudes of Plan amendments that would warrant reposting.

3342

3343 MAM activities and corresponding documents will be reported annually in the DIVER Restoration Portal.  
3344 This will include information on the monitoring parameters, performance criteria (if applicable),  
3345 monitoring duration and frequency, etc.

3346

3347

3348 **7.2. Mid-Basin Sediment Diversion Project Annual Operations Plans**

3349

3350 The basis of Project operations is the main OMRR&R Plan, and the Annual Operations Plan is its yearly  
3351 implementation. Information and lessons learned from the previous year will be taken into account  
3352 when adjusting the operations plan for each upcoming year. Draft Annual Operations Plans will be  
3353 presented to the Stakeholder Review Panel and at public meetings to solicit comments, perspectives,  
3354 and insights. Following any revisions, the plan will be finalized for approval by the CPRA Executive  
3355 Director.

3356

3357

3358 **7.3. Annual Operations Performance Reports**

3359

3360 The Project DMT will develop Annual Operations Performance Reports to underpin CPRA's annual  
3361 Project operations funding requests to the CPRA Board and the Louisiana Legislature. These reports will  
3362 be limited to a summary of the Project Effectiveness monitoring data available in October of any  
3363 particular Calendar Year, immediately following the end of a WY. Once developed, these reports will be  
3364 posted onto CPRA's CIMS website, as well as uploaded to the DIVER Explorer and Trustee Council  
3365 websites.

3366

3367

3368 **7.4. Annual Operations, Maintenance & Monitoring Reports**

3369

3370 Annual OM&M Reports of Water Year Project Effectiveness and Status & Trends Data will be developed  
3371 by the Operations Management Team that provides data collection results, attribute outcomes,  
3372 operations information, maintenance updates, recommendations for monitoring, additional project  
3373 features, lessons learned, etc. from the previous year's operations. As described in Section 5.2.2, these  
3374 reports will provide a summary of the monitoring data collected during the WY regarding Project  
3375 Operations and river and basin responses. Some descriptive and initial statistical analyses will be  
3376 conducted on the WY data. However, more robust analyses will be relegated to the Multi-Year Report  
3377 described below. Once developed, CPRA will post these reports the CIMS website, as well as upload  
3378 them to the DIVER Explorer and Trustee Council websites.

3379

3380 **7.5. Multi-year Monitoring and Adaptive Management Reports**

3381  
3382 Multi-year Monitoring and Adaptive Management Reports will be developed as described in Section  
3383 5.2.3 to provide a comprehensive analysis of Project Effectiveness and Status & Trends Data during the  
3384 duration of the project. To the extent practicable, the interim and final MAM reports will be consistent  
3385 with the MAM report template in the Deepwater Horizon TIG MAM Manual. Once developed, CPRA will  
3386 post these reports the CIMS website, as well as upload them to the DIVER Explorer and Trustee Council  
3387 websites .  
3388

3389  
3390 **7.6. Compliance Reporting**

3391  
3392 **7.6.1. US Fish & Wildlife Service Coordination Act Annual Report**

3393  
3394 CPRA’s responsibilities with regards to the US Fish & Wildlife Service (USFWS) Coordination Act require  
3395 the development and communication of an annual report outlining data specific to USFWS trust  
3396 resources in the Barataria Basin. CPRA intends for that report to represent a subset of, but otherwise  
3397 largely mirror the level of analysis in, the Annual OM&M Reports (7.4). The final format, content, and  
3398 review process for this report will be developed by CPRA and USFWS.  
3399

3400 **7.6.2. Louisiana Trustee Implementation Group Annual Report**

3401  
3402 CPRA will develop an annual report to the LA TIG outlining data specific to NRDA trust resources in the  
3403 Barataria Basin. CPRA intends for that report to represent a subset of, but otherwise largely mirror the  
3404 level of analysis in, the Annual OM&M Reports (7.4). The final format, content, and review process for  
3405 this report will be developed by CPRA and the LA TIG.  
3406

3407 **8. MONITORING AND ADAPTIVE MANAGEMENT BUDGET**  
3408  
3409 Under development  
3410

DRAFT

3411

DRAFT



3412 **9. REFERENCES**

3413

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3709 **10. INVENTORY OF PROJECT-RELATED DISCRETE/APERIODIC STUDIES**

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3711 **This section will be populated through time as outstanding research needs are identified.**

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3714 **11. PROJECT ADAPTIVE MANAGEMENT DECISION LOG AND CATALOG OF UPDATES TO THE**  
3715 **MONITORING AND ADAPTIVE MANAGEMENT PLAN**

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3717 **This section will be populated through time as this Plan is updated.**  
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## **R3: Mitigation Summary Table**

Appendix R-3: Summary Table NEPA Analysis for Mitigation Measures  
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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
<b>Best Management Practices (BMPs)</b>			
Mitigation Summary – BMPs	Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention, Control, and Countermeasure (SPCC) Plan	Plan implementation does not have effects; actions taken under plan may affect: <ul style="list-style-type: none"> <li>▪ Hazardous, toxic, and radioactive waste assessment</li> <li>▪ Aquatic resources</li> <li>▪ Marine mammals</li> <li>▪ Public health &amp; Safety</li> <li>▪ Surface water and coastal processes</li> <li>▪ Wetland resources and WOTUS</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis by affected resource category. (See EIS Section 4)
Mitigation Summary – BMPs	Electroshocking of the cofferdam to retrieve fish (e.g. sturgeons), to be returned to the river	<ul style="list-style-type: none"> <li>▪ Aquatic resources</li> <li>▪ T&amp;E species</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Section 4.27.)
Mitigation Summary – BMPs	Advising staff that manatees may approach the proposed Project area, 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.	<ul style="list-style-type: none"> <li>▪ Marine mammals</li> </ul>	NEGLIGIBLE AND ADDRESSED IN EIS: Environmental impacts of professional and public education would be negligible.
Mitigation Summary – BMPs	Soil compaction mitigation	<ul style="list-style-type: none"> <li>▪ Geology and soils</li> <li>▪ Terrestrial wildlife and habitat</li> <li>▪ Land use and land cover</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2 and 4.27.)
Mitigation Summary – BMPs	Construction – temporary erosion control	<ul style="list-style-type: none"> <li>▪ Geology and soils</li> <li>▪ Terrestrial wildlife and habitat</li> <li>▪ Land use and land cover</li> <li>▪ Wetland resources and WOTUS</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2 and 4.27)
Mitigation Summary – BMPs	Construction – dust management	<ul style="list-style-type: none"> <li>▪ Air quality</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.7, 4.13, 4.15, 4.19, 4.25, and 4.27.)

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Summary – BMPs	Environmental inspections	<ul style="list-style-type: none"> <li>▪ Aquatic Resources</li> <li>▪ Wetland resources and WOTUS</li> </ul>	NEGLIGIBLE: Environmental impacts from inspection activities would be negligible. Environmental effects addressed in EIS impact analysis. (See EIS Section 4.27.)
<b>Mitigation Measures</b>			
Mitigation Plan – Avoidance and Minimization	Compensatory wetland mitigation for impacts to BLH during construction	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Section 4.6.)
Mitigation Plan – Avoidance and Minimization	Rehabilitation of jurisdictional waters during construction	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Section 4.27.)
Mitigation Plan – Avoidance and Minimization	Monitoring in Outfall Area in the Barataria Basin to assess the Project’s effects on bathymetry	<ul style="list-style-type: none"> <li>▪ Navigation</li> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Section 4.20.)
Mitigation Plan – Avoidance and Minimization	Adjust operations to reduce aggradation in Barataria waterway, if needed	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> <li>▪ Navigation</li> </ul>	ADDRESSED IN EIS: Environmental effects within the scope of operations considered in the EIS (from No Action to max capacity of 150kcfs). (See EIS Section 4.2.)
Mitigation Plan – Avoidance and Minimization	Conduct maintenance dredging of the canal to address aggradation in Barataria waterway, if needed	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> <li>▪ Navigation</li> <li>▪ Noise</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Section 4.2.) Additional maintenance dredging may occur in areas not covered by the EIS but it is not currently possible to predict where it may be required. Environmental analysis of these dredging effects may be tiered at that time as needed, or the activity may be covered by categorical exclusion or other NEPA analyses.
Mitigation Plan – Avoidance and Minimization	Outfall management to limit the loss of sediments in Barataria waterway as needed	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> <li>▪ Navigation</li> <li>▪ Water quality</li> <li>▪ Sediment quality</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2 and 4.27.)

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Plan – Avoidance and Minimization	Operational management to reduce aggradation in Wilkinson Canal as needed	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> <li>▪ Navigation</li> <li>▪ Water quality</li> <li>▪ Sediment quality</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.13 and 4.27.)
Mitigation Plan – Avoidance and Minimization	Maintenance dredging to address aggradation in Wilkinson Canal as needed	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Aquatic resources</li> <li>▪ Aesthetics and visual resources</li> <li>▪ Navigation</li> <li>▪ Water quality</li> <li>▪ Sediment quality</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.13 and 4.27.)
Mitigation Plan – Avoidance and Minimization	Provide alternative boat access to Myrtle Grove and Woodpark communities.	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Navigation</li> <li>▪ Recreation and tourism</li> <li>▪ Commercial fisheries</li> <li>▪ Environmental justice</li> </ul>	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 categorical exclusion or other NEPA analyses.
Mitigation Plan – Avoidance and Minimization	Tidal flooding: Monitor and adaptively manage operations to address tidal flooding impacts	<ul style="list-style-type: none"> <li>▪ Socioeconomic impacts</li> <li>▪ Environmental justice</li> <li>▪ Public health and safety</li> </ul>	NEGLIGIBLE: Environmental impacts of monitoring activities are negligible. The potential effects of operational modifications under adaptive management are covered within range of impacts analyzed in the EIS.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Tidal Flooding	Tidal flooding: Property rights acquisition (e.g., flowage easement, fee acquisitions, or other) of inundated properties	<ul style="list-style-type: none"> <li>▪ Socioeconomic impacts</li> <li>▪ Environmental justice</li> <li>▪ Public health and safety</li> </ul>	ADDRESSED IN EIS: Environmental effects from increased tidal flooding addressed in EIS impact analysis. (See EIS Sections 4.13, 4.15, and 4.20.)  The acquisition of property acquisition to compensate landowners for unavoidable tidal flooding impacts is an administrative action that has no inherent environmental impacts. The environmental effects of 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.



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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Plan – Avoidance and Minimization	Tidal flooding: Structural mitigation and infrastructure improvements (e.g., helping property owners to elevate homes and other structures on private property, elevating public roadways, utility upgrades, water control structures, or other structural measures) to offset additional inundation	<ul style="list-style-type: none"> <li>▪ Socioeconomic impacts</li> <li>▪ Environmental justice</li> <li>▪ Public health and safety</li> </ul>	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. See Appendix R-4.
Mitigation Plan – Avoidance and Minimization	Interim risk reduction measures would be designed and built to provide the same level of risk reduction currently provided by the NOV-NFL and MR&T levee systems	<ul style="list-style-type: none"> <li>▪ Socioeconomic impacts</li> <li>▪ Environmental justice</li> <li>▪ Public health and safety</li> </ul>	TO BE DETERMINED: Depends on measures selected.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Re-establishment of public seed grounds (relocation of native cultch materials within areas or the provision of new cultch material to establish the oyster beds)	<ul style="list-style-type: none"> <li>▪ Aquatic resources</li> <li>▪ Wetland resources and WOTUS</li> <li>▪ Commercial fisheries</li> <li>▪ Socioeconomic</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Provision of cultch material	<ul style="list-style-type: none"> <li>▪ Aquatic resources</li> <li>▪ Wetland resources and WOTUS</li> <li>▪ Commercial fisheries</li> <li>▪ Socioeconomic</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Provision of broodstock reefs to provide larval supply, as needed	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Alternative Oyster Aquaculture (AOC) Introduction and Training	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	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 Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Alternative Oyster Aquaculture (AOC) Startup Assistance	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Alternative Oyster Aquaculture (AOC) Designated Use Areas (areas on state-water bottoms could be designated specifically for use by oyster grower)	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to oysters/oyster fishery	Marketing to support the oyster industry	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.  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.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to commercial fishery	Marketing to support the finfish industry (and transition to other species if abundance patterns change)	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.  NEGLIGIBLE: No additional environmental analysis needed for grant program. Environmental impacts from grant program would be negligible.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to commercial fishery	Grant program to equip fishing vessels with refrigeration	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Commercial fisheries</li> <li>▪ Aquatic resources</li> <li>▪ Water quality (possibility of refrigerant leakage)</li> <li>▪ Air quality (extended vessel trip length)</li> </ul>	YES: See Appendix R-4.  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.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to commercial fishery	Marketing to support the Louisiana shrimp industry	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Aquatic resources</li> <li>▪ Commercial fisheries</li> <li>▪ Recreation and tourism</li> </ul>	YES: See Appendix R-4.  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.

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to commercial fishery	Grant program to support gear change/improvements – shrimp fishery	<ul style="list-style-type: none"> <li>▪ Socioeconomic</li> <li>▪ Commercial fisheries</li> <li>▪ Aquatic resources</li> </ul>	YES: See Appendix R-4.  NEGLIGIBLE: Environmental impacts from grant program implementation would be negligible. Grant programs that support fishing gear improvements emphasize technologies that reduce bycatch and habitat impacts, leading to more efficient harvest and effective fishery management. Investments in improved or more diverse gear types may lead to changes in fisheries engagement, but any resulting environmental effects would be addressed through existing fishery management and related regulatory mechanisms.
Mitigation Plan – Avoidance and Minimization  Mitigation Plan: Potential impacts to commercial fishery	Workforce and business training for commercial fishers	<ul style="list-style-type: none"> <li>▪ Socioeconomics</li> </ul>	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 Plan	Implementation of Measures in the NHPA 106 Programmatic Agreement; includes details regarding Alternative Mitigation for Potential Cultural Resource Impacts	<i>NHPA 106 Programmatic Agreement is currently in development, details of included actions are unavailable. Affected resources will depend on measures agreed upon by the parties.</i>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Section 4.24.)
Mitigation Plan	ESA-listed species: implement Reasonable and Prudent Measures and Terms and Conditions [TBD]	Depends on measures identified in NOAA and USFWS Section 7 consultations.	TO BE DETERMINED: Effects depend on measures selected.
Mitigation Plan	Implement measures proposed by FWS under the Fish and Wildlife Coordination Act [TBD]	Required actions under the FWCA are currently pending. Affected resources will depend on the type of measures recommended.	TO BE DETERMINED: Details of such actions to be required under the FWCA are pending. Affected resources will depend on the type of measures recommended.

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
Mitigation Plan	Bottlenose Dolphin mitigation including: <ul style="list-style-type: none"> <li>▪ Operational minimization measures as indicated by the MAM Plan</li> <li>▪ Statewide stranding program funding</li> <li>▪ Human interaction /anthropogenic stressor reduction</li> <li>▪ Contingency funding for Unusual Mortality Events</li> </ul>	<ul style="list-style-type: none"> <li>▪ Marine mammals</li> </ul>	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) <i>Final Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program</i> .
Mitigation Plan	EFH – TBD	Mitigation measures are currently under discussion. Affected resources will depend on the type of measures selected.	TO BE DETERMINED: Details of such mitigation measures under discussion. Affected resources will depend on the type of measures selected.
Mitigation Plan	<ul style="list-style-type: none"> <li>▪ Environmental justice mitigation – improved public access for recreational and subsistence fishing</li> <li>▪ Additional measures TBD</li> </ul>	<ul style="list-style-type: none"> <li>▪ Recreation and tourism</li> <li>▪ Commercial fisheries</li> <li>▪ Environmental justice</li> </ul>	YES: See Appendix R-4.
Mitigation Plan & Mitigation Summary	Beneficial use placement and upland reuse (e.g. filling existing borrow pits) of excess soils and sediments	<ul style="list-style-type: none"> <li>▪ Aquatic resources</li> <li>▪ Geology and soils</li> <li>▪ Terrestrial wildlife and habitat</li> <li>▪ Land use and land cover</li> <li>▪ Wetland resources and WOTUS</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.2, 4.4, 4.8, 4.9, 4.10, 4.12, and 4.27.)
<b>Monitoring and Adaptive Management (MAM)</b>			
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.

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
MAM Plan – Objective #1	Freshwater and estuarine monitoring, including: <ul style="list-style-type: none"> <li>▪ Mississippi River discharge monitoring</li> <li>▪ Mississippi River suspended sediment monitoring</li> <li>▪ Mississippi River nutrient monitoring</li> <li>▪ Alliance South sand bar bathymetry and sedimentology monitoring</li> <li>▪ River bathymetry monitoring at around the Project inlet structure</li> <li>▪ Topography/bathymetry monitoring at the Project delta development area</li> <li>▪ Bathymetric monitoring of canals in the Project influence area</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Water quality</li> <li>▪ Sediment quality</li> <li>▪ Aquatic resources</li> <li>▪ T&amp;E species</li> </ul>	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.
MAM Plan – Objective #1	Freshwater and estuarine monitoring, including: <ul style="list-style-type: none"> <li>▪ Water volume conveyed into Barataria Basin</li> <li>▪ Sediment concentrations conveyed in Barataria Basin inflows</li> <li>▪ Mississippi River sediment load</li> <li>▪ Nutrient loads conveyed in Barataria Basin inflows</li> <li>▪ Water velocities at multiple locations in the Barataria Basin</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Water quality</li> <li>▪ Sediment quality</li> <li>▪ Aquatic resources</li> <li>▪ Marine mammals</li> <li>▪ T&amp;E species</li> </ul>	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.

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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
MAM Plan – Objective #2	Upland and soils monitoring, including: <ul style="list-style-type: none"> <li>▪ Soil bulk density</li> <li>▪ Rate of accretion above feldspar marker horizons</li> <li>▪ Soil strength</li> <li>▪ Rate of marsh surface elevation change in the Project Influence Area</li> <li>▪ Sediment dispersal and retention on the emergent marsh surface</li> <li>▪ Soil organic and mineral matter density</li> </ul>	<ul style="list-style-type: none"> <li>▪ Geology and soils</li> <li>▪ Terrestrial and wildlife and habitat</li> <li>▪ Land use and land cover</li> <li>▪ Aquatic resources</li> <li>▪ Wetland resources and WOTUS</li> </ul>	<p>NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible.</p> <p>Soil density and composition sampling would involve the collection of field samples using hand equipment. Soil and water sample collection would have insignificant effects on species and habitats in the project area.</p>

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<p>MAM Plan – Objective #3</p>	<p>Land and water extent / Area of new delta formation in the Project Influence Area monitoring, including:</p> <ul style="list-style-type: none"> <li>▪ Emergent wetland area</li> <li>▪ Vegetation Cover, Abundance, and Height</li> <li>▪ Submerged aquatic vegetation area</li> <li>▪ Emergent and submerged vegetation community composition</li> <li>▪ Emergent vegetation biomass in the Project area</li> <li>▪ Dissolved oxygen, salinity, and chlorophyll a</li> <li>▪ Phytoplankton Species Composition</li> <li>▪ Harmful Cyanobacterial/Algal Bloom Toxins</li> <li>▪ Nutrient constituents in Barataria Surface Waters</li> <li>▪ Temperature of Barataria Surface Waters</li> <li>▪ Total suspended solids and turbidity in Barataria Surface Waters</li> <li>▪ Nekton (fish and shellfish) species abundance and community composition</li> <li>▪ Eastern Oysters (<i>Crassostrea virginica</i>) sampling/monitoring</li> <li>▪ Wildlife presence/abundance (annual surveys)</li> <li>▪ Aquatic and terrestrial species use of created/restored habitat</li> <li>▪ Compliance monitoring</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wetland resources and WOTUS</li> <li>▪ Surface water and coastal processes</li> <li>▪ Aquatic resources</li> <li>▪ Marine mammals</li> <li>▪ T&amp;E species (direct and indirect)</li> <li>▪ Navigation</li> <li>▪ Commercial fisheries</li> <li>▪ Geology and soils</li> </ul>	<p>NEGLIGIBLE: Environmental impacts from monitoring activities would be negligible.</p> <p>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 (chlorophyll 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 insignificant relative to baseline natural mortality and therefore negligible at population scales.</p>
<p>MAM Plan – Reporting</p>	<p>DIVER Restoration Portal Reporting</p>	<p>Not applicable</p>	



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Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
MAM Plan – Reporting	Mid-Basin Sediment Diversion Project Annual Operations Plans		NEGLIGIBLE: Environmental impacts from planning and reporting activities would be negligible. Consistent with 33 C.F.R. 230.9(d), routine 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	<ul style="list-style-type: none"> <li>■ Wetland resources and WOTUS</li> <li>■ Aquatic resources</li> <li>■ Surface water and sediment quality</li> <li>■ Recreation and tourism</li> <li>■ Aesthetics and visual resources</li> <li>■ T&amp;E Species</li> <li>■ Aquatic resources</li> <li>■ Marine mammals</li> <li>■ Terrestrial wildlife and habitat</li> <li>■ Socioeconomics</li> <li>■ Commercial fisheries</li> <li>■ Land use and land cover</li> <li>■ Recreation and tourism</li> <li>■ Public lands</li> <li>■ Navigation</li> </ul>	ADDRESSED IN EIS: Environmental effects addressed in EIS impact analysis. (See EIS Sections 4.14, 4.16, 4.19, 4.21, 4.25, and 4.27.)
	Implement outfall management measures to limit the loss of sediments to the canals.		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.		
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.		

Appendix R-3: Summary Table NEPA Analysis for Mitigation Measures  
 Draft 1/28/21

Plan Element	Plan Measures	Resource Category to which Measures Apply	Additional Environmental Review Requirements
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.	<ul style="list-style-type: none"> <li>▪ T&amp;E Species</li> <li>▪ Aquatic resources</li> <li>▪ Recreation &amp; tourism</li> <li>▪ Navigation</li> <li>▪ WOTUS and wetland resources</li> </ul>	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.	<ul style="list-style-type: none"> <li>▪ T&amp;E species</li> <li>▪ Marine mammals</li> </ul>	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) <i>Final Programmatic Environmental Impact Statement for the Marine Mammal Health and Stranding Response Program</i> .
MAM Plan – Adaptive management for bottlenose dolphins	Increase vessel and UAS based visual assessment along with a vessel based PhotoID survey following CMR track lines in the specific dolphin habitat.	<ul style="list-style-type: none"> <li>▪ Marine mammals</li> </ul>	

# **R4:Mitigation Measures Environmental Analysis**

# APPENDIX R-4. MITIGATIVE MEASURES: ENVIRONMENTAL REVIEW

## 1.0 Purpose

This document provides environmental review of mitigation and stewardship measures proposed in the Mitigation Plan and the Monitoring and Adaptive Management (MAM) Plan for the Mid-Barataria Sediment Diversion (MBSD) Project (the Project), including best management practices (BMPs) and environmental protection measures (EPMs) 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 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 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 proposed in the Mitigation and MAM plans are summarized in Appendix R-3. This table 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 three 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 fully considered in the EIS and therefore do not require additional review.
- ANALYSIS PROVIDED; ADDITIONAL ANALYSIS MAY BE REQUIRED IN THE FUTURE: Measures with definable environmental impacts addressed by the supplemental analysis provided in this document. 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:

- Construction and operational BMPs and EPMs,
- Mitigation measures for unavoidable impacts on oysters and commercial oyster fisheries,
- Mitigation measures for unavoidable impacts on commercial brown shrimp and finfish fisheries,
- Mitigation measures for unavoidable tidal flooding impacts,

- Mitigation measures to address disproportionately high and adverse impacts on some low-income and minority populations (i.e., environmental justice communities) resulting from the identified unavoidable impacts to oyster and shrimp fisheries and tidal flooding impacts,
- Mitigation measures for unavoidable impacts on bottlenose dolphins,
- A range of environmental monitoring and reporting activities to track project performance and inform adaptive management, and
- Proposed adaptive management measures to address specific environmental impacts should they occur.

The environmental effects of mitigation measures for unavoidable impacts on the following resources are addressed below in Section 3 through Section 7, respectively: oysters and oyster fisheries, commercial brown shrimp and finfish fisheries, environmental justice communities, tidal flooding, 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 and EPMs 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 8.2.

### **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 loss of oyster culture areas elsewhere in the basin. The proposed 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 proposed 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.
  - 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.
- Re-establishment/relocation of public seed grounds 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 appropriate substrate for larval recruitment and establishment of oyster beds.
- Provision 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 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 latter 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:

- *Planning and data management:* These activities are data-based actions completed without additional or supporting field work. As such they are consistent with the PDARP/PEIS evaluation of preliminary phases of restoration (planning, feasibility studies, design engineering, and

permitting activities) provided in Section 6.4.14 of the PDARP/PEIS and result in no environmental impacts.

- *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**

Proposed oyster mitigation and stewardship measures are described below, and their environmental impacts are addressed in this document. It is likely that 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:

- *Re-establishment of historic public seed grounds 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 appropriate substrate for larval recruitment and establishment of oyster beds.*
- *Provision 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 that 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, 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 (listed in Section 8.2) considered 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 proposed action. 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, and 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 habitat 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 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 setting; 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 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 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 and Finfish Fisheries**

The effects of the MBSD Project on commercially important fish and shrimp are expected to range from beneficial to major and adverse, depending on the species in question. In the case of finfish, the project is expected 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 proposing 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 are being proposed to avoid and mitigate these unavoidable effects.

While the MBSD Project includes a range of measures to avoid and minimize 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 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 and shrimp industry
- Grant funding to equip commercial fishing vessels with refrigeration
- Grant funding to support fishing gear changes and/or improvements in the shrimp fishery
- 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 proposed mitigation measures for unavoidable effects on commercial finfish 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 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). 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.

#### **5.0 Mitigation Measures for Unavoidable Impacts on Environmental Justice Communities**

The objective of this measure is to provide access to public waterways to facilitate recreational access for fishing and birding, a pier for subsistence fishing, kayak/pirogue launch, and views of the marsh creation area near the diversion structure for traditionally underserved communities. These access points will be sited to provide optimal access to restored habitats and natural resources in the Barataria Basin. As described in the Mitigation Plan (Appendix R-1), additional measures may be developed based on outreach to low income and minority populations and the Mitigation Plan appended as appropriate.

## 5.1 Environmental Review

The development of new or improved public access facilities would involve construction of access roads, parking lots, pavilions, boat ramps, floating docks, footpaths, and appurtenance facilities like restrooms. The number, location, and scale of new public access facilities proposed as Project mitigation has not yet been determined; however, many potential environmental impacts of these actions have been previously analyzed.

## 5.2 Analysis Provided; Additional Analysis May be Required in the Future

The LA TIG has previously considered the potential environmental effects of such activities as part of LA TIG RP #4 Nutrient Reduction and Recreational Use. The projects analyzed by the LA 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 in 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.

### **Previously Evaluated LA TIG Restoration Measures for Recreational Access**

In general, facility construction 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.

Similarly, 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 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 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 habitat, 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 low-income and minority communities 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 low-income and minority populations. As such, this measure would provide a net benefit to minority and low-income populations.

## **6.0 Mitigation Measures for Unavoidable Impacts from Tidal Flooding**

The objective of these measures is to adaptively manage 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
- Assisting property owners to elevate homes and other structures on private properties
- Property rights acquisitions to mitigate unavoidable tidal flooding impacts
- Infrastructure improvements and structural mitigation measures to offset unavoidable tidal flooding effects

Details regarding these measures are set forth in the Mitigation Plan. Which measures are implemented, as well as when and where they will occur, has not yet been fully determined and will depend in part on the outcome of monitoring once the Project has begun operating.

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 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 proposed 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 (easement, fee, or other interest) 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 any 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 acquisition, structures or infrastructure are proposed to be removed from any acquired properties, 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**

While the general risk and extent of tidal flooding are addressed in the EIS, the specific location, extent, and frequency of tidal flooding effects will not be known until after the Project has begun operating. As such, the scope, scale, and location of structural mitigation/infrastructure improvement to address tidal flooding impacts are currently unknown. 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 proposed 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 for Property Rights Acquisition, Infrastructure Improvements and Structural Mitigation**

The FL TIG Restoration Plan #2 and Environmental Assessment includes the evaluation of environmental impacts of property right acquisitions, 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, 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 Mitigation Measures for Unavoidable Impact on Bottlenose Dolphins, Essential Fish Habitat, Threatened and Endangered Species, and Fish and Wildlife Coordination Act Resources**

The object 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 Fish and Wildlife Coordination Act (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. Specific details of these measures have not yet been fully determined; however, it is anticipated that these measures will be neutral or beneficial with respect to environmental impacts. As details become available, additional review and environmental analyses will be conducted if necessary.

### **7.1 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 activities that have no or negligible environmental impacts; and a range of potential measures that will be developed to result in further reduction of impacts or beneficial impacts to sensitive species and habitats (i.e., dolphin mitigation, RPMs, and FWCA actions). The latter category of activities has not been fully defined at this time; however, these activities 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.

### **7.1.1 Environmental Effects of Proposed Mammal Mitigation Measures**

Proposed 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.

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 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, and 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 proposed, 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.

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 proposed 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 proposed monitoring and marine mammal stranding and entanglement response activities are likely to be negligible to beneficial.

## **8.0 Remaining Proposed Mitigation and Stewardship Measures 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, EPMs, 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 mitigation and stewardship measures 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.

### **8.1 Environmental Review**

No additional environmental review is required for the following mitigation measures proposed 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.

#### **8.1.1 *No Environmental Impacts or Negligible Environmental Impacts***

The following MAM activities are included in the MBSM 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)
- Monitoring of the environment to inform adaptive management of the project, including:
  - 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
- 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.

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 proposed MBSD. 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 review of the proposed 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.

### **8.1.2      *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, as well as specific BMPs developed for the project. The following BMPs have been evaluated as part of the Project in the EIS in Section 4.27 Mitigation Summary and therefore do not require additional analysis:

- Stormwater Pollution Prevention Plan (SWPPP) and Spill prevention, control, and countermeasure plan (SPCC)
- Electroshocking for fish capture and relocation from construction areas
- Compliance with in-water construction guidance for manatees
- Soil compaction minimization measures
- Temporary erosion control measures
- Construction dust management