2021

LOUISIANA TRUSTEE
IMPLEMENTATION GROUP

MONITORING AND ADAPTIVE MANAGEMENT STRATEGY

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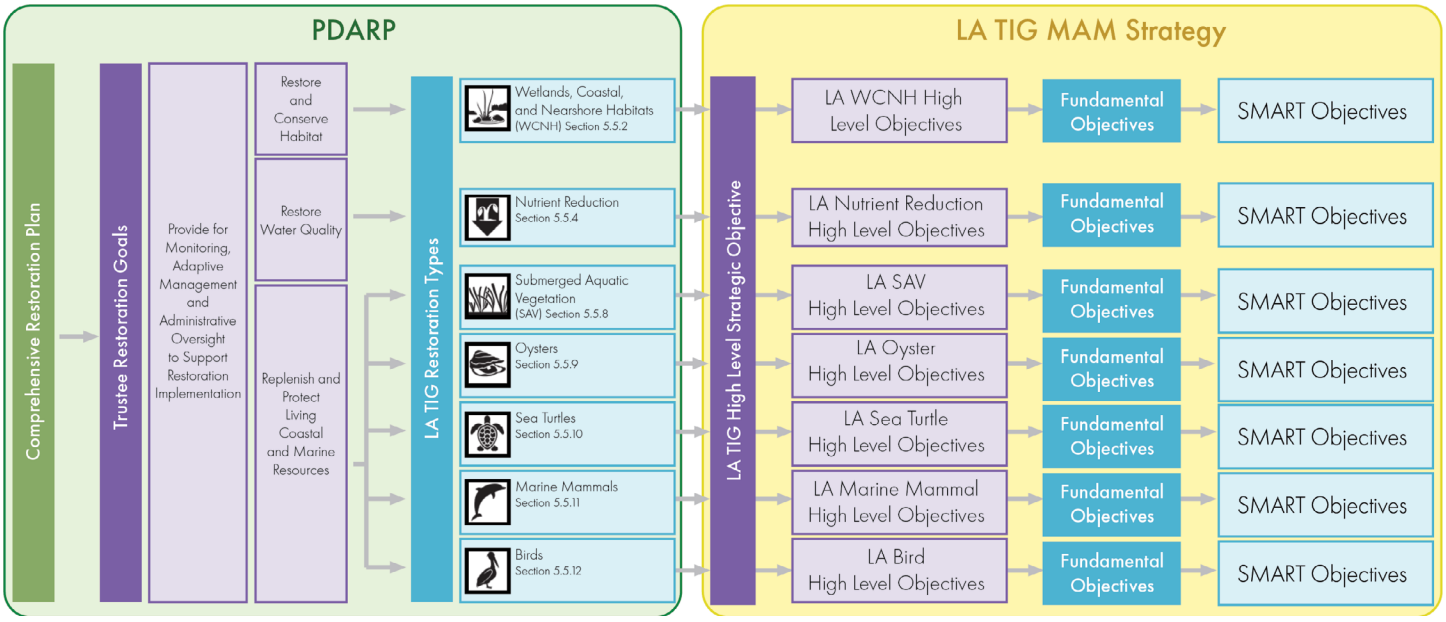
EXECUTIVE SUMMARY

The purpose of the Louisiana Trustee Implementation Group (LA TIG) Monitoring and Adaptive Management (MAM) Strategy is to outline an approach for the LA TIG to prioritize MAM activities in Louisiana for effective and efficient evaluation of the restoration of resources injured by the Deepwater Horizon (DWH) oil spill. Working from the Restoration Goals and Restoration Approaches outlined in the Programmatic Damage Assessment and Restoration Plan (PDARP), the LA TIG developed High Level Objectives specific for Louisiana-designated Restoration Types. Fundamental Objectives were then developed for each High Level Objective to specify key natural resource processes specific to Louisiana. For each Fundamental Objective, a framework of Specific, Measurable, Achievable, Relevant, appropriate Timeline (SMART) Objectives was developed to assess progress towards attaining PDARP Restoration Goals.



Framework for building the LA TIG MAM Strategy from the foundation provided in the PDARP. The LA TIG High Level Strategic Objective was synthesized from information and goals of the PDARP specific to the DWH injured resources in Louisiana. High Level Objectives, Fundamental Objectives, and SMART Objectives were then developed for each Louisiana Restoration Type. Modified from Figure 5.4-1 (PDARP/PEIS; DWH NRDA Trustees, 2016).

The specific purpose of the LA TIG MAM Strategy is to:

1. Describe SMART Objectives as a framework for reporting on the High Level Objectives and Fundamental Objectives to be achieved through implementation of restoration within each Louisiana Restoration Type, and to identify key MAM needs for each Restoration Type. These MAM needs include targeted data collection and monitoring. They additionally include information to support restoration planning and implementation, ecosystem evaluation, and programmatic evaluation and management (e.g., data management and capturing lessons learned)
2. Describe the LA TIG process for screening and approval of DWH Natural Resource Damage Assessment (NRDA) LA TIG MAM activities
3. Outline a process to ensure transparency for, and maximize benefits from, LA TIG MAM activities

Creating a Consensus-based LA TIG MAM Strategy

The LA TIG sought extensive input in developing the LA TIG MAM Strategy. During 2018 and 2019, coastal scientists from state and federal Trustees provided input into development of a report capturing the status of, and future recommendations related to, adaptive management for coastal restoration activities in Louisiana. Those Trustee discussions provided the

background and context to develop the LA TIG MAM Strategy. Additional engagement with Subject Matter Experts (SMEs) from state and federal LA TIG Trustee agencies was conducted over 12 months to produce a consensus set of SMART Objectives within each Restoration Type and Cross Restoration Types (objectives related to multiple restoration types). The SMART Objectives are linked to Adaptive Management needs with identified activities that will address those needs.

The resulting LA TIG MAM Strategy and SMART Objectives provide the basis for prioritizing, approving, and implementing LA TIG MAM activities as well as outline a process to assess progress towards accomplishing the Fundamental Objectives within each Restoration Type. Some SMART Objectives are fully developed whereas others will require additional data or analyses, which are identified as MAM needs.

Reporting on SMART Objectives

To fully develop and report on Restoration Type SMART Objectives, data will be used from Louisiana foundational data collection programs (Section 2.3.2), other sources of available data, and additional collection of new data. Data availability to report on SMART Objectives varies greatly between Restoration Types. To meet the data and knowledge needs identified through the development of the SMART Objectives and Programmatic MAM tables, it is anticipated that roughly 60% of the remaining LA TIG MAM funds could be spent on foundational data collection programs, 30% on targeted data collection, monitoring, and analysis, and 10% on programmatic adaptive management. It is expected that the annual LA TIG MAM funding allocation will vary year to year, with a potentially greater allocation of LA TIG MAM funds for the next five years to:

- Address known baseline data needs
- Fully develop SMART Objectives
- Develop a longer-term monitoring and evaluation framework to measure and report on progress towards the SMART Objectives
- Establish MAM support mechanisms

In addition to reporting on restoration-type SMART Objectives, this focused effort to meet MAM needs and fill knowledge gaps will help to identify potential emerging unknown conditions for Louisiana and assist the LA TIG in establishing plans to address those needs.

LA TIG MAM Activity Planning Process

The LA TIG MAM Strategy also outlines an overall process and cycle for LA TIG MAM activity submission, screening, and approval that will be coordinated by an LA TIG MAM Small Working Group (SWG). The anticipated overall cycle for approval and planning of LA TIG MAM activities is annual, based on the cycling of release of NRDA funds (April). There will be flexibility in this cycle to accommodate activities that have a specific time constraint (e.g., field sampling season). However, in general, MAM activity proposal documents will be received by the coordinating LA TIG MAM SWG until October 1st each year.

The LA TIG MAM Strategy outlines 12 key elements to be included by Implementing Trustees in initial proposals for MAM activities. It also outlines 12 criteria that the LA TIG MAM SWG can use to screen proposed MAM activities. Once proposal screening is complete, by November 30th, a summary of all proposed activities will be provided to the LA TIG for consideration. LA TIG approved proposals will be further developed in the standard TIG MAM Activities Implementation Plan (MAIP) format for submission to the LA TIG by April 1st. These MAIPs will subsequently be considered for approval by the LA TIG.

The LA TIG MAM Strategy is a "living document" with specific provisions for further development and refinement of the SMART Objectives for each Restoration Type, identified MAM needs, and activities to address those MAM needs. The LA TIG may request the LA TIG MAM SWG to update or revise details within the LA TIG MAM Strategy at any time.

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The LA TIG MAM Strategy is the result of a collaborative effort by the Louisiana Trustee Implementation Group (LA TIG):

- Coastal Protection and Restoration Authority (CPRA)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Department of the Interior (USDOI)
- U.S. Department of Agriculture (USDA)
- U.S. Environmental Protection Agency (US EPA)

With additional input from:

- Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana Department of Environmental Quality (LDEQ)

The effort included 50 working sessions (amounting to nearly 70 hours of collaborative work), three two-hour working sessions, and three SMART Objective development working sessions with Subject Matter Experts for each of the eight Restoration Types (24 total one-to-two-hour sessions). This effort engaged 48 collaborators across all Trustee agencies.

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LIST OF ACRONYMS

BICM	Barrier Island Comprehensive Monitoring
BISM	Barrier Island System Management
CIMS	Coastal Information Management System
CRMS	Coastwide Reference Monitoring System
CPRA	Coastal Protection and Restoration Authority (LA TIG Trustee – lead agency)
CWPPRA	The Coastal Wetlands Planning, Protection and Restoration Act
DIVER	Data Integration, Visualization, Exploration, and Reporting
DWH	*Deepwater Horizon*
FIMP	Fisheries-Independent Monitoring Program
LA	Louisiana
LiDAR	Light Detection and Ranging
LDEQ	Louisiana Department of Environmental Quality (LA TIG Trustee)
LDNR	Louisiana Department of Natural Resources (LA TIG Trustee)
LDWF	Louisiana Department of Wildlife and Fisheries (LA TIG Trustee)
LOSCO	Louisiana Oil Spill Coordinator's Office (LA TIG Trustee)
MAM	Monitoring and Adaptive Management
MAIP	MAM Activities Implementation Plan
MAM Manual	Monitoring and Adaptive Management Procedures and Guidelines Manual
NOAA	National Oceanic and Atmospheric Administration (LA TIG Trustee)
NEPA	National Environmental Policy Act
NFWF	National Fish and Wildlife Foundation
NRDA	Natural Resource Damage Assessment
PDARP	Programmatic Damage Assessment and Restoration Plan
PEIS	Programmatic Environmental Impact Statement
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States
RSM	Regional Sediment Management
SDM	Structured Decision Making
SOP	Standard Operating Procedure
SMART	Specific, Measurable, Achievable, Realistic, Timely
SWAMP	System-Wide Assessment and Monitoring Program
SWG	Small Working Group
TIG	Trustee Implementation Group
USDA	U.S. Department of Agriculture (LA TIG Trustee)
USDOI	U.S. Department of the Interior (LA TIG Trustee)
USEPA	U.S. Environmental Protection Agency (LA TIG Trustee)
WCNH	Wetland, Coastal, and Nearshore Habitats

1 INTRODUCTION

The purpose of the Louisiana Trustee Implementation Group (LA TIG) Monitoring and Adaptive Management (MAM) Strategy is to provide guidance that will support the LA TIG in identification of MAM activities that will maximize resource benefits as well as to assess and report on collective outcomes from restoration actions taken through Natural Resource Damage Assessment (NRDA) investments. To develop the LA TIG MAM Strategy, more than a year of extensive engagement with state and federal agency Subject Matter Experts (SMEs) was carried out to produce a consensus set of Restoration Type SMART Objectives (Specific, Measurable, Achievable, Realistic, appropriate Timeline). The SMART Objectives were linked to Monitoring and Adaptive Management needs with example activities to meet those needs. The LA TIG MAM Strategy, and tables of Restoration Type SMART Objectives, provide guidance to the LA TIG to prioritize and implement LA TIG MAM activities. The LA TIG MAM Strategy also provides a broad framework for assessment of progress towards NRDA Restoration Type Fundamental Objectives. The LA TIG MAM Strategy outlines an overall process for LA TIG MAM activity submission, screening, and approval.

1.1 BACKGROUND

The *Deepwater Horizon* (DWH) oil spill settlement in 2016 provided the NRDA Trustees (the Trustees) up to $8.8 billion (paid over 15 annual payments) across the Gulf of Mexico to restore natural resources and services injured by the spill (DWH NRDA Trustees, 2016; Henkel & Dausman, 2020). The Consent Decree[1] for the 2016 DWH oil spill settlement allocated funds for NRDA restoration by Restoration Type and Restoration Area, with $5 billion made available for restoration in Louisiana (Figure 1). The Trustees also established a governance structure that assigned a TIG to each of the eight designated Restoration Areas, including the Louisiana Restoration Area. Each TIG makes restoration decisions for the funding allocated to its Restoration Area (DWH NRDA Trustees, 2016) and is also responsible for identifying MAM priorities for its respective TIG (DWH NRDA Trustees, 2021).

As described in the DWH oil spill Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS), the injuries affected such a wide array of interrelated resources over an enormous area of the marine and coastal northern Gulf of Mexico (Figure 2) that the effects of the DWH oil spill were described as an ecosystem-level injury (DWH NRDA Trustees, 2016). Just as the injuries cannot be understood in isolation, restoration efforts must be considered and implemented comprehensively. Consequently, the Trustees selected an integrated ecosystem approach to restoration (DWH NRDA Trustees, 2016).

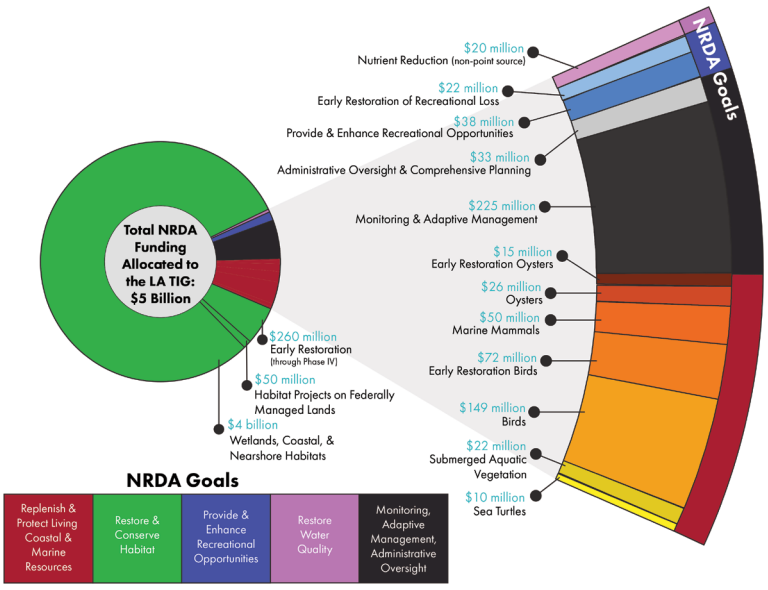

Figure 1. Total restoration funding allocated to the LA TIG for each Restoration Type. Total LA TIG funding ($5 billion) is presented by NRDA Goal categories as well as by Restoration Type within the goals of Replenish & Protect Living Coastal & Marine Resources; Monitoring, Adaptive Management, Administrative Oversight; Provide & Enhance Recreational Opportunities; and Restore Water Quality. Funding for Wetland, Coastal, and Nearshore Habitats is within the Restore & Conserve Habitat NRDA Goal category. Funding is presented as both proportions of the total $5 billion amount as well as in U.S. dollars.

1 On April 4, 2016, a federal court in New Orleans entered a Consent Decree in matters related to the DWH oil spill: United States v. BPXP et al., Civ. No. 10-4536, centralized in MDL 2179, In re: Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010 (E.D. La.). This Consent Decree resolved civil claims against BP arising from the April 20, 2010 Macondo well blowout and oil spill in the Gulf of Mexico. For more information, see: https://www.justice.gov/enrd/deepwater-horizon.

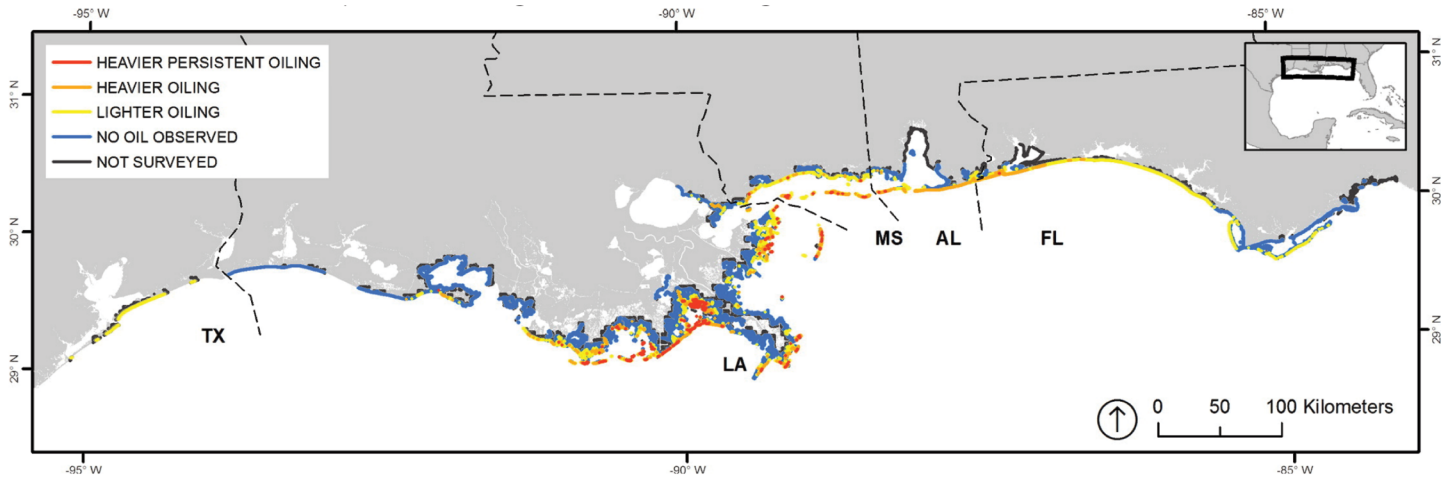

Figure 2. Shoreline oiling extent from the Deepwater Horizon oil spill highlighting impacts of oil to Gulf of Mexico coastal states of Texas (TX), Louisiana (LA), Mississippi (MS), Alabama (AL), and Florida (FL). Exposure categories indicate heaviest oiling along the southern Louisiana coastal zone. Figure reproduced from Nixon et al. (2016).

Given the unprecedented temporal, spatial, and funding scales associated with the DWH oil spill restoration effort, the need for robust MAM was recognized by the Trustees to support restoration planning and implementation. Therefore, one of the programmatic goals established in the PDARP/PEIS is to "Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation" to ensure that the portfolio of restoration projects provides long-term benefits to natural resources and ecosystem services injured by the spill (DWH NRDA Trustees, 2016).

Consequently, Trustees committed to conduct monitoring and scientific support activities within an adaptive management framework (PDARP/PEIS Appendix 5.E; DWH NRDA Trustees, 2016) so that Trustees can evaluate restoration effectiveness, address potential uncertainties related to restoration planning and implementation, and provide feedback to inform future restoration decisions (Williams et al., 2009; Williams, 2011). The Trustees for the LA TIG include the State of Louisiana, represented by the Coastal Protection and Restoration Authority (CPRA – lead agency), Louisiana Oil Spill Coordinator's Office (LOSCO), Louisiana Department of Natural Resources (LDNR), Louisiana Department of Environmental Quality (LDEQ), and Louisiana Department of Wildlife and Fisheries (LDWF), as well as federal Trustees including the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of the Interior (USDOI), the U.S. Department of Agriculture (USDA), and the U.S. Environmental Protection Agency (USEPA) (Figure 3).

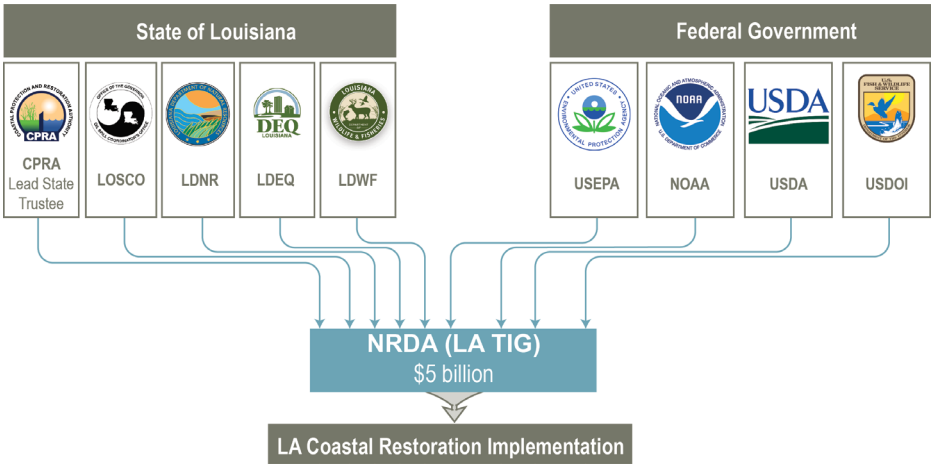

Figure 3. Trustees of the LA TIG working together to implement coastal restoration in Louisiana using the $5 billion NRDA oil spill allocation. State Trustees include the Coastal Protection and Restoration Authority (CPRA), Louisiana Oil Spill Coordinator's Office (LOSCO), Louisiana Department of Natural Resources (LDNR), Louisiana Department of Environmental Quality (LDEQ), and Louisiana Department of Wildlife and Fisheries (LDWF). CPRA is the lead agency representing the State of Louisiana on the LA TIG and is the single state entity in Louisiana with authority to develop, articulate, implement, and enforce a comprehensive Louisiana Coastal Master Plan to reduce tropical storm surge flood impacts, to build and maintain an ecosystem that both protects critical infrastructure and restores natural resources, and to secure Louisiana's coast. Federal Trustees include the U.S. Environmental Protection Agency (USEPA), U.S. Department of Commerce/National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Agriculture (USDA), and U.S. Department of Interior (USDOI)/Fish and Wildlife Service.

The Trustee's Standard Operating Procedures (SOP) and MAM Procedures and Guidelines Manual (the MAM Manual) provide guidance to the Trustees regarding the implementation of MAM for the DWH oil spill restoration effort (DWH NRDA Trustees, 2021, 2017). The SOPs included specific guidance for the Cross-Trustee Implementation Group (Cross-TIG) MAM workgroup to develop a MAM Manual (DWH NRDA Trustees, 2017) and perform programmatic evaluation of restoration outcomes. In addition to those documents, the LA TIG developed an Adaptive Management Framework that collated historic and current MAM governance structures, procedures, capacity, and protocols to develop a vision for improved MAM in Louisiana, including potential for synergies between NRDA specific MAM investments and other ongoing activities (The Water Institute of the Gulf, 2020).

The iterative nature of adaptive management involves several steps that represent the integration of design, management, and monitoring in a structured process to facilitate learning and improve restoration effectiveness (Figure 4). Adaptive management is applied both at an individual project scale as well as programmatically (i.e., portfolios of projects). Programmatic adaptive management provides a structured process for making decisions over time through active learning based on the relative success of implemented projects or portfolios of projects. Extending beyond the life of any one project, programmatic adaptive management enables adjustments in design, management, and selection of projects as new information becomes available on a routine and recurring basis. In addition, it provides a structured process for using quantified assessments of project performance to refine project operation and monitoring or even project redesign (The Water Institute of the Gulf, 2020). Until creation of the LA TIG, restoration effort and associated programmatic MAM were coordinated through the Louisiana Coastal Master Plan which is revised on a regular basis (CPRA, 2007, 2012, 2017).

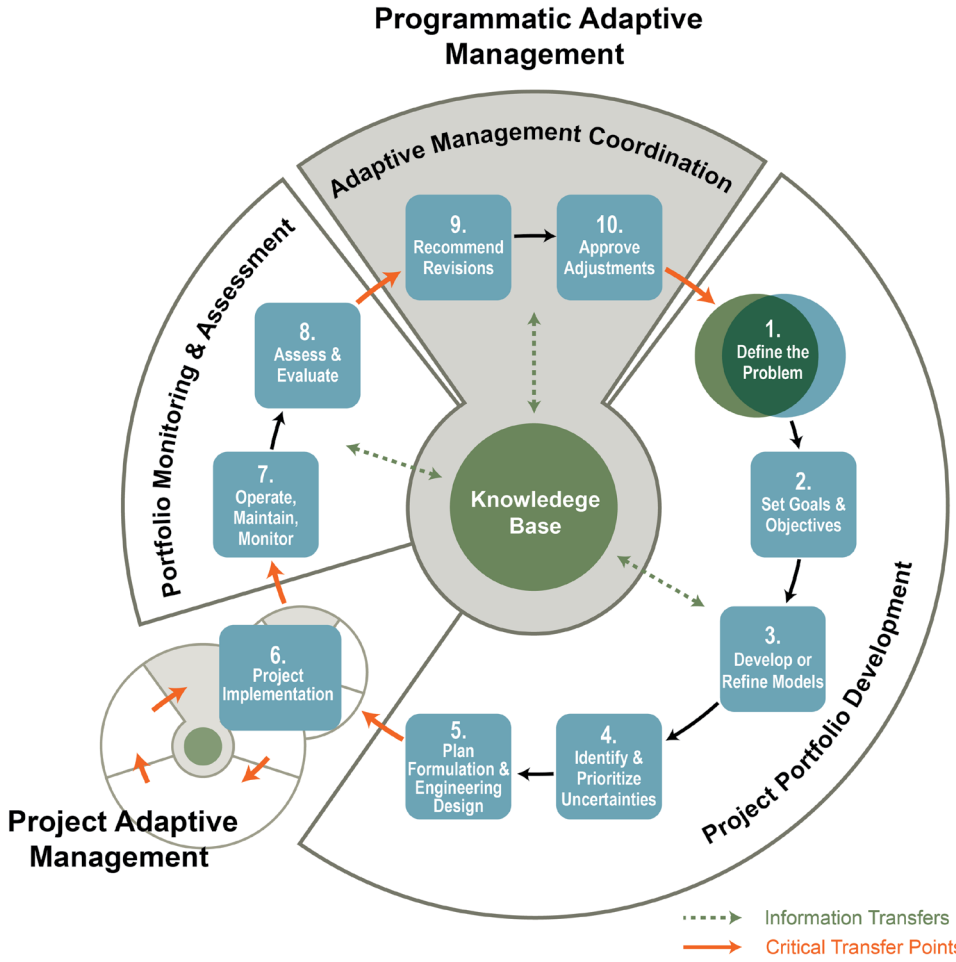

Figure 4. The ten steps for adaptive management for coastal restoration in Louisiana. Programmatic- and project-scale adaptive management cycles are interconnected to optimize benefits at multiple spatial and temporal scales. Programmatically, steps with greatest need and opportunity for adaptive management (Critical Transfer Points) occur first between Plan Formulation & Engineering Design and Project implementation, second between Assess & Evaluate and Recommend Revisions, and lastly from the last step Approve Adjustments to the cycle's first step, Define the Problem (The Water Institute of the Gulf, 2020). Information transfers can also occur at multiple points in this cycle. The LA TIG MAM Strategy specifically relates to programmatic adaptive management.

Version 1.0 of the MAM Manual is focused on MAM at the project level, and subsequent versions will include more information on MAM at the Restoration Type and programmatic levels. Building from the MAM Manual and LA TIG Adaptive Management Framework, the LA TIG MAM Strategy focuses on implementing MAM at the Restoration Type and programmatic levels specifically for the LA TIG, while being fully consistent with the PDARP/PEIS (Section 7.5.1.2 of the PDARP/PEIS, DWH NRDA Trustees, 2016; Section 10.4.1.2(a) of SOP, DWH NRDA Trustees, 2021).

1.2 LA TIG COMMITMENT TO MAM

The Trustee Council's SOPs specify that each TIG will address the following MAM responsibilities, as appropriate to their restoration activities (Section 10.3.2 of SOP; DWH NRDA Trustees 2021):

- Review and approve project MAM Plans for compatibility with the Trustee Council's SOP and MAM Manual for compliance with regulatory requirements, and determine the MAM Plans' readiness for inclusion in restoration plans (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees 2021)
- Identify MAM priorities for the TIG's Restoration Area and communicate priorities to the Cross-TIG MAM work group (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees 2021)
- Ensure project monitoring data, monitoring reports, and other monitoring information are compatible with the MAM Manual and are submitted to the Restoration Portal https://www.diver.orr.noaa.gov/ (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees 2021)
- Provide TIG-related aggregated and quality-controlled MAM data, information, and evaluations to the Trustee Council and Implementing Trustee(s) (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees 2021)
- Provide the Trustee Council an annual status update of project monitoring information and data (Section 10.3.2 of SOP; DWH NRDA Trustees 2021)

The Louisiana Restoration Area has restoration funds allocated to the following nine Restoration Types (Chapter 5 of PDARP/PEIS; DWH NRDA Trustees, 2021). Additional funds were allocated for MAM, as well as Administrative Oversight and Comprehensive Planning.

Wetland, Coastal, and Nearshore Habitats (WCNH)

Habitat Projects on Federally Managed Lands

Nutrient Reduction

Sea Turtles

Submerged Aquatic Vegetation (SAV)

Marine Mammals

Birds

Oysters

Provide and Enhance Recreational Opportunities

Consistent with the Trustee Council's SOP (Section 10.5.1(b) of SOP; DWH NRDA Trustees, 2021), MAM activities that may be approved for the MAM allocation include, but are not limited to, the following:

1. Resolving critical information gaps/uncertainties for restoration planning; inform restoration decision-making
2. Supplementing Restoration Type monitoring activities, where needed
3. Performing cross-resource science and monitoring activities
4. Evaluating regional restoration outcomes (beyond individual project footprints) within the TIG's Restoration Area
5. Performing programmatic or operational MAM activities, such as data aggregation summary and synthesis; report development; and data management activities
6. Responsively re-examine TIG and/or Cross-TIG MAM priorities following a disturbance (e.g., hurricane, oil spill, etc.)
7. Performing monitoring to inform the design and implementation of future restoration projects, including better characterizing ecological functions
8. Conducting Cross-TIG MAM work group operation and coordination activities (DWH NRDA Trustees, 2021)

The Trustee Council's SOP also authorizes the use of Restoration Type funds for some of these activities as it relates to project and resource-level MAM (Section 10.5.2(b)(4) of SOP; DWH NRDA Trustees, 2021). The LA TIG has been allocated $225M for the purpose of conducting MAM activities in support of restoration of Louisiana's natural resources. NRDA MAM funding has already contributed to monitoring and knowledge gathering activities in Louisiana. Prior to the development of the LA TIG MAM Strategy, approximately $23.5M was committed to various types of MAM activities (Table 1). Louisiana has a range of foundational data collection programs coordinated under the System-Wide Assessment and Monitoring Program (SWAMP) to support long-term monitoring and assessment. In addition to NRDA MAM funds, these ongoing programs have received funding through NFWF and other DWH settlement mechanisms, as well as substantive investment over the past two decades from sources independent of the DWH settlements.

Table 1. Approved NRDA MAM Budget at the time of LA TIG MAM Strategy development (August 2021). Additional information about these projects can be accessed via NOAA's DIVER project portal.

	Resolution	Total Commited (2019-2024)	DIVER Project Number
Fisheries (FIMP) Fisheries Extension (April - June, 2020) Fisheries (FIMP) Fish Gear Comparison	LA-2018-017; LA-2019-006 LA-2020-001 LA-2020-015 LA-2018-017; LA-2019-006	$2,120,000 $336,161 $3,951,192 $211,680	Project ID 175
CRMS (Portion)	LA-2020-020	$11,722,398	Project ID 249
Dolphin Photo ID surveys	LA-2018-017	$402,183	Project ID 127
Colonial Waterbird Monitoring Colonial Waterbird Analysis	LA-2018-009 LA-2018-019	$155,287 $275,000	Project ID 178
Secretive Marsh Birds	LA-2019-016	$1,441,421	Project ID 205
Adaptive Management Framework MAM Strategy Development and Planning	LA-2018-003 LA-2019-038; LA-2019-041; LA-2021-008	$913,347 $1,185,407	Project ID 121
Lower Trophic Level Sampling Plan	LA-2021-009	$785,000	Project ID 269
	Total	**$23,499,076**	

1.3 PURPOSE OF THE LA TIG MAM STRATEGY

The purpose of the LA TIG MAM Strategy is to provide MAM guidance to the LA TIG to prioritize funding for effective and efficient restoration of resources in LA that were injured by the DWH oil spill. The specific purpose of the LA TIG MAM Strategy is to:

1. Describe SMART Objectives as a framework for reporting on the High Level Objectives and Fundamental Objectives to be achieved through implementation of restoration within each Louisiana Restoration Type, and to identify key MAM needs for each Restoration Type. These MAM needs include targeted data collection and monitoring. They additionally include information to support restoration planning and implementation, ecosystem evaluation, and programmatic evaluation and management (e.g., data management and capturing lessons learned)
2. Describe the LA TIG process for screening and approval of DWH Natural Resource Damage Assessment (NRDA) LA TIG MAM activities
3. Outline a process to ensure transparency for, and maximize benefits from, LA TIG MAM activities

In consideration of Louisiana's designated Restoration Types, the remainder of the LA TIG MAM Strategy captures the outputs of a process undertaken to develop a conceptual strategy and actionable processes to maximize benefits from MAM investments by the LA TIG.

- **Section 2:** Process for Identification & Prioritization of LA TIG MAM Needs and Activities
- **Section 2.1:** Identification of Restoration Objectives, SMART Objectives, and MAM needs
- **Section 2.2:** Identified DWH NRDA LA TIG MAM needs
- **Section 2.3:** Strategic Approach for Integrated and Synergistic MAM Support
- **Section 2.4:** Process for LA TIG Approval of MAM Activities
- **Section 3:** Process for Sharing Information about MAM Activities
- **Section 4:** Coordination on MAM needs with Other Restoration Programs

2 PROCESS FOR IDENTIFICATION & PRIORITIZATION OF LA TIG MAM NEEDS AND ACTIVITIES

MAM needs refer to key knowledge gaps or information needs relevant to planning, implementing, and/or evaluating restoration (operating at multiple spatial or temporal scales) that would help the Trustees achieve the restoration goals established in the PDARP/PEIS (DWH NRDA Trustees, 2017). MAM needs may apply to a specific Restoration Type, or apply across Restoration Types, and/or at the ecosystem level. As restoration projects continue to be implemented, lessons learned will result in additional knowledge gained and may also identify additional knowledge gaps and information needs; therefore, the LA TIG MAM Strategy is a living document and recognizes that activities may be proposed in the future that are not explicitly identified within the LA TIG MAM Strategy. It will be updated as relevant within the annual activity screening and approval process or as deemed necessary by the LA TIG.

LA TIG MAM Strategy is a *"living document"*

Adaptive management is intended to resolve uncertainties and inform decisions based on past lessons learned – the LA TIG MAM Strategy is a living document to summarize current MAM needs and establish a process for approval of MAM activities.

2.1 IDENTIFICATION OF RESTORATION OBJECTIVES, SMART OBJECTIVES, AND MAM NEEDS

Consistent with the Trustee Council's SOP, the LA TIG developed an initial set of MAM priorities for the Louisiana Restoration Area through extensive collaboration. To accomplish this, an LA TIG MAM working group composed of representatives from LA TIG Trustees USDOI, NOAA, USEPA, USDA, CPRA, and LDWF used a modified Structured Decision Making (SDM) framework as applied by Madsen et al., (2017). SDM was employed to ensure that the identified MAM needs were specifically related to reporting on the success of attaining goals within each NRDA Restoration Type prioritized for Louisiana in the PDARP (DWH NRDA Trustees, 2016). MAM needs were identified for seven of the nine approved Restoration Types in Louisiana as well as MAM needs that addressed multiple Restoration Types, denoted as "Cross Restoration Type MAM needs."

The two Restoration Types for which MAM needs were not identified were "Habitat Projects on Federally Managed Lands" and "Provide and Enhance Recreational Opportunities". "Habitat Projects on Federally Managed Lands" was not considered as a separate LA TIG MAM priority since natural resource benefits will be assessed and monitored within the Restoration Type SMART Objective tables below (in particular WCNH). "Provide and Enhance Recreational Opportunities" was also not considered as those projects are focused on increasing access opportunities with associated project-specific assessment and reporting (metrics of success will be, for example, number of people using a facility).

Louisiana Overall High Level Strategic Objective

Resilient and sustainable coastal habitats and habitat complexes (marsh habitat; barrier island; dune and beach habitat; hard bottoms; and Submerged Aquatic Vegetation) are created, restored, and/or maintained in injured Louisiana coastal basins to maximize ecosystem connectivity, functions, and services for resources that were injured by the oil spill (various life stages of oysters, estuarine-dependent fish species, invertebrates, birds, marine mammals, and nearshore benthic communities).

To generate the LA TIG MAM Strategy and the identified MAM activities, the LA TIG MAM Strategy Functional Points of Contact (Functional POCs) (the "working group") convened 50 working sessions (amounting to nearly 70 hours of collaborative work), three two-hour working sessions (with assistance from the LA TIG MAM Strategy Steering POCs), and three SMART Objective development working sessions with SMEs for each of the seven Restoration Types considered here and the Cross-Restoration Type (24 total one to two hour sessions). This effort engaged 47 collaborators from Trustee agencies: USDOI (11), NOAA (12), CPRA (7), LDWF (3), USDA (3), and USEPA (10), as well as the Louisiana Department of Environmental Quality (LDEQ, 1).

The output of those working sessions was a hierarchical structure of objectives for each Restoration Type nested under the NRDA Restoration Type goals: High Level Objectives and Resource Type-specific Fundamental Objectives. To report on progress towards these Fundamental Objectives, SMART Objectives were developed so that identified MAM needs report on SMART Objectives and/or fill knowledge or data gaps to fully develop an appropriate SMART Objective (Figure 5).

Developing the LA TIG MAM Strategy during 2020 - 2021 involved extensive engagement with LA TIG Trustees. Meetings with representation from all Trustees coordinated development of the LA TIG MAM Strategy, with ongoing reach-out within agency to develop consensus on the approach and mechanisms. This substantive engagement effort was undertaken to ensure that the developed SMART Objectives and MAM needs were consistent with the needs of individual Louisiana Trustees, built on consensus, and provided the greatest potential for effective reporting on progress towards attainment of DWH NRDA restoration goals.

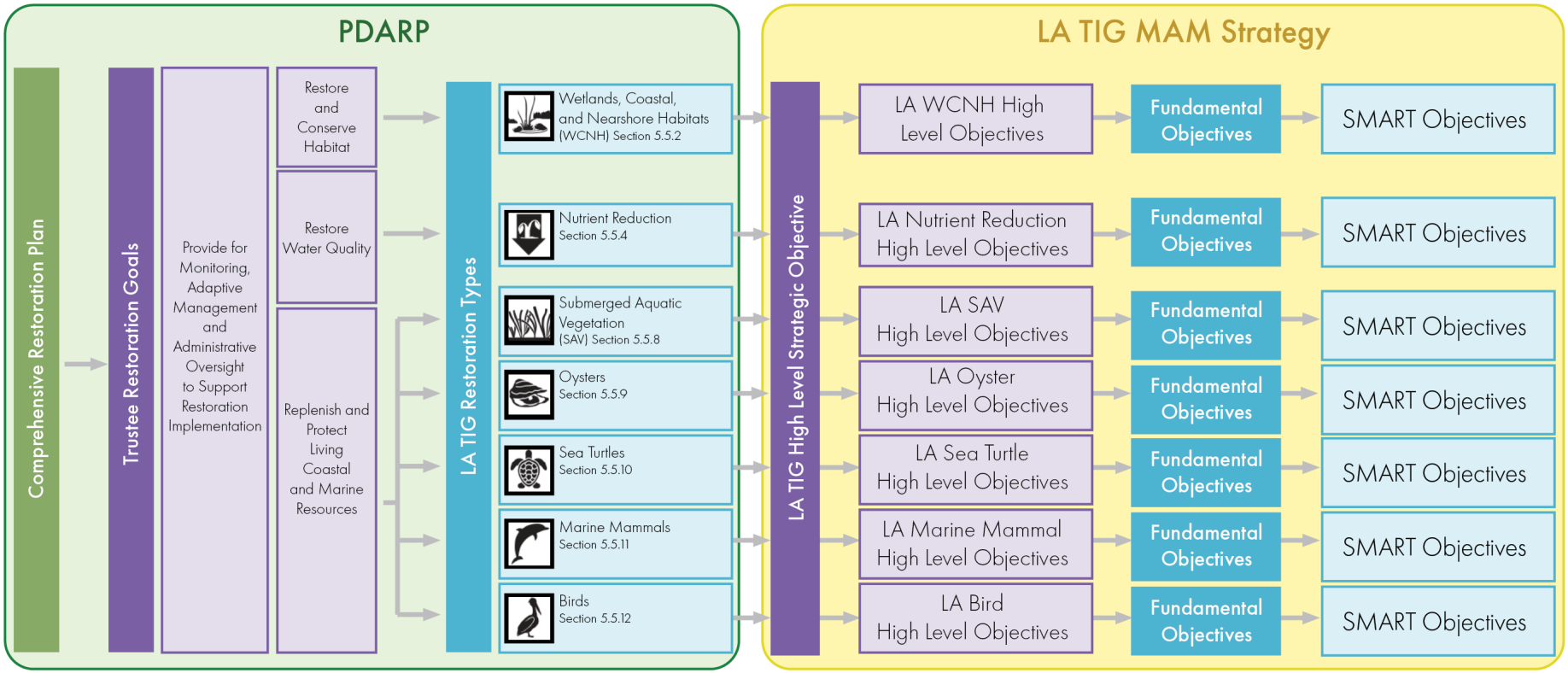

Figure 5. Framework for building the LA TIG MAM Strategy from the foundation provided in the PDARP. The LA TIG High Level Strategic Objective was synthesized from information and goals of the PDARP specific to the DWH injured resources in Louisiana. High Level Objectives, Fundamental Objectives, and SMART Objectives were then developed for each Louisiana Restoration Type. Modified from Figure 5.4-1 (PDARP/PEIS; DWH NRDA Trustees, 2016b).

2.2 IDENTIFIED DWH NRDA LA TIG MAM NEEDS

2.2.1. SMART Objectives

SMART Objectives were developed for seven of the Restoration Types identified for restoration funding in Louisiana and an additional group of MAM needs associated with those addressing multiple Restoration Types (Cross-Restoration):

- Table 2: WCNH SMART Objectives
- Table 3: Nutrient Reduction SMART Objectives
- Table 4: Submerged Aquatic Vegetation (SAV) SMART Objectives
- Table 5: Oyster SMART Objectives
- Table 6: Sea Turtle SMART Objectives
- Table 7: Marine Mammal SMART Objectives
- Table 8: Bird SMART Objectives
- Table 9: Cross Restoration SMART Objectives

S.M.A.R.T. Objectives

SMART Objectives are intended to assist resources managers to create, track, and assess achievement of short- and long-term goals. Specific to the LA TIG MAM process, development of SMART objectives was guided by resource experts and restoration practitioners. Here, the SMART acronym is defined as: specific about what restoration effort will achieve; provide a measurable target for restoration success; targets have been identified by resource experts as achievable; measures are relevant to ecosystem objectives; a program-appropriate timeline is identified for quantifying progress.

Where there are currently sufficient knowledge and data to establish a SMART Objective, they are detailed in the Restoration Type SMART Objective tables (Table 2 - Table 9). In such cases, the MAM need is to ensure that appropriate and sufficient monitoring is carried out to report on that SMART Objective and to recommend additional data collection where needed. However, in many cases, it was realized that the current state of knowledge was not sufficient to establish a SMART Objective, so a "MAM need to develop SMART Objective" was identified and subsequently the suggested MAM activity to address that need was also detailed. The list of activities is advisory and is not comprehensive; it represents an initial scoping of what may be expected in terms of scale of effort to address the identified MAM need and develop a SMART Objective. It is anticipated that the suggested MAM activities needed to develop SMART Objectives will be primarily "short-term" activities, within the next five years. MAM activities to report on SMART Objectives were not included at this stage in recognition that initial activities need to be carried out to finalize most SMART Objectives.

The extensive and thorough engagement with SMEs and managers from all Louisiana Trustees revealed that, in many cases, the baseline data and/or specific information was not available to establish a quantifiable and time-sensitive threshold or target to justify a SMART Objective (Table 2-Table 9). As a result, SMART Objectives are in one of three states of development:

1. Fully Developed: e.g., Oyster SMART Objective 1.a. "Oyster density on coastal Louisiana POSGs and DWH NRDA restored oyster reefs is at least 20 seed-sized oysters (25mm or larger) per square meter at least once during annual sampling within each 4-year monitoring window following project construction" (Table 5)
2. Metric Identified – Target to be Developed: e.g., Bird SMART Objective 2. "Objective related to diversity of ground-associated breeding birds expected to benefit from the habitats to be developed based on current MAM need and activity 2.a. and 2.b." (Table 8)
3. Metric and Target to be Developed: e.g., Sea Turtle SMART Objective 1. "Objective related to habitat use by sea turtles to be developed based on current MAM need and activity 1.b." (Table 6)

Table 2. Restoration Type SMART Objectives: WCNH. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

WETLAND, COASTAL, AND NEARSHORE HABITATS (WCNH)				
High Level Objectives	**Fundamental Objectives**	**MAM need to develop SMART Objectives**	**Suggested MAM activity to address MAM need**	**SMART Objectives**
Marsh platform/ area is created, restored, or maintained (resilient / maintained over time)	**1. Contribute to reduction in net marsh loss in coastal Louisiana**	1.a. Quantify and assess historic, current, and future predicted emergent vegetated wetland habitat area in coastal Louisiana and determine appropriate quantification for implemented and long term land area and from DWH NRDA restoration (*concurrent with* **3.a.**)	1.a. Compile available historic emergent vegetated wetland loss and habitat datasets (e.g., CRMS, USGS), assess trends and limitations; develop coordinated/integrated approach to monitor and assess emergent vegetated wetlands across habitat types at necessary spatial and temporal scales, utilizing new technology, while allowing comparisons to older historic information (*concurrent with* **3.a.**)	*Objective related to area of DWH NRDA created wetland to be developed based on current MAM need and activity* **1.a.** *and* **3.a.**
		1.b. Quantify and assess sediment volume availability for marsh creation projects in target basins, sub-basins, or HUC 12 watersheds	1.b. Synthesize available sediment volume data and, if needed, develop a plan for monitoring in target basins, sub-basins or HUC12 watersheds	*Objective related to sediment volume DWH NRDA created wetland to be developed based on current MAM need and activity* **1.b.**
	2. Maintain elevational landscape sufficient to support wetland vegetation	2.a. Synthesize available data and/or quantify appropriate land elevation for different marsh vegetation types and develop approach for assessment and reporting on DWH NRDA projects to sustain a diversity of emergent marsh vegetation over the life of the restored marshes	2.a. Develop a technical report on available data and knowledge (e.g., CRMS data, and coastwide LiDAR data), supplementing with additional data sampling as needed within target coastal basins	*Objective related to DWH NRDA created wetlands elevation and ability to sustain a diversity of emergent wetlands to be developed based on current MAM need and activity* **2.a.**
	3. Restore habitats injured by the spill in a range of salinity zones (fresh, intermediate, brackish, saline)	3.a. Quantify and assess historic, current, and predicted emergent vegetated wetland habitat area in coastal Louisiana and determine appropriate quantification for implemented and long term vegetated marsh salinity community types from DWH NRDA restoration (*concurrent with* **1.a.**)	3.a. Analyze and synthesize available historical data and numerical model predictions of future without action (LA CMP) to identify coastwide and basin specific marsh salinity community targets (*concurrent with* **1.a.**)	*Objective related to DWH NRDA created wetlands vegetated marsh salinity community types to be developed based on current MAM need and activity* **3.a.** *and* **1.a.**
Barrier island habitat is created, restored, or maintained (resilient / maintained over time) to reduce land loss	**4. Maintain protective function (wave attenuation) of barrier islands**	4.a. Develop approach and plan for monitoring to quantify wave attenuation from barrier islands	4.a. Synthesize available data and develop a numerical model to assess change in wave climate/pattern within a basin or in the lee of a barrier island with different restoration options	*Objective related to wave attenuation by DWH NRDA created barrier islands to be developed based on current MAM need and activity* **4.a.**
	5. Support natural processes of barrier island evolution (e.g., erosion, overwash that builds back-barrier platform, and longshore sediment transport within the littoral zone; barrier island rollover rate) through barrier island restoration projects	5.a. Develop and document approach for assessing and characterizing restored barrier island response to natural processes (e.g., changes to dune morphology and island resistance or resilience to overwash and sea-level rise)	5.a. Synthesize available data (e.g. BICM, BISM) to establish baseline and assessment framework for natural processes in barrier island evolution including (overwash area; cross-shore and long-shore sediment transport volume, barrier island rollover [migration] rate, estuarine salinity gradient) using data synthesis, analysis, expert elicitation, and technical report	*Objective related to maintenance of natural processes of barrier island evolution to be developed based on current MAM need and activity* **5.a.**
	6. Maintain habitat heterogeneity to support resilient nearshore and coastal ecosystems	6.a. Develop and document approach to quantify and assess habitat heterogeneity in restored key barrier island habitat types	6.a. Collect and analyze data to report on habitat heterogeneity in a range of types of restored and reference barrier islands; such as BICM, project data including area by habitat and wetland type, identification of habitat complexes, topography, and aerial/CIR photo analysis	*Objective related to maintenance of habitat heterogeneity in barrier islands to be developed based on current MAM need and activity* **6.a.**
Provide habitat and habitat complexes for Wetland Coastal Nearshore Habitats-dependent species and support species diversity for various life stages	**7. Provide benefits to estuarine dependent fish and invertebrates (nekton and benthic) at a variety of life stages through habitat restoration**	7.a. Develop reference ranges for density and relative abundance of target fish and invertebrate guilds or species, based on natural variability of relative abundance and density at appropriate reference sites; identify the distance from a restored area at which a restoration effect could be detected	7.a. Establish fixed area sampling stations, sample, and analyze with existing FIMP data, to develop reference ranges for densities and abundance, and distance and time at which effect could be measured	*Objective related to abundance of target fish and invertebrate guilds or species to be developed based on current MAM need and activity* **7.a.**
		7.b. Estimate the effects of changes in habitat availability and type, and other restoration actions, on estuarine community structure, food web, and population connectivity	7.b. Model [faunal diversity, richness, and/or diets] to forecast effects of estuarine restoration portfolio and recovery times (*informed by or performed in conjunction with Cross Restoration Type SMART Objective* **2.b.**)	*Objective related to food web and habitat to be developed based on current MAM need and activity* **7.b.** *(linkage to Cross Restoration Type SMART Objective* **2.b.***)* *Objective related to ecological connectivity of wetlands, coastal, and nearshore habitat restoration projects to be developed based on current MAM need and activity* **7.b.** *(linkage to Cross Restoration Type SMART Objective* **2.b.***)*
		7.c. Within 5 years quantify habitat characteristics appropriate for target fish and invertebrate guilds or species	7.c. Develop a technical guidance document for restoration project design and monitoring to maximize habitat value for nekton, using data and knowledge at multiple spatial scales, supplementing with additional data sampling as needed within target coastal basins and SMEs as appropriate (relevant datasets may include: hydrologic connectivity, access, inundation, edge:interior ratio, vegetation, interspersion/features)	*Objective related to incorporation of habitat features into restoration approaches to be developed based on current MAM need and activity* **7.c.**

Table 3. Restoration Type SMART Objectives: Nutrient Reduction. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

NUTRIENT REDUCTION High Level Objectives	Fundamental Objectives	MAM need to develop SMART Objectives	Suggested MAM activity to address MAM need	SMART Objectives
Reduce nutrient loads to coastal watersheds	**1. Increase implementation of conservation practices in agricultural areas vulnerable to nutrient and accompanying soil loss into nearby waterways and document nutrient load reductions in coastal waterways**	1.a. Quantified baseline of number of farms implementing management practices (including types of practices)	1.a. Questionnaire (or some other instrument/procedure/CEAP) inventory landowners in watershed and/or NRCS run queries in their reporting system quantifying baseline number of farms implementing conservation plans and practices including types of practices being implemented	*Objective related to implementation of conservation practices on farms to be developed based on current MAM need and activity* **1.a.**, **1.b.**, *and* **1.c.**
		1.b. Increased participation in the voluntary nutrient reduction projects	1.b. Within 3 to 5 years, implement outreach and education efforts to landowners within prioritized watersheds – *essential to success of SMART Objective development*	*Objective related to participation in voluntary nutrient reduction projects to be developed based on current MAM need and activity* **1.a.**, **1.b.**, **1.c.**, *and* **1.d.**
		1.c. Prioritized watersheds for targeted conservation plans and practices (beyond 47 currently prioritized watersheds of on-going LATIG projects)	1.c. Collect and analyze watershed data to determine priority watersheds (including updating RPS (Recovery Potential Screening Tool) and assessing current LA state programs)	*Objective related to targeted conservation plans and practices to be developed based on current MAM need and activity* **1.a.**, **1.b.**, *and* **1.c.**
		1.d. Expanded application of soil vulnerability indices to prioritization of conservation efforts of multiple land uses	1.d. Develop analytical relationships between soil vulnerability indices and multiple land uses	*Objective related to prioritization of conservation efforts using soil vulnerability indices from multiple land uses to be developed based on current MAM need and activity* **1.a.**, **1.b.**, *and* **1.c.**
	2. Establish long term conservation cover (e.g., protect land that might be vulnerable to development) and document nutrient load reductions in coastal waterways	*NOT CURRENTLY A PRIORITY*	*NOT CURRENTLY A PRIORITY*	*NOT CURRENTLY A PRIORITY*
	3. Increase forestry conservation practices in vulnerable areas and document nutrient load reductions in coastal waterways	*NOT CURRENTLY A PRIORITY*	*NOT CURRENTLY A PRIORITY*	*NOT CURRENTLY A PRIORITY*

Table 4. Restoration Type SMART Objectives: SAV. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

SUBMERGED AQUATIC VEGETATION (SAV)				
High Level Objectives	**Fundamental Objectives**	**MAM need to develop SMART Objectives**	**Suggested MAM activity to address MAM need**	**SMART Objectives**
Maintain or increase available habitat and abundance and maintain diversity of SAV in the Chandeleur Islands system to be sustainable and resilient	**1. Provide potential SAV habitat through active restoration techniques (i.e., sediment emplacement) to support natural coastal processes (resilient/ maintained over time)**	1.a. Develop approach to estimate current and future potential SAV habitat area, and compare effectiveness of different restoration approaches	1.a. Develop numerical model and/or technical data synthesis/analysis approach to report on current and future potential SAV habitat area	*Objective related to area of potential SAV habitat to be developed based on current MAM need and activity* **1.a.**
	2. Maintain SAV community	2.a. Develop approach to estimate current SAV area to compare to historic areas and trends	2.a. Develop synthesis of historical survey data and trends, as well as quantify current, SAV utilization of available potential habitat	*Objective related to areal extent of SAV to be developed based on current MAM need and activity* **2.a.**
				2.b. SAV meadows on the lee side of the Chandeleur barrier islands include rolling 3 year average percent cover of at least 50% SAV across all current meadows (in terms of patchiness [Kenworthy et al., 2017]); a minimum of 20% of total SAV area being dominated by *Thalassia testudinum* (Darnell et al., 2017)
Ensure SAV supports a range of ecological functions for the Chandeleur Islands system	**3. Maintain or increase utilization by fish, invertebrates, and wildlife of SAV habitats**	3.a. Develop target ranges for [diversity, richness, density, and relative abundance] of target fish and invertebrate guilds or species, based on historical data and natural variability; identify the distance from a restored area at which a restoration effect could be detected	3.a. Establish fixed area and FIMP sampling stations; acoustic tagging of fish (e.g., red drum, spotted sea trout, tarpon); sample and analyze with existing FIMP data to develop baseline and target ranges for [diversity, richness, density, relative abundance, presence/behavior] and distance and time at which effect could be measured (to inform utility of current FIMP site monitoring	*Objective related to utilization of potential SAV habitat by biota to be developed based on current MAM need and activity* **3.a.**
		3.b. Develop approach and quantify total number of lemon sharks using in the Chandeleur barrier island system	3.b. Synthesize available data, identify data needs, additional surveys to inform development of SMART Objective	*Objective related to utilization of potential SAV habitat by lemon sharks to be developed based on current MAM need and activity* **3.b.**
		Abundance of identified key species of sea turtles is maintained at identified target	*Detailed in Sea Turtle Restoration Type MAM needs to develop SMART Objectives*	*Objective related to utilization of potential SAV habitat by sea turtles to be developed based on current MAM need and activity noted for the* **Sea Turtle Restoration Type**
		Abundance of bottlenose dolphins is maintained at identified target	*Detailed in Marine Mammal Restoration Type MAM needs to develop SMART Objectives*	*Objective related to utilization of potential SAV habitat by marine mammals to be developed based on current MAM need and activity noted for the* **Marine Mammal Restoration Type**

Table 5. Restoration Type SMART Objectives: Oysters. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

OYSTERS				
High Level Objectives	**Fundamental Objectives**	**MAM need to develop SMART Objectives**	**Suggested MAM activity to address MAM need**	**SMART Objectives**
Balance growth of oyster population on NRDA-enhanced and restored reefs with ecologically sustainable public harvesting	**1. Maintain or increase oyster abundance on managed or restored areas of public seed grounds (POSG) over time**	*None needed*	*None needed*	1.a. Oyster density on coastal Louisiana POSGs and DWH NRDA restored oyster reefs is at least 20 seed-sized oysters (25mm or larger) per square meter at least once during annual sampling within each 4-year monitoring window following project construction 1.b. DWH NRDA portfolio maintains, restores, or creates a minimum of 400 acres of oyster cultch placement on POSG/POSR areas [RP#5, 3.6.2.1, pg. 48] by 4 years post-construction of last project 1.c. DWH NRDA project reefs protect a minimum of 40 acres from harvest by completion of implementation of RP5 [3.6.1.1, pg. 43]
	2. Maintain a neutral or positive shell budget on all restored reefs – either naturally (self-generated preferable) or through continued addition	2.a. Assess current monitoring efforts, available data and numerical shell budget models to plan reporting on SMART Objective	2.a. Review available data, ongoing monitoring metrics and methodologies, including simple shell budget models to plan a recommended approach on reporting	*Objective related to shell budgets of DWH NRDA restored oyster reefs to be developed based on current MAM need and activity* **2.a.**
	3. Maintain sufficient recruitment to, and survival of oysters on, restored reefs to maintain viable multi-generational oyster populations	3.a. Understand linkage of source areas with a mix of size classes to ensure a mix of male and female oysters, located in such a way that larvae will seed other reefs	3.a. Develop a metapopulation model that considers both larval transport dynamics and on-reef oyster growth, mortality, and reproduction metapopulation model that considers both larval transport dynamics and on-reef oyster growth, mortality, and reproduction	*Objective related to maintenance of multiple size classes of oysters (e.g., spat, seed and sack) to be developed based on current MAM need and activity* **3.a.** 3.b. All reefs show larval settlement at least once within each 5 year period 3.c. All DWH NRDA restored reefs are at or above the minimum threshold for spawning-sized oysters (20 seed-sized oysters, 25mm or larger, per square meter) at least once within each 4-year monitoring window following project implementation
Spatial connectivity between source and sink reefs for larval transport to foster resilience and sustainability of oyster populations	**4. Maintain or increase stock of spawning sized oysters on restored reefs**	*Objective equivalent to SMART Objective* **3.c.**	*Objective equivalent to SMART Objective* **3.c.**	*Objective equivalent to SMART objective* **3.c.**
	5. Utilize restoration techniques which will increase the likelihood of larval input and settlement to promote development of restored reefs	5.a. Quantify sustainable number of reefs and recruitment for the program of reefs restored and maintained in coastal Louisiana	5.a. Synthesize data and/or larval transport and recruitment modeling/ genetic studies, over spatial extent of constructed brood reefs and oyster cultch areas, to determine linkage between reefs and develop thresholds for sustainability	*Objective related to recruitment measured in density of oyster spat on DWH NRDA restored oyster reefs to be developed based on current MAM need and activity* **5.a.**
	6. Place restored reefs, potentially including non-harvestable reefs, across habitat gradients (tidal / subtidal; salinity; depth; onshore – offshore) in a manner informed by hydrodynamics to promote recruitment and connectivity between reefs	*Objective equivalent to SMART Objective* **3.c.**	*Objective equivalent to SMART Objective* **3.c.**	*Objective equivalent to SMART objective* **3.c.**
Oyster restoration contributes to estuarine habitat service functions (e.g., water quality, fish habitat, shoreline protection)	**7. Provide multi-dimensional habitat to support fish and invertebrate use of restored oyster reefs**	7.a. Compile existing equations from literature for use in quantifying filtration rates	7.a. Quantify filtration rates using existing equations from the literature based on oyster density salinity, and temperature	*Objective related to filtration rates of DWH NRDA restored oyster reefs to be developed based on current MAM need and activity* **7.a.**
		7.b. Assess feasibility of monitoring nekton status in restored reefs	7.b. Synthesize available data to document feasibility and/or plan and design monitoring for nekton abundance across DWH NRDA oyster restoration areas	*Objective related to nekton presence (abundance/ density) on DWH NRDA restored oyster reefs to be developed based on current MAM need and activity* **7.b.**

Table 6. Restoration Type SMART Objectives: Sea Turtles. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

SEA TURTLES High Level Objectives	Fundamental Objectives	MAM need to develop SMART Objectives	Suggested MAM activity to address MAM need	SMART Objectives
Reduce indirect threats to target species of sea turtles occurring in LA	**1. Restore and maintain forage and prey resources sufficient to support injured sea turtle species and life stages in LA waters**	1.a. Enhance understanding of sea turtle diets to inform indirect threat reduction to sea turtles in LA	1.a. Diets of sea turtles in LA are characterized (e.g., preferred prey, prey abundance, prey trends, etc.) using the integration of existing data and collection of additional relevant data to the extent possible across coastal Louisiana to inform development of LA TIG sea turtle restoration plan and SMART Objectives to evaluate potential restoration actions and feasibility to address threats affecting sea turtle prey Potential activities: Synthesize existing satellite and acoustic tracking data along with existing habitat data to identify potential locations where and when sea turtles may be feeding; identify data gaps and collect baseline data to characterize sea turtle diets	*Objective related to sea turtle prey availability to be developed based on current MAM need and activity* **1.a.** *and* **2.a.**
		1.b. Enhance understanding of habitat use by sea turtles in LA	1.b. Sea turtle temporal and seasonal distribution, relative abundance, primary habitat use, and key demographic parameters are determined to the extent possible across coastal Louisiana to inform development of LA TIG sea turtle restoration plan and SMART Objectives, and evaluate potential adaptive management and restoration actions and feasibility to reduce marine-based threats (e.g., timing, scale, locations, and prioritization of DWH NRDA restoration actions) Potential activities: Synthesize existing satellite and acoustic tracking data along with existing demographics, to the extent possible, and identify whether there are any data gaps in addressing this MAM need; collect baseline data on sea turtle habitat use and demographics	*Objective related to habitat use by sea turtles to be developed based on current MAM need and activity* **1.b.**
			1.c. Important habitats for sea turtle species in coastal Louisiana are better understood to inform development of LA TIG sea turtle restoration plan in order to support timely adaptive management and restoration planning to reduce marine-based threats (e.g., scale and locations of DWH NRDA restoration actions related to sea turtle habitat), and to inform development of SMART Objectives Potential activities: Analyze data from **1.b.** and supplement as necessary to document priority geographic areas and habitat use and foraging.	*Objective related to important habitats for sea turtles to be developed based on current MAM need and activity* **1.b.** *and* **1.d.**
			1.d. Characterize effects of marine habitat change (e,g. habitat loss and marine habitat restoration) to inform development of LA TIG sea turtle restoration plan in order to reduce construction impacts on identified sea turtle habitat and to improve timing, scale, locations, and prioritization of DWH NRDA restoration actions to restore sea turtles, and to inform development of SMART Objectives Potential activities: Analyze data from **1.b.** and project MAM activities to understand turtle response of non-turtle related restoration activities.	*Objective related to habitat change and impacts to sea turtles to be developed based on current MAM need and activity* **1.b.** *and* **1.d.**
Reduce direct sources of mortality to sea turtles occurring in LA	**2. Reduce sea turtle bycatch in recreational fisheries in LA waters**	2.a. Enhance understanding of mortality resulting from recreational bycatch to inform direct threat reduction to sea turtles in **1.b.**	2.a. Characterize and quantify bycatch of sea turtles in recreational fisheries to the extent possible in coastal Louisiana in order to develop restoration actions to reduce mortality and to inform development of SMART Objectives	*Objective related to sea turtle bycatch in recreational fisheries to be developed based on current MAM need and activity* **1.b.** *and* **2.a.**
	3. Reduce sea turtle bycatch in commercial fisheries in LA waters (e.g., fish trawl, shrimp trawl, pot/ trap, trot lines, purse seine)	3.a. Enhance understanding of mortality resulting from commercial bycatch to inform direct threat reduction to sea turtles in **1.b.**	3.a. Integrate existing data and collect additional relevant data to characterize and quantify bycatch of sea turtles in commercial fisheries (e.g., fish trawl, shrimp trawl, pot/trap, trot lines, purse seine) in coastal Louisiana in order to develop restoration actions to reduce mortality to the extent possible across coastal Louisiana to inform development of LA TIG sea turtle restoration plan and to inform development of SMART Objectives	*Objective related to sea turtle bycatch in commercial fisheries to be developed based on current MAM need and activity* **1.b.** *and* **3.a.**
	4. Reduce sea turtle mortality from vessel strikes	4.a. Enhance understanding of mortality resulting from vessel strikes to inform direct threat reduction to sea turtles in **1.b.**	4.a. Integrate existing data and collect additional relevant data to more accurately characterize sources, extent, and magnitude of vessel strikes to the extent possible across coastal Louisiana to inform development of LA TIG sea turtle restoration plan in order to develop restoration actions to reduce mortality and to inform development of SMART Objectives	*Objective related to threat of vessel strikes to sea turtles to be developed based on current MAM need and activity* **1.b.** *and* **4.a.**
	5. Reduce terrestrial threats (e.g., nest predation)	5.a. Enhance understanding of sea turtle nesting in Louisiana	5.a. Identify and characterize important nesting habitats for sea turtle species in coastal Louisiana to support timely adaptive management and restoration planning to reduce terrestrial-based threats (e.g., scale and locations of DWH NRDA restoration actions related to sea turtle habitat), and to inform development of SMART Objectives Potential activities: Utilize existing satellite and acoustic tracking data along with existing habitat data to identify potential locations where sea turtles may be nesting; collect baseline data on sea turtle nesting and conduct threats analysis on nesting sites.	*Objective related to sea turtle nesting to be developed based on current MAM need and activity* **1.b.** *and* **5.a.**

Table 7. Restoration Type SMART Objectives: Marine Mammals. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

MARINE MAMMALS High Level Objectives	Fundamental Objectives	MAM need to develop SMART Objectives	Suggested MAM activity to address MAM need	SMART Objectives
All DWH-injured bottlenose dolphin stocks are restored to a condition that is analogous to what they would have been but for the spill, to the extent possible	**1. Quantify and assess bottlenose dolphin stocks across LA basins and nearshore coastal waters**	1.a. Within 5 years design and implement a long-term (15 year) monitoring program in the nine stock areas of LA that capture stock status and trends (abundance/ density/ distribution/ population genetics/ fecundity/ survival/ health)	1.a. Monitor trends in bottlenose dolphin stock (stock status and trends [abundance/ density/ distribution/ population genetics/ fecundity/ survival/ health]) across coastal LA basins (nine stocks) over 5 years (beginning within one year of completing monitoring design) to establish a pre-restoration baseline and to develop restoration actions to reduce mortality	*Objective related to bottlenose dolphin stocks to be developed based on current MAM need and activity* **1.a.** *and informed by* **3.a.**
	2. Restore bottlenose dolphin populations state-wide, to the extent practical, resulting in a decreased number of years to recovery in stocks and/or a reduced number of lost dolphin years over time	*As in* **1.a.**	2.a. Within 5 years, based upon initial baseline sampling, design analysis and modeling approach to assess trends in bottlenose dolphin populations and stocks (nine) in LA over a 15 year period – *MAM activity to be developed based on completion of* **1.a.**	*Objective related to bottlenose dolphin stocks to be developed based on current MAM need and activity* **1.a.***, assessed using* **2.a.***, and informed by* **3.a.**
	3. Understand bottlenose dolphin utilization of foraging habitat (e.g., via restoration of barrier islands and marine SAV)	3.a. Develop and implement a plan to quantify bottlenose dolphin habitat use in LA	3.a. Quantify bottlenose dolphin abundance in key habitats and foraging effort during reproductive season (and/or high flow and low flow) for identified key habitats in each of the nine stock areas (twice per year) for a period of 5 years in LA	*Informs development of other SMART Objectives by identifying areas of highest priority, highest use, and seasonal distribution to identify appropriate spatial and temporal focus of restoration efforts (e.g., restoration of forage and prey resources) and to be able to assess restoration success*
		3.b. Develop and implement a plan to assess prey for bottlenose dolphins in key habitats (in each of nine stock areas) in LA	3.b. Within 5 years identify key prey items and assess the density, distribution, and essential habitat for these prey species and how these change with changes in habitat in each of the nine stock areas in LA	
		3.c. Design and implement a study on how prey species impact dolphin bioenergetics and the effect of prey availability on population-level metrics in each of nine stock areas in LA	3.c. Within 5 years quantify dolphin bioenergetics related to prey species and effect of prey availability on dolphin population-level metrics in key habitats in each of nine stock areas in LA	
Sources of mortality and morbidity are decreasing as a result of restoration (as determined by data collected or leveraged through NRDA restoration efforts)	**4. Decrease direct threats from vessel strikes, fishing (e.g., shrimp, menhaden, hook and line, gunshots, arrows), and indirect threats (e.g., habitat, changes in prey, contaminants, HABs)**	4.a. Synthesize available data (including NOAA stock assessment reports) and identify opportunities to quantify and monitor these threats in LA	4.a. Within 5 years, identify, characterize, and quantify magnitude to establish baselines (using available data) for the following threats: shrimp trawls (skimmer and otter), menhaden fishery, commercial hook and line, recreational hook and line, commercial trap/pot gear, intentional harm (e.g., gunshots, arrows), vessel strikes, and environmental stressors in LA	*Objective related to decreasing threats to bottlenose dolphin stocks to be developed based on current MAM need and activity* **4.a.** *and informed by* **3.a.**
	5. Document and investigate freshwater exposure effects, and apply the knowledge to decrease, mitigate, or treat future impacts to bottlenose dolphins	5.a. Develop and implement a plan for quantifying and better characterizing freshwater exposure and effects on bottlenose dolphins in the nine LA stock areas	5.a. Within 5 years, quantify and better characterize freshwater exposure and effects on bottlenose dolphins in the nine LA stock areas	*Objective related to freshwater exposure of bottlenose dolphin stocks to be developed based on current MAM need and activity* **5.a.** *and informed by* **3.a.**
	6. Characterize and decrease environmental contaminants and their cumulative effects	6.a. Develop and implement a common framework for assessing risk from environmental contaminants and apply it to the nine LA stock areas	6.a. Within five years, assess and characterize risk from contaminants (including through large weather or emergency events) in the nine LA stock areas	*Objective related to environmental contaminant risks to bottlenose dolphin stocks to be developed based on current MAM need and activity* **6.a.** *and informed by* **3.a.**
	7. Detect infectious and non-infectious sources of disease	7.a. Design and implement a study to assess risk to bottlenose dolphins of infectious and non-infectious diseases of concern in the nine stock areas in LA	7.a. Within 5 years, assess and characterize risk from infectious and non-infectious diseases of concern in the nine stock areas in LA	*Objective related to disease sources for bottlenose dolphin stocks to be developed based on current MAM need and activity* **7.a.**

Table 8. Restoration Type SMART Objectives: Birds. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

BIRDS				
High Level Objectives	**Fundamental Objectives**	**MAM need to develop SMART Objectives**	**Suggested MAM activity to address MAM need**	**SMART Objectives**
Restore, maintain, and enhance nesting/ foraging/ loafing/stop-over habitats	**1. Restore, maintain, and enhance nesting; foraging; loafing habitat to support shrub nesting birds, including sufficient elevation for supratidal habitat and vegetation above the intertidal zone**	**1.a.** Understand how to incorporate features into wetland, coastal, and nearshore habitat restoration project designs that will benefit a diversity of shrub nesting birds	**1.a.** Use the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019)	*Objective related to area of restored or enhanced habitat occupied by indicator shrub nesting birds to be developed based on current MAM need and activity* **1.a.**, **1.b.** *and other potential related data sources* *Objective related to diversity of shrub nesting birds to be developed based on current MAM need and activity* **1.a.** *and* **1.b.** *Objective related to trend in number of indicator shrub nesting birds to be developed based on current MAM need and activity* **1.b.** *and* **1.c.**
		1.b. Establish baselines for evaluating restoration in terms of abundance and diversity of shrub nesting birds	**1.b.** Synthesize monitoring data for indicator species across available data sets in Louisiana, preferably with data for years pre-spill with due respect to detection probability considerations **1.b.** Once the *Regionwide TIG Colonial Waterbird Monitoring* MAM project (NOAA Gulf Spill Restoration Tracker Project ID 257; also LA-2018-009; LA-2018-019) is complete, with data available from aerial surveys through 2021, use existing data to determine appropriate starting point for trend analyses of indicator species abundance (e.g., pre-spill or just after spill). If aerial surveys are not sufficient for all indicator species, consider information in the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019) along with existing data to determine best abundance metric	
		1.c. Consider additional means (e.g., potentially including, but not limited to correction factors) that compare single-survey nest count estimates from aerial surveys to other "ground truth" nest count data at monitored colonies in Louisiana where counts occur more frequently throughout a nesting season	**1.c.** Report on whether additional means (e.g. potentially including, but not limited to visibility correction factors) should be developed at the colony or species level to be used in correcting aerial survey nest counts	
	2. Restore, maintain, and enhance nesting; foraging; loafing habitat to support ground nesting birds, including sufficient elevation for supratidal habitat and vegetation above the intertidal zone	**2.a.** Understand how to incorporate features into wetland, coastal, and nearshore habitat restoration project designs that will benefit a diversity of ground nesting birds	**2.a.** Use the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019)	*Objective related to area of restored or enhanced habitat occupied by indicator ground nesting birds to be developed based on current MAM need and activity* **2.a.** *and* **2.b.** *Objective related to diversity of ground nesting birds expected to benefit from the habitats to be developed based on current MAM need and activity* **2.a.** *and* **2.b.** *Objective related to trend in number of indicator ground nesting birds to be developed based on current MAM need and activity* **2.b.**, **2.c.**
		2.b. Establish baselines for evaluating restoration in terms of abundance and diversity of ground nesting birds	**2.b.** Synthesize monitoring data for indicator species across available data sets in Louisiana, preferably with data for years pre-spill with due respect to detection probability considerations **2.b.** Once the *Regionwide TIG Colonial Waterbird Monitoring MAM* project (NOAA Gulf Spill Restoration Tracker Project ID 257; also LA-2018-009; LA-2018-019) is complete, with data available from aerial surveys through 2021, use existing data to determine appropriate starting point for trend analyses of indicator species abundance (e.g., pre-spill or just after spill). If aerial surveys are not sufficient for all indicator species, consider information in the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019) along with existing data to determine best abundance metric	
		2.c. Consider additional means (e.g., potentially including, but not limited to correction factors) that compare single-survey nest count estimates from aerial surveys to other "ground truth" nest count data at monitored colonies in Louisiana where counts occur more frequently throughout a nesting season	**2.c.** Report on whether additional means (e.g. potentially including, but not limited to visibility correction factors) should be developed at the colony or species level to be used in correcting aerial survey nest counts	
	3. Restore, maintain, and enhance tidal and supratidal marshes (saline, brackish, intermediate, and fresh) used by Mottled Ducks and other marsh nesting birds	**3.a.** Understand how to incorporate features into wetland, coastal, and nearshore habitat restoration project designs that will benefit Mottled Ducks and a diversity of marsh nesting birds	**3.a.** Use the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019	*Objective related to area of restored or enhanced habitat occupied by Mottled Ducks and indicator marsh nesting birds to be developed based on current MAM need and activity* **3.a.** *and* **3.b.** *Objective related to diversity of marsh nesting birds expected to benefit from the habitats to be developed based on current MAM need and activity* **3.a.**, **3.b.**, *and* **3.c.** *Objective related to trend in the number of Mottled Ducks and indicator marsh nesting birds to be developed based on current MAM need and activity* **3.b.**, **3.c.**
		3.b. Consider whether restoration progress should be accounted for separately by marsh type (such as defined by salinity or vegetation composition)	**3.b.** Use the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019) and results from the Louisiana Secretive Marsh Bird Habitat Relationships and Distributions in Selected Coastal Louisiana Marshes MAM Project (NOAA Gulf Spill Restoration Tracker Project ID 205; LA-2019-016)	
		3.c. Establish baselines for evaluating restoration, in terms of abundance and diversity for mottled ducks and other marsh nesting birds	**3.c.** Synthesize monitoring data for indicator species across available data sets in Louisiana, preferably with data for years pre-spill with due respect to detection probability considerations **3.c.** Use existing data, the *Avian Habitat Restoration and Monitoring Guidance Document* (NOAA Gulf Spill Restoration Tracker Project ID 248; LA-2020-019), and results from the *Louisiana Secretive Marsh Bird Habitat Relationships and Distributions in Selected Coastal Louisiana Marshes* MAM Project (NOAA Gulf Spill Restoration Tracker Project ID 205; LA-2019-016) to determine most appropriate abundance metrics, including use of habitat suitability or related models as appropriate, and determine starting point for trend analyses of indicator species abundance (e.g., pre-spill or just after spill)	

Table 9. Cross-Restoration Type SMART Objectives. This table also highlights the associated MAM needs and MAM activities nested under this Restoration Type's High Level and Fundamental Objectives.

CROSS RESTORATION TYPE High Level Objectives	Fundamental Objectives	MAM need to develop SMART Objectives	Suggested MAM activity to address MAM need	SMART Objectives
Contribute to maintaining and restoring ecosystem-scale condition and resilience at coastwide, basin, and sub-basin scales	**1. Maximize the combined benefits of the various Restoration Types and approaches across the overall restoration portfolio (PDARP Section 5.5.1)**	1.a. Evaluate the efficacy of various strategies in land creation/ restoration (diversions, marsh platform creations, barrier island restoration, ridge restoration)	1.a. Identify appropriate time scale for evaluating the significant change or trajectory (every 5 years or it may be on a longer time scale?)	*Objective on efficacy of land creation/restoration strategies to be developed based on current MAM need and activity* **1.a.**
		1.b. Quantify wetland net ecosystem carbon balance at pre-spill/post-spill time scales and basin/sub-basin spatial scales, including export to nearshore Gulf of Mexico	1.b. Within the next 5 years, targeted numerical modeling based upon available/ collected data to calculate carbon capture of flora, fauna, and soils, associated with restoration portfolio; synthesize as carbon budget and calculate carbon export to nearshore marine systems	*Objective related to coastal / basin carbon budget to be developed based on current MAM need and activity* **1.b.**
	2. Support injured species (trophic structure) via the estuarine food web structure (benthic and pelagic)	2.a. Assess whether the DWH NRDA restoration portfolio supports lower trophic level diversity, distribution, and productivity comparable to appropriate reference areas, when accounting for expected changes in environmental drivers (e.g., hydrology, water quality, conversion of shallow open water to wetlands)	2.a. Perform synthesis of available data and fill gaps with Lower Trophic Level/ benthic inventory and analyze samples to establish pre-restoration baseline conditions for potential long-term monitoring of pelagic and benthic lower trophic levels (e.g., amphipods, small clams, zooplankton) as a basis for identifying change	*Objective related to lower trophic level biota to be developed based on current MAM need and activity* **2.a.**
		2.b. Develop approach to analyze and synthesize food web characteristics, identify and characterize appropriate reference ecosystems/basins	2.b. Ecosystem modeling to evaluate ecosystem function and drivers, improving confidence in ecosystem model outputs and parameters, and quantifying/ modeling the contribution of transient/ estuarine- dependent species to offshore food webs (*in conjunction with Wetland, Coastal, and Nearshore Habitat Restoration Type objective* **7.b.**)	*Objective related to food web characteristics to be developed based on current MAM need and activity* **2.b.**
		2.c. Identify and develop approach to interpret and assess trophic linkages	2.c. Analysis of Ecosystem modeling (**2.b.**) to interpret and assess trophic linkages	*Objective related to trophic linkages to be developed based on current MAM need and activity* **2.c.**
	4. Provide for equivalent pre-spill baseline ecosystem communities and productivity	4.a. Develop approach to understand and assess how the DWH NRDA restoration portfolio can maximize support to ecosystem communities primary and secondary productivity	4.a. Synthesize available data from different restoration techniques to identify relative benefits to ecosystem communities and productivity (project size, tidal flow, balance of elevation/resilience vs habitat, marsh creation scale ratio of edge to interior, oyster reef placement)	*Objectives related to primary and secondary productivity to be developed based on current MAM need and activity* **4.a.**

2.2.2. Programmatic Adaptive Management Needs

The identified MAM needs, and suggested activities to meet them, outlined within the Restoration Type SMART Objectives and MAM needs tables (Table 2-Table 9) are primarily focused on the Monitoring aspect of MAM, to evaluate progress towards the identified restoration objectives, and will only indirectly support programmatic Adaptive Management. DWH NRDA has clear guidelines for MAM within individual restoration projects (DWH NRDA Trustees, 2017); the LA TIG MAM Strategy specifically includes actions that will support, facilitate, and accomplish programmatic Adaptive Management of DWH NRDA restoration in Louisiana (Table 10).

These programmatic objectives include ecosystem reporting and tracking of lessons learned as well as practical, accessible, and usable tools for capturing and accessing lessons learned. These Adaptive Management needs are not specifically targeted to a particular Restoration Type; however, they are important to ensure implementation of effective adaptive management to maximize the natural benefits from the collective restoration effort implemented through DWH NRDA by the LA TIG. These identified activities will also facilitate the synthesis and reporting that will be used to assess progress of the DWH NRDA restoration portfolio of projects towards the high-level goals established in the PDARP (DWH NRDA Trustees, 2016).

Table 10. Programmatic Adaptive Management Needs and Activities. The items in this table are not listed in order of priority. The "AM Framework Report" references are the numbered Key Findings documented in The Water Institute of the Gulf (2020) Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations.

LA TIG Programmatic MAM Needs	Possible Activities to address Programmatic MAM Need
1. DWH NRDA Lessons learned are systematically captured and incorporated into future project selection, design, implementation, and evaluation accessed by Trustees and available for use by planners/ engineers/ consultants for DWH NRDA in coastal Louisiana	• Develop and employ a process for identifying lessons learned from LA TIG restoration projects and rationale for operation and maintenance decisions to inform future planning and objective setting • Capture LA TIG restoration lessons learned (e.g., within DIVER or a database), where they can be accessed by project planners, implementers, and contractors • Evaluate former projects conducted under other programs, as needed, to apply lessons learned to DWH NRDA restoration planning (AM Framework Report #59)
2. Relative effectiveness of different restoration approaches are identified	• Develop best practice guidelines for restoring for injured resources and increasing habitat services in coastal Louisiana – *To be informed by Cross RT Table activity* **1.a.***; also, per Adaptive Management Framework Report recommendation 3.0*
3. Understand the influence that DWH NRDA restoration has on ecosystem condition of coastal Louisiana at present and for comparison at 5-year intervals	• Contribute to integrated coastal ecosystem condition reporting (assessment / report card that quantitatively synthesizes physical, ecological, social; at coastal basin level and coast-wide scales) in coastal Louisiana, focusing on assessing progress towards short- and long-term programmatic DWH NRDA goals and objectives – *To be informed by Cross RT Table activity* **1.a.***; also, per Adaptive Management Framework Report recommendation 3.0* • Expand model-based comparisons of predicted future condition in terms of DWH NRDA programmatic objectives and compare to observed data, adjusting as appropriate (AM Framework Report #23) • Contribute to regular evaluation and refinement of SWAMP monitoring purpose and design, with a focus on components of SWAMP that are utilized for LA TIG restoration planning, implementation, and monitoring and evaluation (AM Framework Report #19)
4. Data Management: increase access to and availability of collected data, monitoring, project documents, and lessons learned from LA TIG restoration projects and MAM activities	• Enable interoperability of CIMS, LDWF FIMP (and other datasets as necessary) and DIVER to facilitate transfer and synergies, while minimizing duplication of data access and utilization for restoration management, planning, and decision making (AM Framework Report 2.0) • Assist in aligning monitoring methodologies and core performance monitoring metrics amongst Louisiana data collection efforts (AM Framework Report #18) • Develop or refine LA TIG data management guidelines, including guidance on use of DIVER and CIMS for data associated with LA TIG restoration projects, and where possible, improve alignment between DIVER and CIMS guidelines and templates, including for data management plans, data repository reporting, storage protocols, metadata standards, and data discoverability (AM Framework Report #40, 45, 47,50,52) • Enable public access to numerical models and tools used by the LA TIG (AM Framework Report 7.0) (e.g., DIVER or an online model repository)
5. Increase communications about MAM within and across agencies, stakeholders, and the public to support effective adaptive management of coastal restoration in Louisiana, to increase public transparency, and to increase engagement with and understanding of LA TIG restoration efforts	• In coordination with the DWH NRDA communications team, develop communication approaches (e.g., outreach events, synthesis fact sheets) that increase effectiveness of dissemination of MAM information (AM Framework Report 6.0 and #91) • Engage the public in the development of an LA TIG MAM Outreach and Communications Plan (AM Framework Report #71) • Develop methods to measure the effectiveness of public outreach, communication, and stakeholder engagement (AM Framework Report #72) • Leverage opportunities for Trustee agencies to collect and utilize public data (AM Framework Report #73) • Coordinate a biannual LA Adaptive Management Implementation Working Group meeting to seek opportunities for knowledge transfer across agencies involved in Louisiana restoration (AM Framework Report #90)

2.3 STRATEGIC APPROACH FOR INTEGRATED AND SYNERGISTIC MAM SUPPORT

2.3.1. The Process for Addressing Identified MAM Needs and Reporting on SMART Objectives

High Level Objectives, Fundamental Objectives, SMART Objectives, MAM Needs to Develop SMART Objectives, and Suggested MAM Activities to address those MAM needs are summarized in Table 2-Table 9. In addition, Table 9 and Table 10 identify MAM needs to report on ecosystem scale condition and programmatic progress towards Fundamental Objectives. Many identified activities to meet MAM Needs within the Restoration Type SMART Objectives tables (See Section 2.1; Table 2-Table 9) are flexible in scope to allow for phasing of data collection and analysis so that results can be used to indicate whether subsequent data collection or analysis is needed.

LA TIG MAM Strategy is *consensus-based*

Trustee consensus SMART Objectives and MAM needs were generated through extensive engagement with 100+ Louisiana Trustee SMEs and managers nationwide in 175+ working sessions from 2018 through 2021.

There are three categories of data needed to develop SMART Objectives, report on ecosystem condition and progress toward attaining Fundamental Objectives for each Restoration Type as well as Cross Restoration Type Objectives and Programmatic Adaptive Management:

- **The first:** leverage ongoing foundational data collection programs that are conducted coastwide in Louisiana coordinated through the state's integrated System-Wide Analysis and Monitoring Program (SWAMP)
- **The second:** identify and compile data from multiple sources; this will often be opportunistic data collections and include some data being collected on projects that have previously been approved by the LA TIG through MAM
- **The third:** target additional data collection and monitoring to obtain baseline, population, and ecological process data that will build scientific understanding of specifically identified uncertainties and report on SMART Objectives where data are not available through other sources

Data availability to report on SMART Objectives varies greatly among Restoration Types. The state of Louisiana's integrated foundational monitoring program, SWAMP, has a primary focus as to the real extent and sustainability of coastal habitats and therefore much of these data exist to report on SMART Objectives for WCNH and Cross Restoration Types. However, for more specifically defined Restoration Types such as Birds, Marine Mammals, SAV, and Sea Turtles, there are some habitat data and isolated data sets, but it is recognized that the knowledge and data gaps are greater and will require additional targeted data collection to develop and report on SMART Objectives.

2.3.2. Details of Louisiana Foundational Data Collection Programs

In 2003, Louisiana commenced implementation of a coastwide integrated monitoring program to report on the effectiveness of the large increase in restoration effort due to implementation of the Coastal Wetlands Planning, Protection and Restoration Act (CWPRRA) of 1990. Over the past two decades, this has been coordinated with SWAMP, which is a coastwide foundational monitoring network for assessing ecosystem condition and restoration effectiveness at multiple spatial scales. SWAMP expands on and provides the overall framework for specific sub-programs such as the Coastal Reference Monitoring System (CRMS), the Barrier Island Comprehensive Monitoring program (BICM), the Fisheries-Independent Monitoring Program (FIMP), and supports the Barrier Island System Management (BISM). Except for FIMP, the data for those programs are stored and managed in the Coastal Information Management System (CIMS).

This comprehensive network of ongoing integrated coastal data collection spans the past two decades and provides a foundational framework and contextual data for assessing and reporting on the DWH NRDA restoration effort in the state of Louisiana. As such, the LA TIG can leverage and enhance Louisiana's systematic coastwide monitoring capabilities to successfully monitor and assess overall DWH NRDA programmatic restoration efforts at basin and coastwide spatial scales, as well as quantitatively report on progress towards restoration goals outlined in the PDARP. Continued support of these comprehensive, integrated, foundational programs will support partial (habitat-specific) reporting on progress towards the majority of developed SMART Objectives (Figure 6) and provide a process for strategic inclusion of additional resource knowledge and monitoring (e.g., coastwide colonial bird monitoring and marine mammal monitoring).

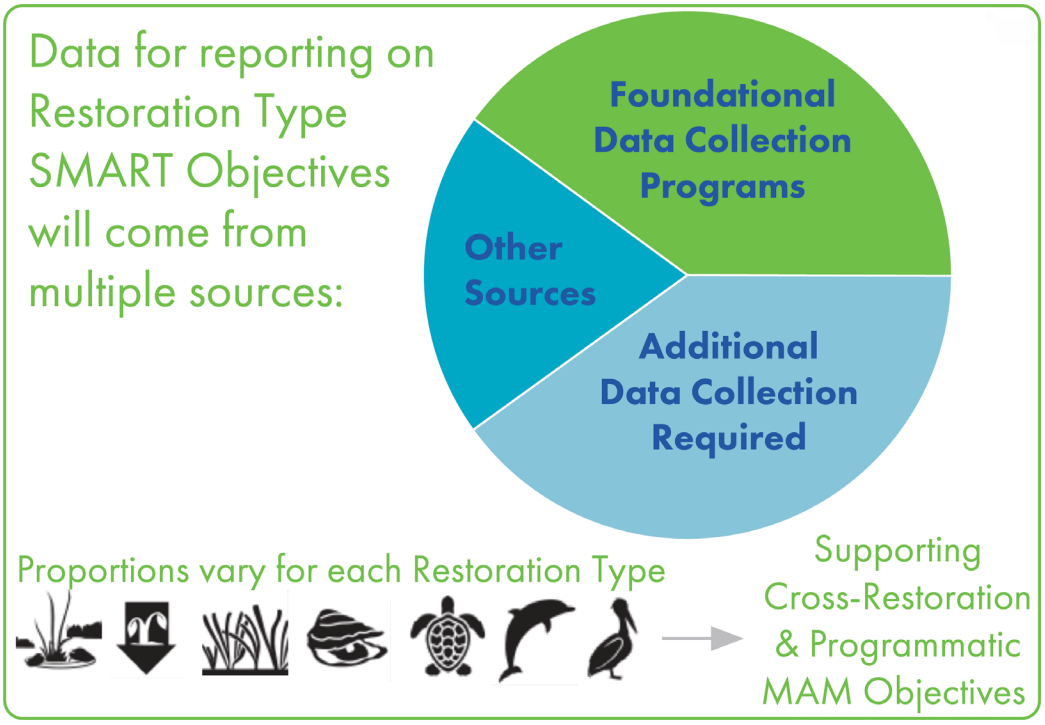

Figure 6. Assessing and reporting on the DWH NRDA restoration effort in Louisiana through SMART Objectives will depend on multiple sources of information. Foundational Data Collection Programs and Other Sources of data will be leveraged and enhanced. Collection of Additional Data will also be required to report on many objectives. These activities will support Cross-Restoration and Programmatic MAM Objectives.

These existing foundational data collection programs in Louisiana are based upon the CPRA goals and objectives that focus specifically on creation, maintenance, or restoration of habitat (geomorphological elements of the ecosystem) and primary biological structuring elements within those habitats (in particular, emergent vegetation). This aligns with the DWH NRDA goals to restore for injuries to coastal habitats and resources that use these habitats.

To address the DWH NRDA goals that are not adequately addressed by foundational data collection programs, including specific injured natural resources identified within the PDARP (e.g., birds, marine mammals, sea turtles, oysters, SAV), the LA TIG MAM Strategy includes targeted data collection or monitoring.

2.3.3. Strategy for Broad Categories of Activities to Meet LA TIG MAM Needs

As of August 2021, $23.5M of the $225M total LA TIG MAM funds have been committed for a range of activities (Table 1). The majority of the funds committed to date have been for foundational data collection programs (77%) to ensure continuity of data acquisition for these ongoing programs. Additionally, funding has been committed to support targeted data collection, monitoring, or analysis (14%), as well as support to programmatic adaptive management (9%). To meet the data and knowledge needs identified through the development of the SMART Objectives and Programmatic MAM tables (Table 2-Table 10), it is estimated based on existing MAM investments that roughly 60% of the uncommitted LA TIG MAM funds (total remaining $201.5M) will be spent on foundational data collection programs, 30% on targeted data collection, monitoring, or analysis, and 10% on programmatic adaptive management (Figure 7).

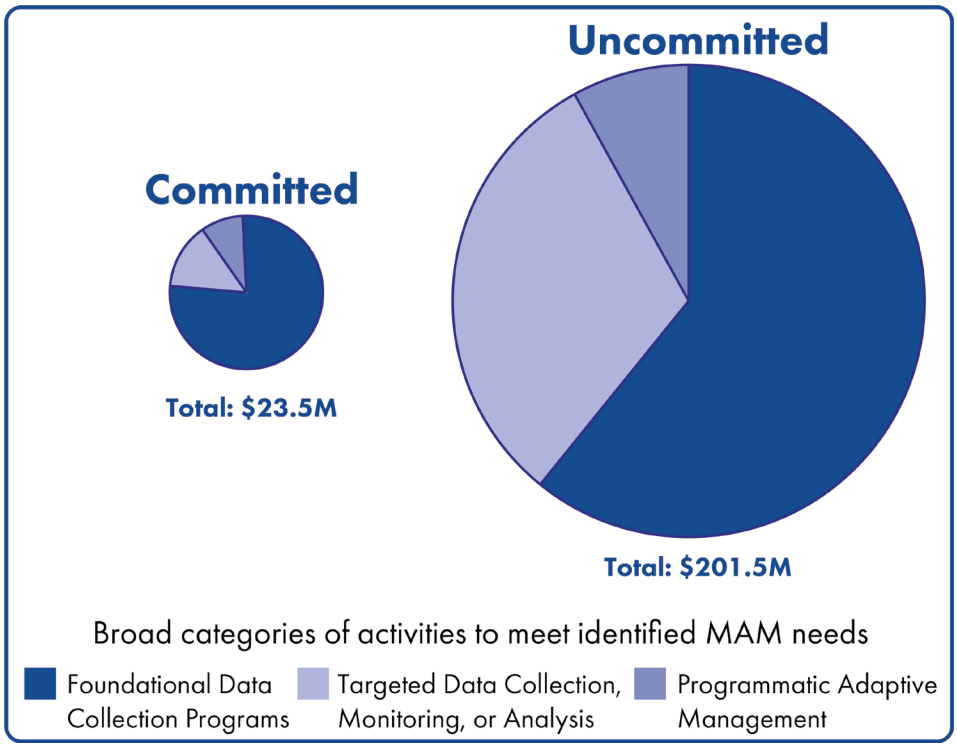

Figure 7. Proportional funding of broad categories of activities to meet identified MAM needs, both committed ($23.5 mil) and uncommitted ($201.5 mil). Committed funds to date have mostly supported Foundational Data Collection Programs, but it is anticipated that Targeted Data Collection, Monitoring, or Analysis will increase to fill specific data gaps for Louisiana Restoration Types to fully spend the $225M of LA TIG MAM funds.

2.3.4. Strategy for Flow of Funds to Meet LA TIG MAM Needs

Availability of LA TIG funds for MAM activities will likely vary across years and may be based upon projected needs within any given year. Therefore, MAM activities will need to be balanced with funds needed for project implementation and other funding needs of the LA TIG. The MAM need for fully developed SMART Objectives is to ensure that sufficient monitoring occurs to report on progress towards meeting the Objectives at appropriate spatial and temporal scales (Section 2.2.2). In all other cases, SMART Objectives can only be developed after targeted MAM needs have been met. Many, but not all, of those initial activities have been identified within Table 2-Table 9. To support full reporting on SMART Objectives, the activities to develop SMART Objectives should occur over the next five years (FY2022 – FY2026).

Flow of funds for Programmatic Adaptive Management Support is also anticipated to be higher in the near term (FY2022 – FY2026) to establish mechanisms that support successful adaptive management of the DWH NRDA restoration effort in Louisiana.

After extensive engagement with LA TIG SMEs in developing the LA TIG MAM Strategy, it was recognized that there are currently knowledge gaps in understanding the status and trends of key Restoration Types prioritized for funding in Louisiana through DWH NRDA. The LA TIG MAM Strategy is designed to fill as many of those knowledge gaps as feasible over the next five years so that the effectiveness of DWH NRDA restoration can be quantified (Figure 6). Key outcomes of this increased knowledge will be the identification of potential unknown conditions, clarity on what is still unknown or uncertain, and the establishment of plans to address those strategic gaps. The LA TIG MAM Strategy also recognizes that within the PDARP there is a provision made possible by up to an additional $700M allocation for "Unknown Conditions and Adaptive Management" to address these resource restoration needs. These "Unknown Conditions and Adaptive Management" funds, which may become available as early as FY2026 depending on the decision of the Trustee Council, will be governed by an Unknown Conditions and Adaptive Management TIG based on needs across all seven DWH Restoration Areas (DWH NRDA Trustees, 2016).

2.4 PROCESS FOR LA TIG APPROVAL OF MAM ACTIVITIES

If there is a clear process of coordination as MAM activities are considered and approved, it is more likely that the accumulated benefits from all actions undertaken by the LA TIG will be strategic, maximize the impact of MAM funds expenditure, and improve overall restoration success. This process includes recommending, planning, and tracking activities approved and implemented by the LA TIG MAM.

2.4.1. Proposed Cycle of Submission and Process for LA TIG MAM Activity Planning

The proposed cycle for planning and approval of LA TIG MAM activities is annual, based on the release of NRDA funds in April. There is intentional flexibility in this proposed cycle, e.g., to accommodate activities that have specific time constraints. In general, "Step 1 MAM Activity proposals" (see Section 2.4.2) should be submitted to the LA TIG MAM Small Working Group (SWG) from the lead agency and/or project proponent (see Section 2.4.3) no later than October 1st. Prior to this date each year the LA TIG will identify high priority MAM needs to address for the following year based on the Restoration Type, Cross Restoration Type, and Programmatic AM MAM needs identified (Table 2-Table 10) or other needs identified by the LA TIG Trustees. The LA TIG MAM SWG will then have October and November to review and prioritize the proposed activities, presenting the recommendations to the LA TIG prior to the end of November of the same calendar year. The LA TIG MAM SWG will then work with the Implementing Trustee from January through March to develop full draft MAM Activities Implementation Plans (MAIPs) for activities approved by the LA TIG to begin the following State's fiscal year. MAIPs can also be considered and approved for multiple-year funding. Full draft MAIPs will be presented to the LA TIG prior to the end of April, with revisions occurring through May and into June. Prior to the end of June, the LA TIG will approve the list of LA TIG MAM activities. This can include funding for multiple year proposals. Approved projects can then commence once funds are available within the new State fiscal year effective July 1st and before the beginning of the new federal fiscal year effective October 1st, for MAM activities led by one of the Federal Trustees (Figure 8).

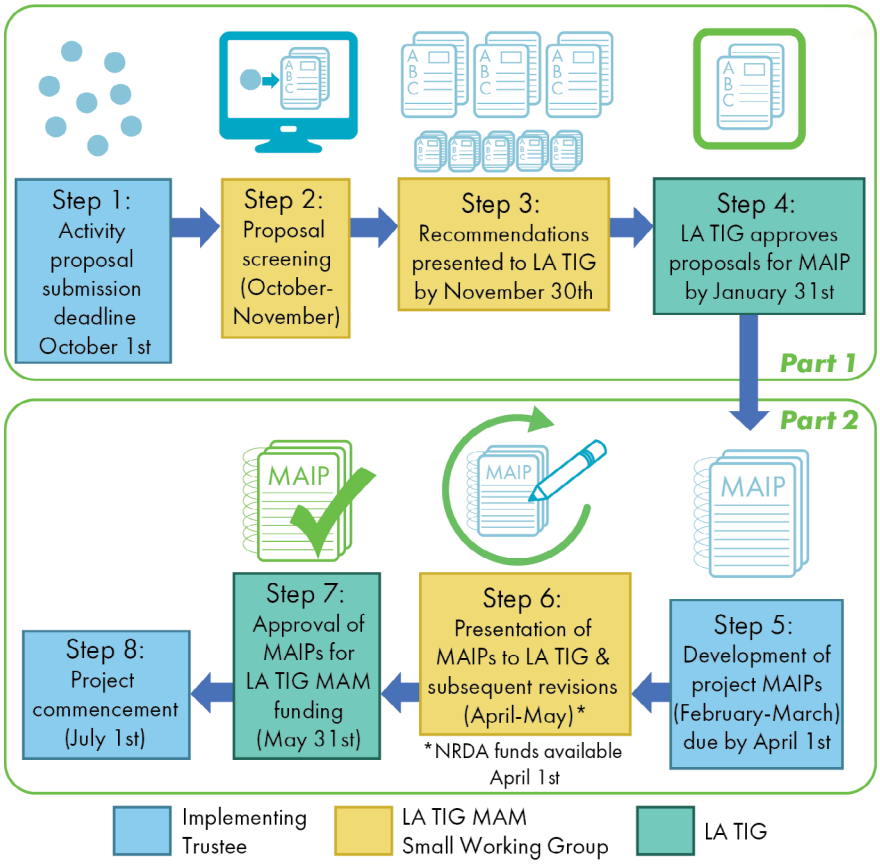

Figure 8. The LA TIG MAM activity planning process occurs in eight steps, starting from activity proposal submission in October to project commencement in July. Implementing Trustees, the LA TIG MAM Small Working Group, and the LA TIG play key roles throughout this process.

Key dates and steps:

- Step 1: Activity proposal submission deadline — October 1st
- Step 2: Proposal screening — October – November
- Step 3: Recommendations presented to LA TIG — November 30th
- Step 4: LA TIG approves proposals for MAIP — January 31st
- Step 5: Development of project MAIPs — February – March
    - MAIP submissions due — April 1st
- Step 6: Presentation of MAIPs to LA TIG & revisions — April – May
- Step 7: Approval of MAIPs for LA TIG MAM funding — May 31st
- Step 8: Project commencement (earliest) — July 1st

Having an annual cycle of proposed activities provides greatest opportunity for the LA TIG to be strategic and intentional in planning, prioritizing, and budgeting for LA TIG MAM activities. During this annual cycle and during the process of project screening, the LA TIG MAM SWG will carry out any updates or additions to the SMART Objectives tables, for example adding SMART Objectives that were finalized during the preceding year.

In some cases, urgent MAM needs may arise that do not coincide with this cycle. If the LA TIG decides that a screening proposal is warranted outside of this cycle, it would clarify the need and priority, as well as the availability of funds to progress the potential activity into a screening process and potentially a MAIP, out of cycle.

2.4.2. Submitting an LA TIG MAM Activity Proposal

A two-part approval process for MAM activities proposed to the LA TIG MAM allocation includes initial screening followed by a full MAIP submission for MAM activity proposals approved through initial screening. This process integrates with the cycle of submissions suggested above.

Part 1: Initial MAM Activity Proposal Screening (submission cycle steps 1-4)

The intention of this initial screening is to assess whether the LA TIG MAM allocation is the appropriate source of funding to support this activity based on whether the activity will support the LA TIG in achieving the restoration goals established in the PDARP/PEIS by either (A) developing or reporting on SMART Objectives to assess Restoration Type Fundamental Objectives and/or (B) implementing programmatic Adaptive Management. Wherever possible, synergies will be sought with the priorities of the LA Coastal Master Plan. The LA TIG will prioritize proposed MAM activities based on the following criteria (in no particular order):

- Relevance to DWH injured resources and coastal ecosystem in Louisiana (e.g., linkage to Objectives and MAM Needs identified in Table 2-Table 10)
- Importance for DWH restoration planning and implementation, considering the type, magnitude, and geographic distribution of restoration for injured resources and habitats
- Importance for programmatic evaluation of DWH restoration outcomes
- Importance for multiple Restoration Types
- Importance at the ecosystem level
- Feasibility of obtaining data of sufficient quality and timeliness to meet objectives
- Urgency of the MAM need
- Likelihood of success in meeting the MAM need

This screening process will help determine which projects proceed to Part 2 (below). The structure and indicative content of this screening submission is provided below. First, the lead Implementing Trustee seeking MAM funding through the LA TIG will submit a MAM activity proposal containing relevant information listed in Table 11 to the LA TIG MAM SWG. It is expected that activity submissions will be brief (maximum of four pages). The timing, submission mechanism and other details are described in Section 2.4.1. The LA TIG MAM SWG will then screen all activity submissions using the assessment criteria listed in Table 12. There are four possible recommendation outcomes from the initial activity screening:

a. Highly relevant and/or a priority for LA TIG MAM *and* urgent/time sensitive
   Outcome: Prioritize for LA TIG MAM approval; proceed directly to Part 2 (MAIP), as funding allows

b. Highly relevant and/or a priority for LA TIG MAM *but not* urgent/time sensitive
   Outcome: Prioritize for LA TIG MAM approval and schedule for implementation based upon activities timeline

c. Moderately relevant and/or moderate or low priority for LA TIG MAM *and not* urgent/time sensitive
   Outcome: Retain for future consideration, or if the relevance/urgency/priority changes based on new knowledge or unknown conditions, or revise to make it more relevant and resubmit, or combine with other activities

d. Not relevant and/or a priority for LA TIG MAM objectives – this includes activities that are more appropriate for project specific MAM funding or Restoration Type funding or for a different (i.e., non-NRDA) funding mechanism
   Outcome: Communicate that other funding mechanisms would be more appropriate for the activity

Table 11. MAM activity proposal (to be completed by lead Implementing Trustee seeking MAM funding through the LA TIG).

	Information	Explanation of Content	Activity Detail (*example*)
P1	**Project name**		*New monitoring metric*
P2	**Proposing agency**	**Lead TIG agency**	*AGENCY*
P3	**Project cost**	**Round to $100K**	*$500K*
P4	**Other funding sources**	**Potential opportunities and/or leveraging**	*Data reflect strong linkages to cross-TIG*
P5	**Project duration**	**Years**	*2.5 years*
P6	**Type of project**	**Foundational Activity, Targeted data collection, monitoring, or analysis, Programmatic MAM**	*Additional Monitoring - Analysis*
P7	**Restoration Type addressed**	**Name** **Name**	*WCNH* *Cross Restoration Type*
P8	**Fundamental Objective addressed**	**# Title** **# Title**	*WCNH Objective 2* *CRT Objective 3*
P9	**MAM SMART Objectives addressed**	**1. Develop (and/or)** **2. Report on (or)** **3. Neither**	*Develop*
P10	**What are specific actions?**	**3-5 Bullet points of what the project will do and high level method and/or design**	*-Baseline sample across Louisiana basins* *-Establish coastwide monitoring plan*
P11	**Partners included to complete the work**	**List partners (federal and subcontracts - % of total effort completed by each)**	*FED 20% (administration),* *STATE 20% (data management),* *Contractor X 40%, Contractor (unknown)20% (field work)*
P12	**Potential challenges**	**Are there potential challenges in collecting the data and/or contingency plans in the event of hurricanes or other intrinsic/ extrinsic factors?**	*Sampling not relevant in very high flow year, in that case the sampling would be extended for an additional 12 months*
P13	**Outputs**	**Data sets or reports or analyses**	*-Monitoring data (baseline data)* *-Coastwide monitoring plan*
P14	**Intended outcomes**	**What will change, how will the information be used, which decisions will use this knowledge etc.**	*Fill current knowledge gap in WCNH and support reporting on SMART Objectives and project prioritization*
P15	**Additional information that relevant (specific need, time sensitivity, strategic opportunity):** *This project must be completed by 202X to address X knowledge gap*		

Table 12. Screening assessment for proposed LA TIG MAM activities, to be completed by the LA TIG MAM Small Working Group.

	Assessment Criteria	Explanation of Content	Detail for individual project being assessed (*example*)
A1	**Assigned proposal code**	**Proposal code for internal use by LA TIG MAM review team (i.e., prior to a DIVER assigned project code)**	*MAM_PROPOSAL_1*
A2	**Is activity aligned with DWH injured resources in Louisiana – will multiple Restoration Types benefit? How?**	**Review Fundamental Objectives addressed and support to High Level Objectives; list injured resources and Restoration Types that will benefit**	*This activity supports reporting on four Fundamental Objectives in three Restoration Types as well as the full development of two SMART Objectives. Informs x and y injured resources*
A3	**Is timing aligned with known restoration planning need (e.g., needed for planning projects for upcoming Restoration Plan); why?**	**Imminent RP vs future RP, or ongoing or imminent project design or implementation**	*Urgent, data needed to inform RPx being developed over next 12 months*
A4	**Imminent RP vs future RP, or ongoing or imminent restoration planning for one or more Restoration Types**	**Urgent, data needed to inform Restoration Plan being developed over next 12 months**	*Projects x, y in RPx are focused on the geography of this prosed activity*
A5	**Is geography aligned with restoration actions? Which ones?**	**Restoration plans or projects that need this output in the geography, spatial scales proposed**	*Projects x, y in Restoration Plan RPx are focused on the geography of this proposed activity*
A6	**Does the activity have importance at the ecosystem level?**	**What ecosystem components and scales and/or processes will be better understood and/or reported on by this activity?**	*This activity will report on the entire Basin x and data on this ecosystem component will improve modeling of process y to inform Restoration Plan development*
A7	**Potential challenges**	**Has the proponent accounted for potential challenges in collecting the data and/or continency plans in the event of hurricanes or other intrinsic/ extrinsic factors?**	*An excessively wet year would limit variation in metric and reduce utility of results, the proposal includes multiple potential timelines to accommodate this situation*
A8	**Is the method and design appropriate to answer the question raised?**	**Is the method and/or design appropriate (at a high level) for the question being addressed?**	*Methodology known and tested but needs broader implementation to inform restoration planning*
A9	**Does the project budget appropriately match the scale of the outputs for the type of work proposed? Why?**	**Considerations of benefits relative to cost, in recognition of the type of work required and the value of the output/data to the LA TIG**	*These data are costly to obtain, however will fill a substantive and long identified knowledge gap to support restoration planning*
A10	**Assessment**	**Methodology known and tested but needs broader implementation to inform restoration planning**	*A (highly relevant and urgent)*
A11	**Recommendation**	**Rank:** **- A (proceed to full MAIP);** **- B (schedule for future LA TIG MAM funding);** **- C (retain for future consideration or resubmission with alterations);** **- D (recommend other funding sources are most appropriate)**	*A (proceed to full MAIP)*
A12	**Additional comments, justifications, or caveats, from the reviewer:**		
	This project meets a knowledge gap that is well established in the literature and will support implementation of marsh creation projects		

With activity screening, the LA TIG MAM SWG would provide a summary of the project screening to the LA TIG for final decision on proposed projects that should proceed to full MAIP (Table 13). This summary would include all submitted MAM activity proposals even if not selected to proceed to full MAIP during a given cycle.

Table 13. Example summary table to be presented to the LA TIG for final decision on proposed projects that should proceed to a full MAIP.

Project Name	Project Code	Recommendation	Proposing Agency	Project Cost	Project Duration	Project Type	Additional Comments
New monitoring metric	*MAM PROPOSAL 1*	*Proceed to MAIP*	*AGENCY*	*$500K*	*2.5 years*	*Additional Monitoring or Analysis*	*This is an example*
-	-	*Proceed to MAIP*	-	-	-	-	-
-	-	*Proceed to MAIP*	-	-	-	-	-
-	-	*Schedule for future LA TIG MAM funding*	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	*Retain for future consideration or resubmission with alterations or in combination with another activity*	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	*Other funding sources are most appropriate*	-	-	-	-	-
-	-	-	-	-	-	-	-

Part 2: MAIP (submission cycle step 5-8)

Activities/projects that are approved through Part 1 proceed to the development of a full MAIP. The development of the MAIP is likely to be led by the LA TIG MAM SWG POC from the Implementing Trustee. A major benefit of this two-part process is that all Trustees will be aware of activities being proposed, and so will have the opportunity to engage early in the development of the MAIP when the activity is relevant to multiple agencies. This will increase efficiency in MAIP development and review as well as maximize synergy between activities and maximize outcomes from LA TIG MAM funding. Even though a MAM activity may be selected to proceed at this point, the scale, scope, timing, and potentially phasing of the project will be clarified through discussion of project details in development of the MAIP. Suggested information to be required for MAIPs is given in Table 14 and is based on previously developed MAIPs (Unpublished Document; example). It is likely that the activity proponent will be requested to develop MAIP sections 1, 2, 3 initially and only develop sections 5 and 6 once the details of the sampling or activity have been clarified. Sections 4 and 5 of the MAIP are broadly covered in Part 1; it is anticipated that within Part 2 this will be primarily for the purposes of clarity and record. It is anticipated that the full MAIP will be around 12 pages in length for most projects.

Table 14. Required information to be provided in approval Part 2: the MAIP for proposed LA TIG MAM activities. Letter codes refer to proposal and assessment information: P#-Proposal Table 11; A# Assessment Table 12.

Section	Content
1	**Introduction**
2	**Document Purpose**
3	**MAM Activity Overview: [Title] (P1)** **a. Activity Description (P15, P6, P7; A12)** **b. Background (A3, A4; A6)** **c. Objectives (P14)** **d. Tasks (P10)** **e. Activity Implementation Description (A7, A8)** **f. Phase 1…** **g. Phase 2….** **h. Budget (P3; A9)** **i. Timeline (P5; A3)** **j. Implementation Roles (P2, P11; A13)** **k. Data Management and Reporting** **TIG MAM Strategy Goals Addressed by this MAM Activity (P7, P8, P9; A2, A5, A6)**
4	**Consistency of MAM Activity with the PDARP/PEIS (P7, P8, P9; A2, A5, A6)**
5	**National Environmental Policy Act (NEPA) Review** **a. NEPA Review of MAM Activity: Title** **b. NEPA Conclusion**
6	**Compliance with Environmental Laws and Regulations**
7	**References**

2.4.3. LA TIG MAM SWG

There is currently an ad-hoc LA TIG MAM SWG, with representation from all Louisiana Trustees, that is convened on an "as needed" basis. One of the Key Findings of the "Louisiana Adaptive Management Status and Improvement Report: Vision and Recommendations" was to formalize the role and responsibilities of the currently ad-hoc LA TIG MAM SWG (The Water Institute of the Gulf, 2020). The LA TIG MAM SWG will support the LA TIG in planning, tracking, and implementation of MAM activities and provide a practical and efficient approach to ensure consistency in review and prioritization of proposed LA TIG MAM activities. It is anticipated that some tasks would also require targeted input from SMEs within Trustee agencies and/or reach back for preliminary input within the agency, prior to the LA TIG MAM SWG presenting recommendations to the LA TIG for approval.

Suggested roles and responsibilities for the LA TIG MAM SWG:

1. Review LA TIG MAM activity screening proposals, providing recommendations to the LA TIG for final decision on an annual list of activities to proceed to a MAIP
2. Provide support as requested to the Implementing Trustee in the development and revision of the MAIP, coordinating input from agency SMEs and higher-level reach back in agency as appropriate
3. Coordinate/collate MAIPs in each round of submission for presentation to the LA TIG

4. Guide the Programmatic Adaptive Management activities – Table 10 (with assistance of contractors and cooperators as needed)
5. Coordinate brief updates, by Implementing Trustees, on LA TIG MAM activities, funding, and MAIP progress as a regular standing agenda item to the LA TIG meeting
6. Identify and/or work with agency relevant SMEs to ensure successful and timely implementation of LA TIG MAM activities
7. Serve as the primary Point of Contact for LA TIG MAM activities that require Louisiana Trustee input or review in the development of activity outputs
8. Coordinate public reporting related to LA TIG MAM activities, including publishing web stories, reviewing annual reports for MAM activities, and contributing information on MAM activities for TIG and Trustee Council annual public meetings and to support Trustee Council program reviews
9. Oversee development of appropriate data management approaches for LA TIG restoration projects and MAM activities

3 PROCESS FOR SHARING INFORMATION ABOUT LA TIG MAM ACTIVITIES

3.1 METHODS FOR RELEASING MAM ACTIVITIES

Once the LA TIG has approved MAM activities information on the activities will be released to the public. The types of information to be provided will include, as appropriate, a description of the MAM activity being proposed (e.g., objectives, tasks, methods, anticipated information to be acquired, timeline, and summary budget information), an overview of the approach to data management and reporting, any environmental compliance considerations, and other relevant information. This information may be released to the stakeholders through a variety of mechanisms, such as: (1) A MAM Activities Implementation Plan for Louisiana available on the USDOI Administrative Record; (2) a web story on the Gulf Spill Restoration site; and/or (3) project information maintained on the DIVER restoration portal.

The Implementing Trustee releases a final report for each completed MAM Activity. Finally, the Trustees provide an annual update of every approved project (e.g., MAM Activities and Restoration Projects) in DIVER, where all documents, data, and reports are uploaded, linked from the USDOI Administrative Record, and/or refer to CIMS.

3.2 INFORMING STAKEHOLDERS ABOUT PROGRESS OF MAM ACTIVITIES

The LA TIG will inform the stakeholders about MAM activities being implemented in Louisiana. Potential methods of communication include, but are not limited to:

- Providing updates at the Trustee Council annual meeting
- Providing updates during the LA TIG annual meeting
- Providing project information in the DIVER platform and/or the CPRA Coastal Information Management System (CIMS) platform
- Providing updates in the Trustee Council annual report
- Contribute to the Trustee Council's 5-year Program Reviews
- Highlighting accomplishments in a webstory and/or e-mail blast (e.g., when a LA MAM activity is approved)

Posting LA MAM-related documents (e.g., LA MAM Activities Implementation Plan, restoration plans) to the Gulf Spill Restoration website (https://www.gulfspillrestoration.noaa.gov/) and Administrative Record (https://www.doi.gov/deepwaterhorizon/adminrecord).

4 COORDINATION ON MAM NEEDS WITH OTHER RESTORATION PROGRAMS

4.1 COORDINATION WITH OTHER TIGS

Other than SAV, each of the Restoration Types in the Louisiana Restoration Area also has funding available in other Restoration Areas. In addition, MAM efforts are being coordinated by each TIG as well as across TIGs by the Trustees and through the Cross-TIG MAM work group. Thus, the LA TIG will coordinate with the other TIGs and the Cross-TIG MAM work group on MAM needs and activities where appropriate. This may include coordinating on:

- Monitoring efforts for LA TIG Restoration Types that cross TIG boundaries
- Opportunities to fill data gaps for shared Restoration Types that would improve the Trustees' collective efforts to prioritize restoration and evaluate progress toward restoration goals
- Monitoring and other activities to support the identification of outcomes from LA TIG restoration projects that contribute to resource, cross-resource, and ecosystem benefits across Restoration Areas
- Monitoring and other activities to support the identification of outcomes of other TIG projects that affect LA TIG resources
- Ensure MAM activities are compatibility with the Trustee Council's SOP and MAM Manual
- Communicate priorities and MAM activities to the Cross-TIG MAM work group (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees 2021)

4.2 COORDINATION WITH SCIENCE PROGRAMS AND OTHER RESTORATION PROGRAMS

As the Trustees noted in the PDARP/PEIS (DWH NRDA Trustees, 2016), the DWH NRDA restoration effort is being conducted within a matrix of other restoration and science efforts and programs across the Gulf of Mexico, both originating from and unrelated to the DWH incident (Appendix 5.E of PDARP/PEIS; DWH NRDA Trustees, 2016). Within Louisiana, a major program for coordination of coastal restoration is the CPRA led LA Coastal Master Plan that was in place prior to DWH and will continue after all NRDA related restoration has been implemented. In addition, many relevant science and other technical datasets, research results, models, and decision-support tools are available to support restoration planning, implementation, and/or evaluation. Recognizing this, the Trustees are committed to leverage existing work, when possible, to address priority uncertainties and conduct monitoring and scientific support activities efficiently (Appendix 5.E of PDARP/PEIS; DWH NRDA Trustees, 2016). The Trustees are also committed to maintaining coordination with the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Council and other appropriate programs and/or partners in the Gulf of Mexico (e.g., National Oceanic and Atmospheric Administration's RESTORE Science Program, RESTORE Centers of Excellence, National Academies of Sciences' Gulf Research Program) throughout the restoration process in order to identify synergies across programs and ensure efficiencies are realized (Appendix 5.E of PDARP/PEIS; DWH NRDA Trustees, 2016).

Consistent with the PDARP/PEIS, the LA TIG will coordinate with potential partners for implementing MAM activities and other restoration and science efforts or programs that could include, but are not limited to:

- Communicating MAM priorities and identified critical information gaps to applicable science programs
- Engaging with other restoration programs participating in research, restoration, and/or management of Louisiana's resources to determine whether they are collecting or plan to conduct activities that may meet LA TIG MAM needs or priorities
- Exploring opportunities to coordinate or partner with existing programs to obtain data needed to support restoration of Louisiana's resources and/or evaluation of Louisiana restoration

The LA TIG also recognizes that the best available science for planning restoration activities will evolve as the amount of information from the DWH NRDA restoration effort, as well as other science, monitoring, and restoration programs in the Gulf of Mexico, continues to grow. Thus, the LA TIG will seek to leverage newly available scientific knowledge in the identification of MAM priorities and activities. The LA TIG may engage with relevant SMEs and targeted stakeholders (e.g., NGOs) for specific Restoration Types, as well as for cross-resource and ecosystem level issues as appropriate, to obtain relevant information regarding MAM priorities or activities. This could include coordinating with SMEs and stakeholders to:

- Help identify MAM needs and provide input on future MAM priorities
- Provide technical input on potential future MAM activities
- Provide input on the best approaches for collecting data to address future MAM priorities

4.3 NEXT STEPS

The first cycle of activity screening will commence in October 2021 and be annual thereafter, following the process outlined within the LA TIG MAM Strategy.

The LA TIG MAM Strategy is a "living document" with specific provisions for further development and refinement of the SMART Objectives for each Restoration Type, identified MAM needs, and activities to address those MAM needs. The LA TIG may request the LA TIG MAM SWG to update or revise details within the LA TIG MAM Strategy at any time.

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KEY TERMS AND DEFINITIONS

The LA TIG MAM Strategy describes Monitoring and Adaptive Management (MAM)-related processes, procedures, and guidelines that are relevant to the Deepwater Horizon (DWH) oil spill Natural Resource Damage Assessment (NRDA) restoration effort in Louisiana. To provide clarity and avoid confusion, definitions are provided below for key terms that are used throughout the LA TIG MAM Strategy. Where possible, these definitions were drawn from the DWH NRDA Trustees' MAM Procedures and Guidelines Manual (MAM Manual; DWH NRDA Trustees 2017) and/or the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; DWH NRDA Trustees, 2016).

BICM (Barrier Island Comprehensive Monitoring): Using both historical and current data collections, BICM assesses and monitors changes in the aerial and subaqueous extent of barrier islands and shorelines in Louisiana and is critical to informing the BISM program (below). BICM commenced in 2006; phase one and phase two of this program are complete and were funded by Louisiana state and the National Fish and Wildlife Foundation (NFWF) respectively. Data includes habitat types, sediment texture, geotechnical properties, environmental processes, and vegetation composition. Aerial still and video photography are used for documenting shoreline changes, habitat mapping, land change analyses, topographic (light detection and ranging [LiDAR]) surveying for elevation determination, bathymetric surveying, and sediment sampling.

BISM (Louisiana Barrier Island System Management): Initially funded by NFWF, the BISM program enables restoration projects to be integrated components of a long-term, system-wide, and holistic regional sediment management (RSM) approach that supports increased restoration project longevity and a more sustainable barrier island system. In addition, BISM utilizes adaptive management principles to minimize costs and maximize benefits while achieving barrier island restoration targets.

CIMS (Coastal Information Management System for Data Storage, Management, Delivery): CIMS provides a suite of tools to access geospatial, tabular databases, and documents to CPRA's suite of protection and restoration efforts, including project specific information, the 2017 Coastal Master Plan, coastal community resiliency information, and SWAMP datasets. Standard protocols for data acquisition (collection and processing), quality assurance, and quality control are outlined to ensure data quality prior to incorporation in the CIMS database. Restoration projects that are not associated with DWH NRDA have alternate sources of funding data and information support by CIMS.

Cross-TIG MAM work group: The Cross-Trustee Implementation Group (TIG) MAM work group was established by the Trustee Council to serve as a forum for the TIGs to collectively address MAM topics relevant to multiple TIGs. The Cross-TIG MAM work group has no independent authority to act except when directed by the Trustee Council. See the Trustee Council's Standard Operating Procedures for more information (DWH NRDA Trustees, 2021).

CRMS (Coastwide Reference Monitoring System): Originally developed to characterize coastal Louisiana wetlands by the CWPPRA Task Force, CRMS has been used by other programs, including NRDA, to evaluate change in Louisiana's coastal ecosystems. Data collection focuses on hydrology, vegetation, surface elevation dynamics, soil properties, and land/water configuration. The network includes 390 sites across coastal Louisiana that encompass the range of ecological conditions and habitat types where restoration actions are considered. Trajectories of reference sites are compared with project site data to assess attainment of restoration objectives by individual projects in reference to the wider system.

FIMP (Louisiana Fisheries Independent Monitoring Program): FIMP (Louisiana Fisheries Independent Monitoring Program): The FIMP is a comprehensive fish and shellfish monitoring program using multiple gear types, coordinated by LDWF. The coastwide FIMP Program began in 1967 and is used to track the relative abundance, status and trends, species composition and size distribution of key fish and shellfish within Louisiana's five coastal basins.

Implementing Trustee: The Implementing Trustee is the Trustee Agency designated by the TIG that is responsible for leading a specific restoration project or MAM activity.

Louisiana Restoration Area: The Louisiana Restoration Area includes all geographic areas where restoration projects may be implemented to restore resources in Louisiana, including restoring these species throughout their life stages and geographic ranges.

Louisiana Trustee Implementation Group (LA TIG): The LA TIG comprises the state of Louisiana Trustee and four federal Trustees that are responsible for planning, implementing, and evaluating restoration for Louisiana Restoration Types. The state of Louisiana Trustee is led by the Coastal Protection and Restoration Authority (CPRA) and federal Trustees are the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of the Interior (USDOI), the U.S. Department of Agriculture (USDA), and the U.S. Environmental Protection Agency (USEPA).

MAM Activities: MAM activities are actions taken (e.g., monitoring, modeling, data collection, synthesis, targeted investigations) to reduce uncertainty or otherwise fulfill MAM needs and priorities. MAM activities are funded through MAM allocation. The LA TIG may allocate MAM funds for MAM-related operational activities of the TIG in Louisiana.

MAM Activities Implementation Plan (MAIP): A MAM Activities Implementation Plan (MAIP) is a document that details the actions to be taken to obtain information identified as MAM priorities.

MAM Framework: The MAM framework is the iterative process the Trustees outlined in Chapter 5 of the PDARP/PEIS (DWH NRDA Trustees, 2016) to measure the effectiveness of restoration and support restoration decision-making.

MAM Manual: The MAM Manual is a document developed by the Cross-TIG MAM work group that presents details on MAM procedures and guidelines applicable to all TIGs (DWH NRDA Trustees, 2017).

MAM Needs: MAM needs are knowledge gaps or information needs that, if addressed, may help the Trustees successfully plan, implement, and/or evaluate Gulf restoration. MAM needs may be identified at any scale or at any time, including at a project concept or restoration-technique level, a single Restoration Area or multiple Restoration Areas, a single Restoration Type or multiple Restoration Types ("cross-resource"), at the ecosystem level, and/or for programmatic management.

MAM Priorities: MAM priorities are the subset of knowledge gaps or information needs identified by the LA TIG as being of highest importance to accomplish in order to plan, implement, or evaluate Gulf restoration. MAM priorities may be identified at any scale or at any time, including at a project concept or restoration-technique level, a single Restoration Area or multiple Restoration Areas, a single Restoration Type or multiple Restoration Types ("cross-resource"), at the ecosystem level, and/or for programmatic management.

NRDA Programmatic Trustee Goals: The Trustees' goals for DWH NRDA restoration planning are specified in Chapter 5, section 5.3.1, of the PDARP/PEIS (DWH NRDA Trustees, 2016). These goals are placed at the highest level to guide restoration activities across a range of habitats, resources, and services injured by the spill; these goals acknowledge the interconnected ecosystems of the Gulf Coast as well as connections to human uses. The goals defined by Restoration Type directly link to the following goals: 1) Restore and Conserve Habitat; 2) Restore Water Quality; 3) Replenish and Protect Living Coastal and Marine Resources; 4) Provide and Enhance Recreational Opportunities; 5) Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation. The fifth goal supports each Restoration Type and informs overall decision-making within the adaptive management framework

Restoration Areas: Restoration Areas are geographic areas identified in the Consent Decree[2] for the 2016 DWH oil spill settlement to which the NRDA funding is allocated. There are seven Restoration Areas, including each of the five Gulf States, Region-wide, and Open Ocean (Sections 5.10.2 and 7.2 of PDARP/PEIS; DWH NRDA Trustees, 2016). An eighth Restoration Area focused on Unknown Conditions and Adaptive Management will be established by the Trustees 10–15 years following the 2016 settlement (Sections 5.10.2 and 7.2 of PDARP/PEIS; DWH NRDA Trustees, 2016).
Restoration Types – Restoration Types are the broad restoration categories the Trustees identified pertaining to the programmatic goals described in the PDARP/PEIS (DWH NRDA Trustees, 2016). These Restoration Types were identified based on the Trustees' understanding of 1) the injuries incurred by the DWH spill, and 2) the ecosystem setting of the northern Gulf of Mexico. The defined Restoration Types are nested within the high level NRDA Programmatic Trustee Goals as outlined in section 5.4.5 of the PDARP/PEIS. Within the Louisiana Restoration Area, the Trustees identified 9 Restoration Types: WCNH; Habitat Projects on Federally Managed Lands; Nutrient Reduction; Sea Turtles; Submerged Aquatic Vegetation; Marine Mammals; Birds; Oysters; and Provide and Enhance Recreational Opportunities (Chapter 5 of PDARP/PEIS; DWH NRDA Trustees, 2016).

Restoration Portfolio: The concept of a Restoration Portfolio is defined in Chapter 5, section 5.1, of the PDARP/PEIS (DWH NRDA Trustees, 2016) and is used in defining many of the Restoration Type goals. A portfolio approach involves utilizing a range of restoration approaches across a broad spatial extent such that benefits of restoration activities can maximize ecological benefits and reduce potential risks.

SWAMP (System-Wide Assessment and Monitoring Program): SWAMP expands on, and provides the overall framework for, specific sub-programs such as CRMS, BICM, and FIMP; supports BISM; and stores and manages data in CIMS. The monitoring variables and objectives of SWAMP characterize and track the physical and ecological systems in coastal Louisiana to support understanding and assessment of trends and distributions of habitat types, as well as floral natural resources and nekton. The data broadly include weather and climate, biotic integrity, water quality, hydrology, physical terrain, population and demographics, housing and community characteristics, economy and employment, ecosystem dependency, residential properties protection, and critical infrastructure and essential services protection. Integration of sampling location and replication was designed with a rigorous statistical analysis, examination of modeling needs, and thorough reviews of previous planning and monitoring efforts.

Trustee Implementation Group (TIGs): TIGs are the decision-making bodies the Trustees established for the purposes of planning, administering, implementing, and evaluating restoration within their Restoration Area. There are currently seven active TIGs, one for each Restoration Area, as follows: Alabama, Florida, Louisiana, Mississippi, Texas, Region-wide, and Open Ocean. An eighth TIG, the Unknown Conditions and Adaptive Management TIG, will be established by the Trustees 10–15 years following the 2016 settlement.

2 On April 4, 2016, a federal court in New Orleans entered a Consent Decree in matters related to the DWH oil spill: *United States v. BPXP et al., Civ. No. 10-4536, centralized in MDL 2179, In re: Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010 (E.D. La.).* This Consent Decree resolved civil claims against BP arising from the April 20, 2010 Macondo well blowout and oil spill in the Gulf of Mexico. For more information, see: https://www.justice.gov/enrd/deepwater-horizon.

Louisiana Trustee Implementation Group Monitoring and Adaptive Management Strategy, 2021.