APPENDIX A

MONITORING AND ADAPTIVE MANAGEMENT: DETAILED RECOMMENDATIONS

We believe there are **three fundamental improvements** to the MAMP which would increase its ability to serve the stated purpose and definition of adaptive management for the project. These improvements include: (1) clear adaptive management process, (2) better problem definition, and (3) expanding from centralized governance. These improvements can develop over time as the project is constructed, however the Final EIS should provide a roadmap for how CPRA plans to develop the AM program over the next few years prior to construction.

Improvement #1: Define a clear adaptive management process

Although the MAMP includes several of the necessary and common steps / elements of adaptive management (AM), **there can be increased clarity around the adaptive management process that will be implemented.** There are a variety of different interpretations and approaches that could be adopted to support implementation of adaptive management of the project (e.g., CPRA 2017; Carruthers et al. 2020; TWIG 2020) with different programs from elsewhere tending to tailor their AM processes to suit their unique needs (e.g., Williams and Brown 2012; DSC 2013; Fischenich et al. 2016). For instance, The NRDA Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0 (2017) (MAMPG) recommends project-level AM processes which might be suitable. The MAMP should include a similar process diagram for AM to clarify how the steps and elements described in the MAMP relate to and support the envisioned process. Lessons have been learned about some of the common elements that enable the effective implementation of AM since there is documented variability in its success (Gunderson 2015; Greig et al. 2013). Having an explicit reference to the adaptive management process to which the project is committing (i.e., the steps and supporting elements), will allow the MAMP and the envisioned AM process to be successful in serving its intended purpose.

The MAMP also **needs a clear alignment and integration of elements across steps in the envisioned AM process**. In particular, the MAMP would be strengthened by clarifying the explicit linkages between the restoration objectives (and related sub-objectives) for the project, the management actions that are within scope and will affect performance of the project, the critical management uncertainties that can be tested through adjustments in the management actions, the critical research questions that scientists can resolve through supplementary studies and learning strategies, the monitoring parameters that will be used to evaluate effectiveness of the actions and changes in status and trends of valued components, as well as the specific analytical tools, evaluation approaches, and/or learning strategies that will be used to provide answers to the critical management questions and evaluate success of project relative to its restoration objectives. The line of sight across elements can improve the AM process to provide clarity on elements and their relationship (see Improvement #2).

The MAMP can address Improvement #1 by implementing the following suggestions:

- Include a process diagram for AM which represents the process to which the MAMP is committed.
- Commit to implementing an effective AM process after the FEIS Record of Decision that draws upon experiences from elsewhere and the guidance of AM practitioners.
- Improve communication of the "line of sight" across steps and elements of the AM process to clarify how they are linked, integrated, and mutually supporting each other in the MAMP and related components of the DEIS (e.g., the impact analysis, mitigation and stewardship plan).

Improvement #2: Clarify the problem definition

A second improvement in the MAMP would be to provide **clarity around the definition, scope, and framing of three fundamental elements of adaptive management**. Having a clear problem definition is fundamentally important for clarifying the focus of adaptive management for practitioners. Having a clearly defined problem was noted by Greig et al. (2013) as a fundamental enabler of success for AM programs to ensure that the approach is appropriately and clearly applied by practitioners.

A first element that can be more clearly articulated in the MAMP relates to the **measurable restoration objectives (and sub-objectives)** against which success of the project and related actions would be evaluated. The MAMP describes three objectives and then cross-references those with a list of monitoring parameters (see pages 28-68 in Section 3.7). There is an implied linkage between the restoration objectives and related monitoring parameters, but it is difficult to directly and measurably link them to the desired outcomes that are under the direct influence of the management actions within the scope of the MAMP, and relate to the valued components of most relevance to decision makers of agencies with decision authorities across the Louisiana coast. For instance, as described, the three restoration objectives do not explicitly represent the objectives of relevance to decision makers as implied in Appendix R1 (Mitigation and Stewardship Measures) which include aspects related to the decision authorities and interests of various agencies and stakeholders (e.g., marine mammals, navigation, flooding, and fisheries). The listed monitoring parameters provide a heavy emphasis on monitoring parameters related to physical conditions and it is difficult to determine how changes in these variables will relate to the outcomes that matter to relevant decision makers of affected agencies. If the performance targets and related performance measures are not clearer, it will be difficult for decision-makers to evaluate the trade-offs amongst alternative operations and effectively evaluate performance of the project.

A second element that needs to be more clearly defined involves the **decisions / management actions** to which AM would apply. Specifically, there are a range of possible interpretations

around the scope of management actions which include different points of emphasis around: (1) restoration projects as noted in the definition of AM in MAMP (see lines 272-282 from page 2 in Section 1.1.1), (2) project operations as referenced in the purpose and need in the MAMP, and (3) mitigation and stewardship strategies as listed in Appendix R1. Having agreement and a clear understanding of the scope of management actions is fundamentally important so scientists can articulate the conceptual models and related hypotheses of effect for these actions, which in turn can be tested, monitored, and evaluated through the implementation of the project by operators and decision makers.

Lastly, there should be an improved definition and additional details on the list of **critical uncertainties / questions** that affect the ability of decision makers to understand the effectiveness of their actions. Conceptual models can be a useful tool for identifying critical uncertainties. The one provided in the MAMP (see page 6 in Figure 1.3-1 in Section 1.3) could be tailored to serve this purpose and provide more detail to help identify and clarify the most important and relevant critical uncertainties for decision making. Moreover, how the modelling and assessment work from the DEIS (i.e., the impact analysis) has been or could be used to rigorously identify critical management uncertainties and how these unknowns will be evaluated / tested during the operations of the project could be clarified. The critical uncertainties are described with a mix of management uncertainties and scientific uncertainties. As noted by Nichols and Williams (2006), there is an important distinction between management uncertainties and scientific uncertainties for AM. Since it would not be appropriate to resolve all uncertainties described in the MAMP using AM, there is a need for more information about the learning strategies that are being proposed to resolve different critical uncertainties. Clearly identifying, specifying, and prioritizing the most critical uncertainties is important for an effective AM process to ensure that there is a clear focus for learning and that the proposed learning strategies can provide answers to these questions.

The MAMP can address Improvement #2 by implementing the following suggestions in the FEIS or during the development of the AM program:

- Provide greater specificity to each of the three objectives identified in the MAMP by including more specific sub-objectives that are more relevant to the valued components that matter to decision makers, are more directly measurable, and are under the influence of relevant management actions for the project (i.e., create an objectives hierarchy).
- Provide an explicit list of the specific management actions that are within scope of the MAMP.
- Use more detailed conceptual models to represent, identify, and specify the priority list of critical uncertainties that are of relevance to the management actions for the project and affect progress towards the objectives / sub-objectives. This could include development of near real-time models and decision-support tools to support the operations of the diversion after the FEIS Record of Decision but prior to operation of the diversion.

- Separate the list of identified critical uncertainties into management uncertainties or hypotheses that relate to questions about the effectiveness of management actions of relevance to the project (resolved through passive or active management experiments) and scientific uncertainties that may be important research questions for better understanding the system, but can be resolved through learning strategies other than AM (e.g., model development / application, a literature review, data synthesis / analysis, a targeted field study, long term monitoring activity, a field experiment).
- Clarify the proposed learning strategies that will be used to provide answers to the identified critical uncertainties (whether management or scientifically oriented uncertainties).

Improvement #3: Centralized governance

An effective governance structure is an important ingredient for successful environmental management, generally (Dietz et al. 2003), and adaptive management, specifically (Greig et al. 2013). Effective governance structures provide an important set of functions which include: (1) trust-building, (2) knowledge generation, (3) collaborative learning, (4) preference formation, and (5) conflict resolution (Green et al. 2015). Governance systems vary in their ability to effectively provide these functions and their design has an important influence on their effectiveness. Adaptive management programs tend to require a robust governance system to effectively execute decisions, learn, and innovate in the face of uncertainty (Duit and Galaz 2008). A review of the organizational structures of four large scale AM programs across North America provides the following insights of relevance to the MAMP (Marmorek et al. 2015):

- There is no "one-size fits all" approach to effective governance since success depends on the specific context in which a governance will function.
- Statutory decision makers tend to hold the ultimate responsibility for its relevant decision authority and this decision maker can consider the views of other entities and levels of governance, but they do not relinquish their decision authority to others.
- Effective governance structures for AM tend to separate (though vertically integrate) policy, management, and technical levels of interaction and decision making with external agencies and stakeholders having roles that are integrated at one or more of these levels of interaction.
- Processes to generate technical information (i.e., synthesize the science) are separated from processes to explore preferences, resolve conflicts, and make decisions.
- The synthesis of scientific information to inform decision making tends to be completed independently by technical organizations/agencies with some form of independent peer review.

Based on this understanding of the need for effective governance and factors that contribute to its success, the proposed governance structure in the MAMP can be improved in several ways. Although there is some need for clarity about who would serve on each governance element, the

governance structure in the MAMP focuses all roles and responsibilities for project governance with CPRA (see Figure 2.1-2 on page 16). It appears that the input from any outside entities would only be provided as advisory opportunities with CPRA (i.e., a one-way dialogue). As well, the proposed governance structure seems to mix technical responsibilities with management responsibilities across multiple governance elements. For instance, the Data Management Team and AM Team both have technical responsibilities (e.g., data management, assessment/analysis, reporting). Likewise, the AM Team and Operations Team both have management responsibilities. Based on the experience of effective governance structures for AM programs elsewhere, it could be difficult for the AM Team to have responsibilities for both generating science and contributing to management recommendations. External audiences will be less likely to trust the impartiality of the science being provided to decision makers because they are one and the same. A more effective structure would include a Technical Team that is clearly tasked with managing data, analyzing it, being responsive to peer review, and providing an impartial interpretation / reporting of the evidence to decision makers. This team should comprise an interdisciplinary team of experts, both internal and more importantly external to CPRA, and include good-faith representation of traditional ecological knowledge. Traditional ecological knowledge could be included through researchers that are tasked with gathering information from a large number of fishers and community members and synthesizing information for decision-makers. The Technical Team should be designed to provide independent, science-based assessments to the other teams. In addition to the Technical team, CPRA should consider standing up an interdisciplinary group of national experts to periodically review the science and management actions. This project is of national significance and engaging experts outside of Louisiana, such as the LCA Science and Technical Board or the Coastal Master Plan Science and Engineering Board, can provide decision-makers with additional science support.

The Management Team could then be responsible for ensuring the Technical Team and any external science panel understands the management relevant science around which to focus, evaluating the evidence that emerges from that Team, considering trade-offs among different performance objectives, integrating the different perspectives and risk tolerances of different internal / external audiences, and then developing a management recommendation or a summary of options for approval by senior executives with the ultimate decision authority. Operators will also have an essential voice in iteratively developing management recommendations with a Management Team so that what is being proposed can feasibly be implemented, but decisions should be guided by a clear structure and process that considers the scientific evidence and carefully evaluates trade-offs among alternative decisions.

Over the course of 2020, Environmental Defense Fund in partnership with Restore the Mississippi River Delta coalition convened a group of local stakeholders wanting to learn more about adaptive management for a sediment diversion and how to effectively communicate this topic back to their communities. In addition, the participants provided a number of recommendations on AM

governance that are reflected in the improvements suggested as the DEIS moves forward including identifying a process for how members of the governance structure are chosen or nominated and how long they may serve in a group.
The MAMP can address Improvement #3 by implementing the following suggestions in the FEIS or during the development of the AM program:

- Provide additional clarity about the size, membership from representative organizations, and process for selecting members in the different elements of the governance structure.
- Provide additional clarity around the specific types / examples of decisions that would be considered by each element in the governance structure.
- Separate technical roles (i.e., Technical Focus Group, Peer Review, Data Management Team) from management roles (i.e., AM Team, Operations Team, Executive Team) and clarify that the responsibility of technical roles is to maintain credibility and provide impartial evidence for decision making which involves much more than just data management (e.g., data management, modelling / analysis, scientific interpretation, knowledge synthesis, reporting). Consider engaging experts external to Louisiana.
- Link activities of the Technical Focus Groups / Peer Review to the Data Management Team, as opposed to the AM Team, or provide some alternate governance arrangement that appropriately concentrates technical responsibilities and separates these responsibilities from representatives with management responsibilities.
- Decentralize management responsibilities in the governance structure to enable broader engagement, two-way dialogue, and development of joint recommendations involving multiple interests into decision making (as opposed to a one-way consideration of inputs from a Stakeholder Review Panel or Stewardship Group). Broader engagement may be more appropriate for an AM Team (those involved in recommending a decision) as opposed to an Operations Team (those involved in implementing a decision). A decentralized management structure could still retain a single entity as the ultimate decision authority (e.g., Executive Team), and could allow for an engagement process that recognizes differences in decision authority of different entities (e.g., authorities of federal agencies).
- Provide additional clarity about the engagement process and capacity that will be provided to support implementation of a multi-agency and stakeholder governance structure.
- Clarify linkages between the governance elements, annual / multi-year schedule (as noted in Figure 5.2-1 on page 82), and specific activities that would be conducted to support science and decision-making in the AM process (i.e., clarify linkages between the who, when, and what).

As illustrated by the three fundamental improvements described above, additional work can be done to strengthen and improve the effectiveness of the AM process in the MAMP. Developing a robust AM plan and committing to an effective AM process will serve the mutual interests of CPRA and other decision makers / stakeholders. An effective AM plan and process would increase

the scientific defensibility and evidence base that supports decision-making, focus costs of monitoring on parameters that are of most relevance to decision makers, ensure that investments in mitigation and stewardship measures are targeting outcomes that can be attributed to the project (as opposed to addressing outcomes that are attributable to broader ecosystem changes outside the influence of the project), and contribute to greater transparency, buy-in, and support for the project and its operations. Ultimately, a strong AM process will help reduce disagreements around the scientific evidence serving decision makers (i.e., disputes around causation) and help ensure the dialogue among interests are focused on resolving underlying disagreement in desired outcomes (i.e., disputes around preferences, see Lee 1993).

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