3.0 THE ROLE OF THE SSR IN THE CERP ADAPTIVE MANAGEMENT PROGRAM

The role of AM in complex ecosystem restoration programs, such as CERP, is to substantially improve the likelihood for restoration success by providing a structured process for addressing the many uncertainties that occur in program planning, implementation, and assessment. The CERP AM Strategy (CERP, 2006) establishes a framework for addressing important unanswered questions about how natural systems will respond to various project plans and the most effective design to meet hydrological extremes. When ecosystem responses do not meet predictions or are undesirable, AM can help scientists and managers identify management actions needed to modify the Plan. The SSR assesses the health of the ecosystem as CERP projects and operations are brought on-line. The ecosystem responses and interpretations contained in the SSR become the basis for identifying structural or operational components of the Plan that should be modified to improve the chance of restoration success for CERP. This summary on the role of AM is supported by the definition of AM stated in the CERP AM Strategy:

> "AM is a science and performance-based approach to ecosystem management in situations where predicted outcomes have a high-level of uncertainty. Under such conditions, management anticipates actions to be taken as testable explanations, or propositions so the best course of action can be discerned through rigorous monitoring, integrative assessment, and synthesis. AM advances desired goals by reducing uncertainty, incorporating robustness into project design, and incorporating new information about ecosystem interactions and processes as our understanding of these relationships is augmented and refined. Overall system performance is enhanced as AM reconciles project-level actions within the context of ecosystem-level responses."

The SSR fulfills this performance assessment function as step two of the CERP AM Strategy (Box 2–Performance Assessment; ***Figure 3-1***). When appropriate, results of these system-wide performance assessments will be used to initiate management actions within Box 3 (Management and Science Integration) that are necessary to adjust the Plan to meet desired performance expectations. New knowledge gained from the SSR also may be used to update the CEMs, hypothesis clusters, PMs, and/or modeling tools utilized by CERP (Box 1–CERP Planning) for predictive purposes. SSR data may be used to revise monitoring and assessment approaches used in the MAP (Box 2).

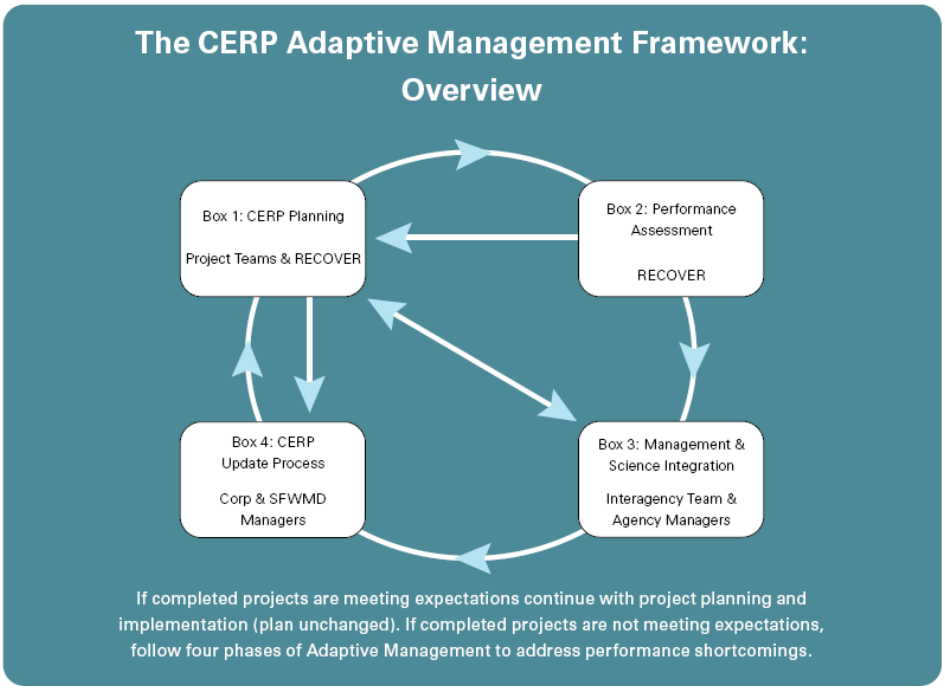

Figure 3-1: CERP AM Framework Overview

3.1 Performance Assessment

Conceptually, there are three plausible outcomes from interpretation of results from system-wide assessments (***Figure 3-2***) (RECOVER 2006). Each outcome from the SSR and interpretation of MAP data is illustrated below using a decision framework. The details of this decision framework will be addressed in the future as part of the CERP AM Implementation Guidance Manual and within the context of future MAP refinement.

1. Outcome 1: Characterized by insufficient data and/or time being available to establish statistical trends, to allow critical examination of MAP hypotheses, and to review the effectiveness of assessment PMs. In the case of inadequate time, the monitoring should continue until there is sufficient data to assess the status and trend of the PM and to establish pre-CERP conditions. In the case of incorrect assessment PMs, metrics, and/or monitoring methods, the option exists to modify the MAP (Box 2).
2. Outcome 2: In this case, monitoring trends and research results are inconsistent (assessment targets are not met) with and/or do not support the CEMs, hypotheses, or the IG/IT. This could result in the following options: (1) modify the hypotheses, CEMs and/or the associated PMs; (2) modify the assessment and evaluation tools (e.g., hydrologic, water quality, or ecological models); and/or (3) identify system-wide hydrological and/or ecological needs to improve performance of the Plan. Options 1 and 2 involve updating the Plan (Box 1) and refining the design of the monitoring plan (MAP) (Box 2). Option 3 provides the basis for initiating the next step of the AM Strategy (Box 3-Management and Science Integration) to develop options that address performance issues identified in the SSR.

3. Outcome 3: This outcome is realized when monitoring trends and research results reveal PM targets are met as predicted indicating that results are consistent with the CEMs, hypotheses, and support the IG/IT, thus no action is required. These PMs should continue to be monitored, as long as they provide valuable information on the status of the ecosystem and the ability to detect CERP induced changes.

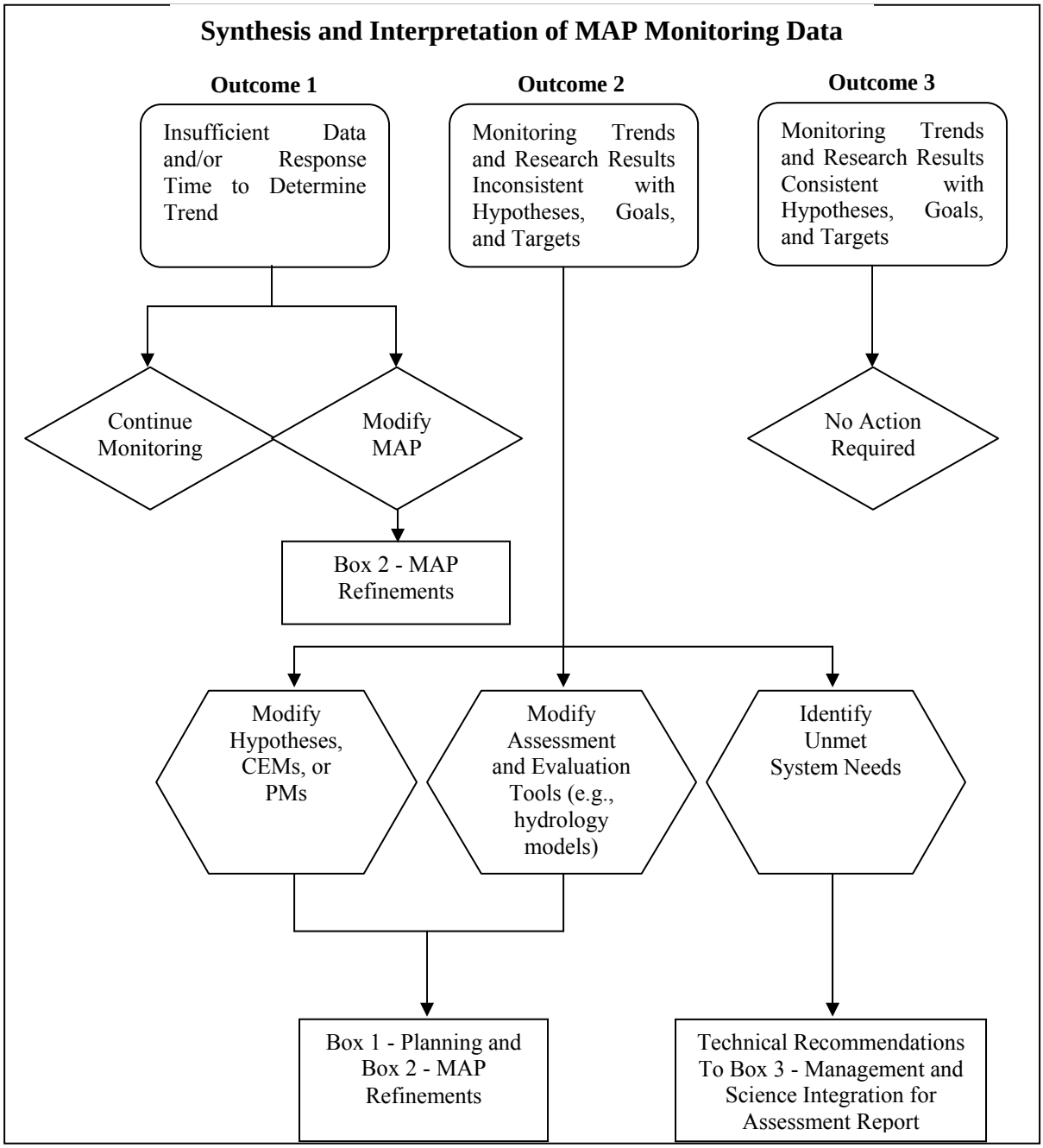

Figure 3-2: Synthesis and Interpretation of MAP Monitoring Data

While Outcome 2 in ***Figure 3-2*** identifies unmet system needs to be addressed by Management and Science Integration (AM process-Box 3), the magnitude and/or duration of system performance deviations used to trigger a management response still needs to be developed. As CERP moves toward the full implementation of the MAP and completes its second biennial assessment of pre-CERP condition in 2009, an analysis framework will be developed to determine the magnitude and duration of performance deviation from PM targets and IGs conveyed in the SSR; this will trigger the need to move from Performance Assessment (Box 2) to Management and Science Integration (Box 3).

Weinstein et al. (1997) illustrates such a decision framework as it relates to the restoration of degraded salt marshes within Delaware Bay. An AM process was used to conduct the restoration effort due to large temporal and spatial scale uncertainties. Using a strategy analogous to the MAP, the salt marsh was conceptualized as a landscape greatly influenced by hydrological forces. From this conceptualization, Weinstein et al. (1997) identified three primary restoration endpoints that served as performance criteria for measuring restoration success. Response thresholds were identified for each of the endpoints to evaluate the progress of the restoration and to trigger a need for corrective measures and an AM response. Applying this type of decision framework and similar AM processes to the MAP will: (1) assist with revising the monitoring and assessment program for CERP; and (2) provide the criteria and rules for establishing system-wide performance triggers that require corrective measures and management intervention.

3.2 AM Conclusions

In general, the results of the 2007 SSR can be categorized as Outcome 1-insufficient data and response time to establish the pre-CERP condition necessary to detect and compare changes in performance For example, in the GE module, most monitoring components have only one or two years of data which is insufficient to establish pre-CERP conditions or identify trends. However, in some cases, the MAP results when supplemented with extensive historical information, allow for the establishment of pre-CERP conditions; this allows verification of CERP hypotheses and assessment of system-wide performance changes once CERP projects are implemented and operational (Outcome 2 and 3). An example of Outcome 3 is current pre-CERP conditions and trends for crocodilian populations in ENP. The SSR analysis indicated that the number of crocodile nests recorded in ENP during 2005 and 2006 is consistent with the trend of higher nest numbers in ENP since 2000. This increasing trend appears to be associated with a decrease in salinity levels that were a result of non-CERP project plugs placed in the East Cape and Buttonwood canals to reduce saltwater intrusion. This example illustrates the value of long-term monitoring in establishing a baseline that can be used to evaluate the efficacy of potential management actions such as will be evaluated in CERP.

A revised version of the MAP will identify how data generated by the SSR relates to meeting triggers, which will be identified by the MAP module teams. These triggers indicate unmet CERP system performance needs. The CERP AM Implementation Guidance Manual, currently under development, will provide details regarding science application as well as the interpretation of SSR data; specifically, it will provide guidance on the magnitude and duration of performance deviations that initiate Box 3 activities (Management and Science Integration).

Finally, the SSR data will be used to inform AM decisions and management actions at CERP project and/or program levels.

3.3 References

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