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MEMORANDUM

To: Glen Canyon Dam Technical Work Group

From: H. Fairley, Core Monitoring Team Leader (Acting)

Subject: Provisional Core Monitoring Plan and Future Planning Process

Attached for your review is the latest iteration of the core monitoring plan, now termed the Provisional Core Monitoring Plan (PCMP). A second attached document describes the process that the Core Monitoring Team is proposing to use to arrive at a Final Core Monitoring Plan. Please review these documents prior to the next TWG meeting on May 18-19, 2005.

The PCMP includes only the projects now considered operational by GCMRC (the "green projects" in the previous CMP). These projects have been ongoing for several years and have had PEP reviews. However, they have not been reviewed by the AMP stakeholders to determine if they meet or exceed management needs. Since these projects are ongoing and there is insufficient time to review them in detail for the 2006 budget cycle, they will be assumed to be part of the FY06 work plan without further discussion.

The PCMP is an interim step towards development of the Final Core Monitoring Plan (FCMP). The FCMP will include only monitoring elements (formerly categorized as green/yellow/red) that have been reviewed and approved by the AMP stakeholders, as well as a formal PEP/peer review process. Once a core monitoring project element has been included in the FCMP, it will be considered core and will not be discussed within the budget process each year. It is anticipated that 40-60% of the annual GCMRC budget will be devoted to projects within the FCMP.

Differences between the PCMP and the former draft of the CMP include the following:

Item
A short discussion has been added to the beginning of the PCMP explaining the PCMP and its relationship to the FCMP
The linkages discussion has been expanded
Sections on flows and power monitoring have been deleted, pending future discussion
Sections describing how PEP recommendations have been addressed have been added to each PCMP project description
Explanations of differences between the PCMP budget and FY06 work plan budget have been added where necessary
Table of contents has been revised

Next steps necessary to complete the PCMP:

Item	Responsibility	Due date
Present PCMP and FCMP process document to TWG; get feedback and approval/recommendation.	GCMRC w/ Henderson/Kubly	5/19/2005
Present FCMP process to AMWG and get concurrence	Henderson/Kubly	08/2005

Getting to a final Core Monitoring Plan will involve the following process:

The Core Monitoring Information Needs (CMINs) will be prioritized according to the process outlined in the attached document (Proposed Process for Developing and Finalizing the Core Monitoring Plan.) In brief, the CMT and TWG will prioritize CMINS. Lower priority CMINS will be considered MINs (monitoring information needs), while the identified high priority Core Monitoring Information Needs (CMINS) for 10 goals (see below) will dictate the core monitoring program.

The FCMP will address 10 AMP goals (the 12 Strategic Plan goals, minus Goals 3 and 12). Each of the ten goals will be addressed in some fashion within the FCMP. The 10 AMP goals will be prioritized for funding allocation purposes.

Detailed data evaluations will be undertaken by GCMRC to ensure that the data match the prioritized CMINS identified under each goal. These data evaluations will be presented to the CMT in a series of formal presentations over the course of the next 8-9 months. A trial run of the data evaluation process will take place at the next TWG meeting on May 19, 2005.

Please read the attached documents for more details about the proposed process, and come prepared to discuss these documents at the next TWG meeting.

PROPOSED PROCESS FOR DEVELOPING AND FINALIZING THE CORE MONITORING PLAN – DRAFT FOR TWG REVIEW

INTRODUCTION

During the Core Monitoring Team (CMT) meeting on March 10-11, 2005, the Team decided to develop a provisional core monitoring plan for FY06 that would include only those monitoring programs that had been subject to a PEP process, were fully piloted, and the pilot results had undergone subsequent peer review. These projects had been previously identified in the September 24, 2004 Core Monitoring Draft Plan as “green projects”, as in “good to go.” It soon became apparent, however, that not all stakeholders were comfortable with accepting even the green projects as approved elements of the core monitoring plan. Some stakeholders asked for a detailed evaluation of these green projects, using a set of explicit criteria.

A preliminary set of criteria for evaluating projects was developed at the March 10-11 meeting. The criteria collectively addressed the main concerns of the CMT members (those who attended the meeting) in terms of identifying the types of information they felt was needed to determine if current monitoring data were fully and adequately addressing AMP needs. The specific information that needed to be evaluated under each of the criteria was also discussed.

Subsequently, at the April 11-12, 2005, CMT meeting, the Team determined that rather than evaluating proposed projects, an independent process was needed that could evaluate current and proposed *monitoring data* relative to defined AMP goals, Management Objectives, and CMINs. In addition, the CMT decided that not all CMINs were “core” and that even among those that are core some had higher priority than others; therefore, the CMT decided to establish a process to prioritize the CMINs under each AMP goal. In addition, some members of the CMT felt that the AMP goals themselves needed to be prioritized, in order to establish a ranking of relative importance for future budgeting purposes. The need for a third process to rank AMP goals was therefore identified.

The CMT members felt that many of the same criteria categories that were initially identified for evaluating monitoring data could also be used for prioritizing the CMINs and ranking the AMP goals, although the specific criteria questions would need to be modified to meet the specific needs of each process.

Below is the list of the criteria, and their relevance to each of the three processes (data evaluation, Goal ranking, CMIN prioritization). The criteria category is in bold, while the data evaluation criteria are posed as questions immediately below the category.

- 1) **AMWG priority** (data evaluation, Goal ranking, CMIN prioritization)
Does the data directly or indirectly address an AMWG priority?

2) MOs and CMINs (data evaluation, CMIN prioritization)

Does the data directly or indirectly address an existing MO and specific CMINs?

3) Compliance (data evaluation, Goal ranking, CMIN prioritization)

Does the data satisfy a specific legal compliance requirement outside of GCPA and the NPS Organic Act (e.g., EIS/ROD, ESA, LOR, NHPA)?

4) Legacy (data evaluation, CMIN prioritization)

Does the data contribute to an historical record that is important to continue?

5) Data quality/availability (data evaluation)

Is the accuracy and precision of the data known for proposed data collection, and if so, is the level of accuracy/precision adequate, inadequate, or more than adequate to meet the needs of the program?

6) Cost/benefit and risk assessment (data evaluation, Goal ranking, CMIN prioritization)

What are the relative merits of collecting this data relative to other data collection?

7) Status of knowledge (data evaluation, Goal ranking, CMIN prioritization)

What is the current status of data analysis and knowledge for the resource?

8) Methodology (data evaluation)

Does methodology exist that provides acceptable accuracy, precision, and frequency of data?

Criteria 1 through 4 address the importance of the data to the program. Criteria 5 through 8 address how well the data is projected to meet the need.

CRITERIA FOR RANKING AMP GOALS FOR FUTURE BUDGETARY PURPOSES

Critical to ecosystem function

- Does the Goal address a critical ecosystem function?

AMWG priority

- Is the goal an identified AMP priority (within the top 10 from the 2004 AMWG prioritization exercise), and if so, what is its level of priority? (Priority 1 will receive 5 points, priority 2 will get 4 points, etc. but priorities 5-7 each get 1 point, and Priorities 8 or less receive no points)

CMINS

- How many "Core" MINS fall under the goal? (This will require completion of the CMIN prioritization process first). List the total number of core MINS identified during the CMIN prioritization exercise.

Compliance

- Does the goal address a resource category that is specifically mentioned in the NPS Organic Act and/or GCPA?
- Does the goal address a resource that was specifically analyzed in the EIS for Operations of Glen Canyon Dam or specifically discussed in the ROD?
- Does the goal fulfill the needs of a specific legal compliance requirement outside of GCPA, EIS/ROD, and the NPS Organic Act (e.g., ESA, LOR, NHPA)?

Cost/benefit and risk assessment

- How critical is the goal for maintaining a healthy and functional Colorado River ecosystem?

Status of knowledge

- How well do we understand the status and trends of the resource related to this goal?

CRITERIA FOR PRIORITIZING CMINS

Definition of "core"

- Does the CMIN meet the definition of "core" as defined in the revised plan?

AMWG priority

- Does the CMIN directly or indirectly address an AMP priority?

MO's

- How well does the CMIN address the MO relative to other CMIN's?
- Does it address multiple MO's or additional CMIN's?

Compliance

- Does the CMIN address a resource category that is specifically mentioned in the NPS Organic Act and/or GCPA?
- Does the CMIN address a resource that was specifically analyzed in the EIS for Operations of Glen Canyon Dam or specifically discussed in the ROD?
- Does the CMIN fulfill the needs of a specific legal compliance requirement outside of GCPA, EIS/ROD, and the NPS Organic Act (e.g., ESA, LOR, NHPA)?

Representation of the resource and ecosystem

How well does the CMIN represent the resource and ecosystem?

- Can it represent multiple resources at equivalent or lower trophic levels?
- Can it be used as an indicator of overall ecosystem health.

Critical to ecosystem function

- Does the CMIN address a critical ecosystem function?

CRITERIA FOR THE EVALUATION OF MONITORING DATA

The information needed to evaluate the monitoring data is listed under each of the criteria. Note that the criteria follow a proposed step-down process, as follows:

Ecosystem> resource>management objective>(CMINs)>indicator(s)>geographic extent>change over time (determined by accuracy, precision, and frequency)

This data evaluation process will also serve as the outline for organizing and presenting the detailed information identified by stakeholders as necessary for inclusion in the final core monitoring plan:

AMWG priority

Does the data directly or indirectly address an AMWG priority?

- Describe the applicable AMWG priority and how the data address it.
- Discuss whether or not an AMWG priority is being addressed directly or indirectly.
- If the priority is not being addressed completely, describe the scope of what is and is not being addressed by current data.

MOs and CMINs

Does the data directly or indirectly address an existing MO and specific CMIN?

- Applicable MOs and CMINs and how the data address them.
- Note whether or not they are being addressed directly or indirectly.
- If the MO's and IN's are not being addressed completely, the scope of what is and is not being addressed.
- Specify the information needed to answer the management objective and associated CMINs completely.
- Describe what would need to be done to overcome current limitations in answering the question completely.

Compliance

Does the data satisfy a specific legal compliance requirement outside of GCPA and the NPS Organic Act (e.g., EIS/ROD, ESA, LOR, NHPA)?

- Applicable compliance requirement and how/why the data address them.
- If the compliance requirement is not being addressed completely, the scope of what is and is not being addressed.

Legacy

Does the data contribute to an historical record that is important to continue?

- Provide a complete description of the legacy data
 - What kinds of data were collected?

- Where were the data collected (location map)?
- What are the accuracy, precision, and frequency of the legacy data?
- For what purpose was the legacy data originally collected?
- Was the data validated by an acceptable QC/QA plan?
- Does GCMRC compliant metadata exist for this legacy data?
- Do the legacy data meet GCMRC data standards?
- Describe the applicable historical record, how many years of data exist, and how the proposed new data will enhance the record.
- Discuss how the historical record addresses AMWG priorities, MOs and CMINs.
- If the AMWG priority or MO or IN is not being addressed completely, describe the scope of what was and was not addressed with the legacy data.
- Describe whether or not the legacy data collection protocols underwent a PEP, when the PEP occurred, whether or not the PEP concurred with methods of data collection, and how they were changed if the PEP did not concur.

Data quality/availability

Is the accuracy and precision of the data known for proposed data collection, and if so, is the level of accuracy/precision adequate, inadequate, or more than adequate to meet the needs of the program? How will it be made available?

- What data is being proposed for collected?
- How will the data be collected?
- Where will the data be collected (need location map)?
- Describe the accuracy, precision, and frequency of the data and explain why this level of accuracy/precision/frequency is necessary for the program.
- What is the statistical power.
- Describe the data QC and QA plan.
- Specify whether or not GCMRC compliant metadata has been developed.
- Specify whether or not the data meet GCMRC data standards.
- How and where will the data be stored?
- How will someone be able to obtain the data?

Cost/benefit and risk assessment

What are the relative merits of collecting this data relative to other data collection?

- How well do the data represent the resource and the ecosystem?
- Do the data relate specifically to a critical ecosystem function?
- What changes to the resource will the accuracy, precision, and frequency of data collection pick up (climatic, natural variability, natural or man-made events, etc. – over what minimum time interval)?
- Describe the consequences of collecting data with higher and lower accuracy, precision, and frequency in terms of cost, ability to detect change over time, knowledge, and risk to the resource.
- Describe how the data are being or will be analyzed.
- Describe products that will be developed from this data.

- Identify the metrics of success.

Status of knowledge

What is the current status of our knowledge about the resource that the data is intended to monitor?

- Discuss whether or not the data has been analyzed.
- Discuss whether or not targets and/or metrics have been established.
- Describe what the data shows relative to AMWG priorities, MOs, and CMINs.
- Discuss whether or not the data are measuring the right things/variables.
- Discuss the current status and trend of the resource based upon this data.
- Describe what is known about cause and effect relationships, and relevance of data to evaluating such relationships.
- Discuss whether or not the data is meeting the AMP's need relative to detecting decline or improvement of a resource over a useful period of time.

Methodology

Does methodology exist that provides acceptable accuracy, precision, and frequency of data?

- Describe proposed methodology.
- Is similar work being done elsewhere? If yes, provide a synopsis of similar work being done elsewhere and methodology being used.
- Describe possible alternative methodologies, and discuss the pros and cons of these alternative methods in terms of cost, accuracy, precision, and frequency of data.

ADDITIONAL CONSIDERATIONS IN EVALUATING THE MONITORING DATA

The value of any monitoring plan is determined by whether measurements of key indicator resource conditions provide managers with sufficiently precise determinations of the changes in those resources over time and space. Researchers are able to use the data they collect on those resources to provide managers with estimates of costs for different levels of precision, but managers who control budgets ultimately must identify the level of precision, and thus the level of risk, that they are willing to assume in making errors based on the data gathered in the monitoring program.

In the GCDAMP provisional core monitoring plan, projects were chosen for inclusion based on a set of criteria that included whether they addressed program goals, management objectives, and AMWG priorities, whether they provided data necessary for compliance with regulatory requirements, whether there was an extended history of data collection in those projects, whether the historical data were available for analysis, and whether accuracy and precision of data collection was sufficient to meet managers' needs. For most of the projects included in the plan, the last determination has not been adequately addressed. Project designs have not been formulated with the recognition that there are tradeoffs among budget allocation, precision of determining change in resource conditions, and risks that managers take when decisions are made based on results from the monitoring.

In the long-term core monitoring plan that will be developed during FY 06, these issues will be addressed directly as part of the data evaluation process and final design of projects. Statistical considerations, including power analysis and precision determinations, will be an integral part of plan development. Resources will be considered for their value as indicators of ecosystem change; metrics applied to those resources will be evaluated for whether they can be adequately measured and whether they serve as valuable indicators in change in status and trend; frequency, intensity, and distribution of samples will be evaluated statistically to determine what level of precision can be provided; and managers will be asked to interact with researchers in determining what tradeoffs between budgets and precision are acceptable for different resource measurements.

APPLYING THE PROCESS

The Final Core Monitoring Plan (FCMP) will address ten AMP goals (the 12 AMP goals, minus Goals 3 and 12). Each of the ten goals will be addressed in within the FCMP. The ten AMP goals will be prioritized so that decisions about relative proportions of funding allocation can be made. The CMT and TWG will prioritize existing CMINS under each of these goals. Lower priority CMINS will be considered MINs (monitoring information needs), while the higher priority Core Monitoring Information Needs (CMINS) will dictate the focus of the core monitoring program.

Item	Responsible	Due Date
Develop data evaluation criteria	GCMRC	5/4/05
AMP goals		
Develop ranking criteria	GCMRC	5/4/05
Rank AMP goals	CMT	Early June?
CMINS		
Develop ranking criteria	GCMRC/Henderson/ McKistry	4/29/05
Rank CMINS	CMT	5/16/05
Create evaluation matrix with ranked CMINS	McKinstry	5/17/05
Present process for ranking goals/CMINS and evaluating CM data needs to TWG w/matrix	Henderson/Kubly/ McKinstry	5/19/05
Evaluate available data and compare to prioritized CMINS	GCMRC	Thru 2005
Complete review process protocol	GCMRC/CMT	June 2005
Conduct review of first green project (stage/discharge)	Melis/Wright	5/19/05

The final CMP will document the extent to which monitoring data satisfies the evaluation criteria. The format is organized by AMP goals, not GCMRC projects. This approach describes monitoring data within the context of AMP goals, a paradigm more intuitive to

resource managers. It also more readily lends itself to the "integration" of diverse scientific activities into a common environmental theme that they support

The data evaluation process and final CMP development will occur as follows:

1. Using a "Delphi process", CMT members will rank the CMINs and help separate core monitoring information needs from other monitoring needs. This will be completed before the next TWG meeting on May 18-19, 2005.
2. GCMRC will present data evaluations relative to each AMP goal through a series of formal presentations to the CMT over the next year. This information will effectively describe how well the current and proposed monitoring projects meet the relevant AMP goals and our "ability" to monitor those goals. The first formal data evaluation presentation will take place at the next TWG meeting (May 18-19) to help refine the process, and the evaluation process will be fully refined before the next AMWG meeting in August.
3. The GCMRC will reformat the current PCMP from project based descriptions to AMP goal-based descriptions in conjunction with the formal presentations of monitoring data relevant to each goal. Loose leaf binders will be distributed containing preface materials and tabs for the inclusion of the reformatted goal based descriptions as they are developed and presented.
4. During the detailed data evaluation presentations, the CMT will determine how well the data meet the AMP goals based upon the evaluation criteria, efficiency (i.e., cost effectiveness), and what makes sense to monitor based upon priority, ability, and budget. Status of knowledge will be a prominent part of these presentations.
5. Simultaneous with this process, the AWMG/TWG will work to refine and clarify goals, MOs, and INs, and establish priorities, targets, metrics, future desired conditions, and required accuracies and precision (to include how much change needs to be detected over what period of time) for each AMP goal. NPS has agreed to take the lead in defining targets for CRE resources. GCMRC would agree to allow metrics to suffice on an interim basis while TWG and AMWG are working towards establishing targets.
6. The Science Advisors will review the provisional plan. They will also review the process outlined here to develop the revised final plan, and the final plan itself as it develops.

The Science Advisors will additionally assist the Center with:

1. Refining the information needed to evaluate criteria and developing an outline for presentation of the information to the CMT.
2. Focusing the plan to an ecosystem science paradigm with integration to other science and management programs.
3. Developing a process for constantly assessing the ecosystem knowledge base and its ability to address changing needs.

4. Developing an adaptive process that provides an assessment of monitoring methodology every 3-5 years to assure access to new technology for data development.
5. Identify indices that together are indicators of the CRE health, proper function, and sustainability, etc.

Status of knowledge will be evaluated annually against both stakeholder needs, and the needs of special resources such as threatened and endangered species. Emphasis will be placed on what is known and not know in order to refine science approaches. The science advisors will be consulted to identify the best way to transmit the knowledge obtained from monitoring data to the AMWG and TWG in a meaningful way keeping in mind that if knowledge is not absorbed, it has not been transferred. The formal presentations and plan revisions will begin in late June of 2005 and continue for nine months at which point monitoring activities for all goals will have been evaluated. It is intended that this process will lead to a fully revised and reformatted plan by March 31, 2007.

THE RELATIONSHIP OF THE CORE MONITORING PLAN TO OTHER GCMRC PLANNING DOCUMENTS

The Core Monitoring Plan is an integral component of a comprehensive planning framework (figure 1) that will be linked through GCMRC's Strategic Science Plan. The other principle components of this framework are the Research Plan (which will include projects that are under development for core monitoring implementation, the Long Term Experimental Plan, plus research elements identified in the HBC Comprehensive Plan), the Humpback Chub Action Plan, plus future management plans that may be developed in response to the research and monitoring.

The Core Monitoring Plan will contain only projects that are measurable using existing methodology that provide acceptable accuracy, precision, and frequency of data. All remaining core monitoring projects will be considered research and development and will be described in the Research Plan.

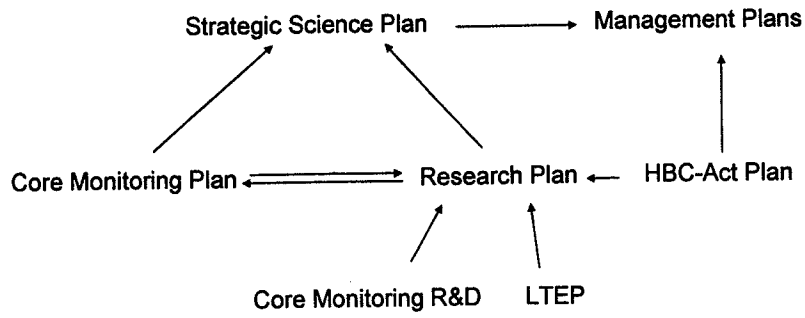


Figure 1. Relationship of core monitoring plan to other planning documents.