QUESTIONS FOR THE ERPP SCIENTIFIC REVIEW PANEL

Purpose of Questions to be Addressed by the Scientific Review Panel

The objective of the Scientific Review Panel is to provide advice and recommendations on some of the key issues surrounding development of the Ecosystem Restoration Program Plan (ERPP) of the CALFED Bay-Delta Program. Questions developed to guide the discussion will focus in two primary areas: 1) evaluation of the scientific validity of the basic concepts and assumptions upon which the ERPP is based; and 2) development of advice and recommendations based on real-life experiences from other restoration programs which may serve to improve the development and implementation of the ERPP.

We do not expect scientists unfamiliar with the Bay-Delta system and its unique problems to review the entire ERPP document with multiple targets and actions and provide a meaningful review in a short time period. Instead, the questions developed focus on conceptual issues of basic scientific theories and principles, ecological planning and processes for implementation. The Scientific Review Panel will not be required to analyze technical data nor have specific prerequisite knowledge of the Bay-Delta system. The questions attempt to challenge the Panel by drawing upon their personal experiences gained from working in other ecological systems and by applying general scientific concepts in making recommendations for the ERPP.

The questions have been developed through extensive interaction with stakeholders in order to facilitate and promote Panel discussions by highlighting the important issues of the ERPP; they are not intended to limit scope of the Panel's review. The questions have been sorted into several general categories to ensure that all aspects of the ERPP are incorporated in the review. Reference to location in the ERPP of more detailed discussions is included in italics at the end of each question category. This information is provided to assist panel members in their review.

Overview of the Ecosystem Restoration Program Plan

The Ecosystem Restoration Program Plan's goal for ecosystem quality is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. The foundation of the ERPP is restoration of ecological processes which are associated with streamflow, stream channels, watersheds, and floodplains. These processes create and maintain habitats essential to the life history of species dependent on the Delta. In addition, the Program aims to reduce the effects of stressors that inhibit ecological processes, habitats, and species.

The ERPP employs an integrated systems approach that aims to reverse the fundamental causes of decline in Bay-Delta fish and wildlife populations. A systems approach will recognize

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the natural forces that created historic habitats and use these forces to help regenerate habitats. The Bay-Delta ecosystem is a complex living system sustained by innumerable interactions that are physical, climatic, chemical, and biological in nature, both within and outside of the geographic boundaries of the Delta. The central theme of the ERPP is the recognition that truly durable and resilient populations of all fish and wildlife inhabiting the Bay and Delta require, above all else, the rehabilitation of ecological processes throughout the Central Valley river and estuary systems and watersheds. *[Volume I, pages 1-2; Volume II, pages 2-4; Volume III, pages 2-3]*

Organization of the ERPP

The ERPP is separated into three volumes to organize and present material in a cohesive, yet comprehensive manner.

Volume I: Visions for Ecosystem Elements presents the visions for important ecological processes and functions, fish and wildlife habitats, species, and stressors that impair the health of the processes, habitats, and species.

Volume II: Ecological Zone Visions presents the visions for the 14 ecological zones and their respective ecological units. Each individual ecological zone vision contains a brief description of the ecological zone and units, important ecological functions associated with the zone, important habitats, species which use the habitats, and stressors which impair the functioning or utilization of the processes, habitats and species. *Volume II* also contains implementation objectives, targets, and programmatic actions which describe the ERPP approach to improving the ecological health of the zone and its contribution to the health of the Delta. Rationale are also contained in *Volume II* which clarify, justify, or support the targets and programmatic actions.

Volume III: Visions for Adaptive Management provides the ERPP approach to adaptive management and contains the proposed plans for indicators of ecological health, a monitoring program to acquire and evaluate the data needed regarding indicators, and program of focused research to acquire additional data needed to evaluate program alternatives and options, and the approach to phasing the implementation of the ERPP over time.

Questions regarding the planning approach of the ERPP.

Background

The goal of the Ecosystem Restoration Program Plan is to implement actions which guide the restoration of ecological health to the Bay-Delta ecosystem. The ERPP proposes to achieve this goal by using a planning approach which converts conceptual goals into actions. The planning approach of the ERPP includes development of visions, implementation objectives,

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targets, and programmatic actions.

Visions - A vision is a statement of what the ERPP seeks to accomplish with the implementation objectives, targets, and programmatic actions for an ecological process, habitat, species or species group, stressors, or geographical unit. The vision statements included in the ERPP provide technical background to increase understanding of the ecosystem and its elements. Two types of vision statements are included in the ERPP: visions for ecosystem elements *[Volume I]* and visions for ecological zones *[Volume II]*. An ecosystem element vision addresses an individual ecological process, habitat, species or species group, or stressor, while an ecological zone vision addresses the integration of ecological processes, habitats, species, and stressors within a clearly delineated geographical area. Cumulatively, the visions also provide detailed descriptions of the ecosystem and its elements as they will look and function after restoration is accomplished. *[Volumes I, II and III, Terms Used in the ERPP; visions for ecosystem elements are presented in Volume I and visions for the ecological zones are described in Volume II]*

Implementation Objectives - An implementation objective is a specific, detailed description of what the ERPP strives to maintain or achieve for each ecosystem element identified in the ERPP. Implementation objectives are fixed and not intended to change over time. Cumulatively, the implementation objectives describe the ERPP vision of ecological health for the ecosystem. Indicators have been selected to track the progress towards attaining the implementation objectives and therefore measure the vision of ecological health. *[Volumes I, II and III, Terms Used in the ERPP; ERPP implementation objectives for ecosystem elements are described in Volume I; Volume II details implementation objectives for ecosystem elements within the ecological zones]*

Targets - A target is a qualitative or quantitative statement of an implementation objective. Targets are something to strive for but may change over the life of the program with new information and progress, or may vary according to the configuration of storage and conveyance in all alternatives. Targets may include a range of values or a narrative description of the proposed future value of an ecosystem element. Targets are to be set upon realistic expectations; must be balanced against other resource needs; and must be reasonable, affordable, cost-effective and practicably achievable. *[Volumes I, II and III, Terms Used in the ERPP; specific targets for implementation objectives with rationale are listed in Volume II]*

Programmatic Actions - A programmatic action is physical, operational, legal, or institutional change or alternative means to achieve a target. Numerous site-specific actions will be implemented to fulfill the programmatic actions based on a process of adaptive management. *[Volumes I, II and III, Terms Used in the ERPP; programmatic actions to achieve targets with rationale are listed in Volume II]*

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Questions

1. To what extent is the general planning approach described in the ERPP appropriate and adequate to meet the ecosystem quality objective of the CALFED Bay-Delta Program? How does this approach differ from other restoration efforts with which you are familiar? What lessons can be learned from other restoration programs? Are there elements of the ERPP planning approach that are unnecessary? Are there elements missing that can improve the process?

2. To what extent do the implementation objectives adequately describe a vision of ecological health?

Questions regarding indicators of ecosystem health.

Background

A comprehensive suite of indicators is essential to:

- explicitly translate broad goals into measurable performance parameters that encompass most or all of the significant characteristics of the ecological system;
- decrease the dependence of the definition of success of the program onto any single indicator; and
- provide guidance for long-term adaptive management strategies.

The ERPP uses a suite of indicators to track the effectiveness of the implementation objectives and assess ecological performance at several ecological scales. Indicators are direct measures of ecosystem performance for each ecological process, habitat and species identified in the implementation objectives. The ERPP describes each indicator with a metric (what will be measured) and how the metric relates to the implementation objective parameter. Cumulatively, the indicators are intended to measure the ERPP vision of ecological health. *[Volume III, pages 46-49]*

For the purposes of assessing the success of the ERPP, ecological indicators are required at two levels: (1) indicators of the health of individual ecosystem elements and (2) broader, integrated indicators of overall ecological health. The information developed thus far addresses potential indicators of health of individual ecosystem elements *[Volume III, pages 50-76]*. The landscape level indicators of ecological health, based on the foundation of the ecosystem element indicators, are being developed at this time and are not presented in *Volume III*. *[Volume III, pages 49-50]*

Question

3. To what extent can indicators adequately measure the ERPP vision of ecological health? Which landscape level indicators would you suggest for the ERPP?

Questions regarding the setting of targets.

Background

A target is a qualitative or quantitative statement of an implementation objective. Targets are something to strive for but may change over the life of the restoration program with new information and progress, or may vary according to the configuration of storage and conveyance in all alternatives. Targets may include a range of values or a narrative description of the proposed future value of an ecosystem element. Targets are to be set upon realistic expectations; must be balanced against other resource needs; and must be reasonable, affordable, cost-effective and practicably achievable.

The intent of the ERPP is to restore ecosystem health by achieving the implementation objectives; targets are flexible tools to guide the effort. The level of implementation for each target will be determined or adjusted through adaptive management. Targets are categorized according to the three levels of certainty: 1) targets that have sufficient certainty of success to justify full implementation in accordance with program priorities and phasing; 2) targets which will be implemented in stages with the appropriate monitoring and evaluation to judge benefits and successes; and 3) targets for which additional research, demonstration and evaluations are needed to determine feasibility or ecosystem response. Targets developed for the 14 ecological zones are classified by their reliability in contributing to attainment of the implementation objectives *[Volume II, pages 6-8]*. *[Volumes I, II and III, Terms Used in the ERPP; specific targets for implementation objectives and rationale are listed in Volume II]*

In developing restoration targets for the ERPP, three different approaches were utilized: 1) historical pre-disturbance conditions; 2) diagnostic and prescriptive indicators; and 3) historical reference period incorporating existing disturbances conditions. The first approach sets targets based on historical pre-disturbance reference conditions. A limitation to this approach is that appropriate reference periods are difficult to select, and in many cases existing conditions have been altered so drastically that restoration to a pre-disturbance condition is infeasible. The second perspective involves setting diagnostic goals to define how the ecosystem should function; identification of diagnostic indicators, implementation of prescriptive measures to achieve the diagnostic goals, and identification of prescriptive indicators. The third approach sets targets based on recent reference periods with healthy ecosystem conditions that supported substantial populations of target species.

Questions

4. Based on your experience, is the hybrid approach developed by the CALFED Program a reasonable method for setting restoration targets? How have other programs set restoration targets? How can we improve this process?

5. Is the relationship between targets and implementation objectives clearly defined? How could the relationship be improved?

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Questions regarding the scope of the ERPP.

Background

The ERPP has been developed to address ecosystem quality problems manifest in or closely linked to the CALFED Bay-Delta problem scope. The problem scope is defined by the legally defined Delta and the Suisun Bay and Marsh areas. To restore ecological health to the problem scope, the ERPP will implement actions within a larger solution scope, the Study Area of the ERPP. The Study Area of the ERPP is defined by the Sacramento and San Joaquin Rivers and their tributaries, its upper watersheds, the San Francisco Bay, the Delta, and the nearshore Pacific Ocean. The type and level of implementation of actions of the ERPP will vary geographically within the Study Area.

Within the Study Area, the ERPP has identified 14 Ecological Zones where the majority of restoration actions will occur. The Ecological Zones are each characterized by a predominant physical habitat type and species assemblage. The Ecological Zones include the Delta, Suisun Bay and Marsh, North San Francisco Bay, the Sacramento River, the San Joaquin River, and their tributary watersheds directly connected to the Bay-Delta system below major dams and reservoirs. The other regions within the Study Area, the upper watershed areas above major dams, the Central and South San Francisco Bay watershed, and the nearshore Pacific Ocean, are addressed at a programmatic level.

A tiered approach has been used to develop ecosystem restoration targets and actions within the ERPP Study Area. The geographic regions within the ERPP Study Area receive varying levels of specificity and emphasis depending on the ability of actions to directly affect problems in the Delta. This approach of tiering actions is an attempt to effectively address problems that are manifest in the Delta problem scope; the ERPP will not address every ecological problem in the Bay-Delta ecosystem. Tiered emphasis does not reflect a priority setting scheme, rather it clarifies the CALFED responsibility to restore ecological health of the Delta and displays where and the degree to which actions need to be implemented. The tiering is an assessment of the number and types of actions identified in the ERPP that need to be implemented to restore ecological health.

The following describes the tiering of the level of actions among the five geographic regions designated within the solution scope of the ERPP:

Sacramento-San Joaquin Delta - The legally defined Delta is comprised of all four Ecological Units of the Sacramento-San Joaquin Delta Ecological Zone and the Suisun Bay and Marsh Ecological Unit of the Suisun Marsh/North San Francisco Bay Ecological Zone. The approach in the Delta Ecological Zones and Units differs from the approach in the remainder of the Ecological Zones and Units in the following two ways:

- Extensive focus on habitat including specific targets and programmatic actions.
- Inclusion of targets for listed species which may have a broad distribution in the ERPP Study Area but are manifest in the Delta as a "problem."

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Sacramento and San Joaquin Rivers, Tributary Watersheds, and North San Francisco Bay - The CALFED approach for the Ecological Units and Zones outside the legally defined Delta is to restore important ecological processes, habitats, and species to address problems manifest in the Delta. Generally, the species list is confined to fish species, particularly anadromous fishes.

Upper Watersheds - CALFED is supportive of watershed restoration programs and efforts within the upper watersheds which result in measurable benefits to the Delta. The ERPP has developed nonspecific targets and programmatic actions for the upper watersheds which are designed to encourage local watershed planning and management efforts.

Central and South San Francisco Bay Watershed - CALFED is supportive of watershed restoration programs and efforts within the Central and South San Francisco Bay area. Central and South Bay programs and projects must be closely linked to alleviation of problems that are manifest in the Delta as a problem. The ERPP has not developed targets or programmatic actions for this area.

Nearshore Pacific Ocean - The nearshore Pacific Ocean is included in the solution area. The ERPP has not developed any targets or programmatic actions that directly address habitat conditions in the ocean. The ERPP has developed targets and programmatic actions to encourage improved harvest management and regulations. *[Volume III, pages 3-4; maps of the ERPP Study Area and the 14 Ecological Zones are included at the end of Volume II]*

Questions

6. What are the conceptual strengths and weaknesses of pursuing this approach of tiering of actions? In your experience, under what circumstances would restoration of ecological processes or habitats and reduction of stressors beyond ERPP's focused Ecological Zones (the uppermost areas of tributary watersheds, the Central and South San Francisco Bay and the nearshore ocean) result in measurable benefits to the Delta itself?

Questions regarding the process of adaptive management.

Background

An important step in the CALFED Ecosystem Restoration Program Plan (ERPP) is the development of a comprehensive adaptive management framework that includes policy and management decision-making based on existing and newly developed scientific and technical information. Adaptive management is an approach to restoration that acknowledges our limited understanding of the interactions between physical processes, habitats and species and our need to better understand these relationships before implementing the entire program. Adaptive management applied to the Bay-Delta ecosystem allows the CALFED Program to proceed with portions of the restoration program using existing information while gathering the scientific and technical data that we lack to implement effective restoration measures on a broader scale. It is

an interactive approach to decision making that involves implementing the actions most likely to achieve ecosystem management goals given today's knowledge while incorporating feedback loops to evaluate and monitor actions and inject new information as it becomes available to modify restoration actions.

Due to uncertainty about the causes of the problems in the Bay-Delta ecosystem and the inability to fully predict responses to proposed actions, the Program will begin using available information and will test these theories through controlled experiments and pilot studies, rather than the wholesale implementation of actions. However, adaptive management is not a prescription to conduct a series of very modest restoration projects and monitor results until all uncertainty is dispelled. A system as large, complex, and troubled as the Bay-Delta demands that we begin to pursue large-scale implementation of actions most likely to achieve ecosystem management objectives. With limited resources (e.g. funding, land, water, time) a careful approach is necessary for success. With many possible directions toward restoration, those routes with the most promise and equity must be found. The challenge will be to find an effective solution that is equitable, balanced, and least costly.

An adaptive management approach will mean the program will proceed on a broad front with many pilot and experimental projects that test the effectiveness and technical feasibility of actions. As the program matures, larger-scale projects will be pursued as information is gained from early pilot studies and experiments. This approach will not preclude early implementation of large-scale projects that address identified needs and have a sound technical basis. *[Volume III]*

Adaptive management for the ERPP is a structured decision-making process that includes the following components:

- development of implementation objectives, restoration targets, and programmatic actions and the hypotheses regarding those elements (planning approach) *[see discussion in Questions regarding the planning approach of the ERPP]*;
- indicators of ecosystem health (indicators) *[Volume III, pages 46-76]*;
- a program for monitoring indicators of ecosystem health (monitoring) *[Volume III, pages 35-45, 107-128]*;
- a program for implementing research to gather new or additional information, test new data collection methods and develop ecosystem models to predict ecosystem responses (focused research) *[Volume III, pages 76-82]*;
- a process to optimize the implementation of projects through time using implementation strategies for each component of the ERPP and a system for establishing and reviewing long-term and short-term priorities (phased implementation) *[Volume III, pages 21-34, 97-106]*;
- a process for reporting programmatic and special information to the public;
- a program for technical and scientific review of the ERPP targets, indicators, programmatic and site specific actions and the monitoring and focused research programs;
- a feedback process to integrate knowledge gained from monitoring and research; and
- the flexibility to change the program in response to new information.

Questions

7. To what extent is the general adaptive management approach described in the ERPP appropriate and adequate to achieve the implementation objectives? How does this approach differ from other adaptive management efforts, and what lessons can be learned? Are there elements of the adaptive management process of the ERPP that are unnecessary? Are there elements missing that can improve the process?

Questions regarding the process of phasing.

Background

Phasing is the logical sequence of implementing restoration actions to achieve CALFED goals as effectively as possible. Phased implementation is comprised of a multistage priority strategy. This program will develop a 25-year implementation plan with potential variations in emphasis grouped in five, 5-year increments. Site-specific actions will be based on the 5-year plans review and modified annually. The present assessment of emphasis over the life of the program is based on existing knowledge and assumptions regarding the need for certain types of actions, but will ultimately change when results from monitoring and focused research suggest changes to the priority strategy.

Implementation Strategies - CALFED and the participating agencies and stakeholders need to develop implementation strategies to provide the pathway to successful implementation. For some elements, implementation programs exist. For others, implementation programs have not yet been developed. A basic strategy for each component will likely be to build on existing programs, bring these programs up to a level to meet CALFED objectives, and augment program staffing levels and funding for implementing projects. Likewise, in areas where no implementation program has been developed, the CALFED strategy may be to encourage the most responsible agency to establish an implementation program and to provide funding for projects. The overall strategy for implementation, however, will influence the shape of the assurances package and be shaped by the decision to create an independent ecosystem management entity which may have full authority to implement the ERPP. Implementation strategies will be analyzed and modified through annual peer review.

Setting Implementation Priorities - The balancing and priority for implementation and funding of ecosystem recovery projects will be based on a hierarchy designed to ensure the greatest level of ecosystem resilience against future disturbance, and to support self-sustaining populations that require the least amount of human intervention possible. Some criteria for setting the programmatic priority plan include the 25-year implementation period, projected availability of funding, needs of endangered species, assurances, and the preferred alternative for storage and conveyance. The 5-year implementation priorities have not been set but may be based on the CALFED mission and ecosystem quality goal; ranking of ecosystem elements (ecological processes, habitats and species); threatened and endangered species; and species status (species that produce a conflict with water and fisheries management, species likely to

produce a conflict with water and fisheries management, and species which contribute to overall ecosystem health and provide resilience to water and fisheries management). The priority plans will be reviewed and modified through annual peer review. *[Volume III, pages 21-34, 97-106]*

Questions

8. Can you comment on our approach or recommend a method that addresses scientific uncertainty and biological urgency to achieve proper phasing of actions?

9. Multiple actions will be needed to achieve the implementation goals. Some of these actions may conflict to varying degrees, while other actions may interact to provide synergistic benefits. Based on your experience, are there any specific elements or types of actions in the ERPP which are likely to conflict with each other? Do you have any suggestions for actions which would optimize the probability of synergistic benefits?

Questions regarding the scientific foundation of the ERPP.

Background

As stated previously, the goal for ecosystem quality in the CALFED Program is to improve aquatic and terrestrial habitats and improve the ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animals species. The ERPP is based on the foundation that restoration of ecological processes and functions associated with streamflow, stream channels, watersheds and floodplains are necessary to create or maintain habitats essential to the life history of species dependent on the Delta. Additionally, the ERPP proposes to reduce the effects of stressors in the system that impair ecological processes, habitats, and species. *[Volume I]*

Questions

10. One of the most debated issues involves the management of hydrologic processes necessary to support basic ecological processes and functions of riverine and estuarine ecosystems. What methods or approaches would you suggest to determine the hydrologic characteristics (including frequency of occurrence, length of duration, quantity of discharge, and others, if applicable) of the system that serve to support basic ecological processes and functions which sustain aquatic ecosystems? Would these be applicable to the Bay-Delta ecosystem?

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Questions regarding irreversible changes of the Bay-Delta system.

Background

Human modifications have irreversibly changed the Bay-Delta ecosystem. The changes include destruction or degradation of habitats; alteration of the hydrologic regimes; introduction of exotic species; chemical contamination; and other problems. *Volume I* discusses the irreversible changes to the Bay-Delta system and their effects on ecosystem elements. *Volume I* and *II* provide implementation objectives for the ecosystem elements that describe a vision of ecosystem health for the Bay-Delta system. *[Volume I and II]*

Questions

11. Given the irreversible changes to the Bay-Delta system, are the implementation objectives of the ERPP reasonable? What irreversible changes have occurred in other systems, how have those affected restoration efforts, and what lessons can be applied to this system?

Questions regarding the elements of a successful restoration program.

12. Does the ERPP identify and incorporate all of the elements necessary for implementation of a successful long-term restoration program? Based on your experience and review of the ERPP, how can the ERPP be strengthened?

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