

**Agenda Item: 9-9**  
**Meeting Dates: February 9 and 10, 2005**

## **JOINT MEETING WITH BAY-DELTA PUBLIC ADVISORY COMMITTEE**

### **RESULTS FROM THE 2004 ENVIRONMENTAL WATER ACCOUNT REVIEW AND A DESCRIPTION OF SCIENCE PROGRAM ACTIVITIES TO ADDRESS SCIENCE NEEDS OF THE ENVIRONMENTAL WATER ACCOUNT**

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**Summary:** The CALFED Record of Decision assigns the Lead Scientist the responsibility of evaluating the Environmental Water Account at the end of every water year. This document presents results of the 2004 review and describes Science Program and agency activities undertaken to address science needs of the Environmental Water Account.

**Recommended Action:** This is an information item only. No action will be taken.

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#### **Background**

The CALFED Record of Decision (ROD) assigns the Lead Scientist the responsibility of evaluating the Environmental Water Account (EWA) at the end of every water year. To meet this obligation, a standing panel of technical experts (EWA Technical Review Panel or Panel) who have not been involved in EWA implementation was convened by the Lead Scientist.

EWA Panel reviews in each of the first three years focused on: 1) the availability and use of scientific information underlying actions taken; 2) the incremental changes in the way decisions were made as new scientific data and information became available; and 3) the technical basis for decisions involving allocation of EWA water. The Year-4 review (completed November 2004) contained many of these elements but focused on technical aspects of EWA planning and implementation related to: the first four years as a whole, and continuation of the EWA beyond Year 4.

After four annual reviews, the EWA Technical Review Panel finds that “as the EWA evolves from an ‘experiment’ to a formal long-term program many science issues continue to need attention if EWA is to be managed with a sound scientific basis, and to assure that EWA assets are efficiently and effectively used in conjunction with other environmental water assets.” Other major conclusions from the Panel’s 2004 review are:

- Consider a systematic approach to program integration. Programs with similar goals such as the Ecosystem Restoration Program (ERP) and EWA or that may overlap in their roles such as EWA, Environmental Water Program

(EWP) and the Central Valley Project Improvement Act (CVPIA) Water Acquisition Program (WAP) should be reviewed and a strategy for developing a synergy among these programs and their goals considered. This integration should focus on integration to achieve synergistic biological benefits, rather than on other aspects of the programs such as personnel or finances.

- The EWA should fully consider the biological consequences of its water purchases. Movement and deployment of EWA assets may have consequences for listed species, and these consequences should be incorporated and justified as part of decisions to manipulate and deploy water assets within the system.
- The EWA implementation process can be improved by: 1) more thoughtful and rigorous use of gaming exercises; 2) increasing research efforts in support of the EWA; and 3) improving the review processes. With EWA moving from a four-year experiment to long-term operation, the scrutiny of EWA science and water management practices will be heightened. The science and management rationale for use of EWA assets and the future costs and benefits for at-risk species should be documented.

Evaluating the scientific basis of the EWA is an important activity of the Science Program. The long-term goal of the CALFED Science Program is to establish a body of knowledge directly relevant to CALFED actions and their implications. That body of knowledge must be unbiased, relevant, authoritative, integrated across program elements, and communicated to the scientific community, CALFED agency managers, stakeholders, and the public. Five types of activities must move forward together to achieve the long-term goal: adaptive management, monitoring, interdisciplinary information gained through research on critical unknowns, integrating scientific knowledge into management, and broad communication of science knowledge and scientific activities. By working to meet these goals, the Science Program aims to achieve consensus on the interpretation and use of technical information needed by EWA and other CALFED managers to make informed water management decisions.

### **List of Attachments**

Attachment 1 -- 2004 EWA Technical Review Panel Report

Attachment 2 -- Lead Scientist's Recommendations to Address Science Needs of the Environmental Water Account

Attachment 3 -- 2005 ISB Work Plan

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**Review of the 2003-04 Environmental Water Account**  
**Submitted by the 2004 Environmental Water Account Technical Review Panel**  
**Submitted: January 17, 2005**

## **INTRODUCTION**

The fourth annual meeting to review the Environmental Water Account (EWA) convened on November 8-10, 2004 at the California Bay-Delta Authority (Authority) office in Sacramento, California. The EWA Technical Review Panel (Panel), as charged by CALFEDs Lead Scientist, was assembled for the fourth and final time. In contrast to the first three years of reviews, the fourth year review focused on two topics: the first four years as a whole, and proposals for a long-term EWA. As in previous reviews, the 2004 review also focused on technical aspects of EWA operations and actions. The ten members of the 2004 review Panel are listed in Appendix 1.

The 2004 review focuses on the future of the EWA as it is poised to move beyond the initial "experiment", and become a more permanent management tool. Written documents that described the fourth (2003-2004) year's activities were distributed and reviewed by the Panel prior to the annual review, and additional materials were received during the review. Materials provided to the Panel after the review meeting were not considered in this report. At the annual review meeting, oral presentations by both agency participants and stakeholders provided important additional information that supplemented the written documents. Following the public presentations and discussions, the Panel met to discuss and evaluate the 2004 EWA operations and to evaluate the progress made in implementing previous Panel recommendations. The Panel drafted a preliminary set of findings and recommendations that serve as the basis for this report, and orally summarized these findings to the meeting participants and the public on Wednesday November 10, 2004. An exchange of comments and questions from the public, stakeholders, and agency personnel followed the Panel's presentation. Those comments and the written documents are considered in this report.

The Panel recognizes that the EWA is moving into a new phase as a tool for long-term ecological water management. The most compelling issue facing managers if EWA is to be a "science based" program is the challenge of expanding the research base and upgrading the quality of the science underlying program decisions. Although the Panel sees the current status of the science in support of EWA as a potential Achille's heel of the program, the Panel also recognizes the budgetary and other constraints on personnel and resources that have limited CALFED's ability to mobilize new resources to address the science needs of EWA. Additional monetary and staff resources will help to address the many science issues facing EWA, but the Panel encourages the managers to consider the more cost effective approaches suggested in this, and the previous three, EWA review reports in the event that proposed funding increases are limited or do not materialize.

The Panel also wishes to acknowledge the efforts of the scientists and managers "in the trenches" that have analyzed data, participated in gaming exercises, attended workshops and meetings, prepared annual reports, and addressed some of the many science needs of EWA in spite of the lack of additional support. Their dedication and efforts have provided the foundation for the viability of EWA as a long-term water management tool.

This year's report is organized as follows. We begin with the many positive findings and accomplishments of the program to date. We then discuss some ways to improve the scientific basis and the review process of a long-term EWA program.

#### **POSITIVE FINDINGS FOR EWA 2004**

The fourth year of the Environmental Water Account (EWA) demonstrated continued improvement and progress in several noteworthy areas that are highlighted below.

- The EWA has done an effective job of assuring water supply reliability to the water contractors, while concomitantly providing an acceptable level of fish protection. The level of fish protection achieved is likely at a higher level than could have been attained by fixed standards. The EWA agencies have taken actions they believed would protect and restore at-risk native fish populations in the Bay-Delta at no uncompensated water cost to export Project contractors south of the Delta, beyond those reductions required under the regulatory baseline of the CALFED ROD.
- As an experiment in organizational and management policy change, the EWA is unquestionably successful. Agencies and stakeholders feuding over how to protect endangered fish now work together in real time collaborations to provide water for fish protection. Management agencies better understand the perspective and the needs of operating agencies and the operating agencies are more cognizant of fisheries needs. Further, the relationships between the representatives of water contractors, including farmers and environmental groups, appear to be on an improved footing. Additional review of conflict reduction in a broader context is included later in this report.
- As has been the case since the beginning of the EWA, the Panel believes that the acquisition of water for the EWA continues to be one of the more effective elements of the Program. Despite the technical and political complexity of acquiring environmental water in a timely and economic manner, the process continues to function smoothly. There is also evidence that managers look for ways of optimizing environmental benefits through careful timing of releases and other actions. The careful descriptions of the rationale for acquisition primarily north of the Delta, the pumping capacity limitations on timing of water shipments, and the difficulties imposed by annual-only transactions are examples that helped the Panel understand the intricacies and admirable efforts being undertaken in the water acquisition aspect of the EWA.

- Since the inception of the EWA Review Panel process, the Authority and agency personnel have produced a substantial written record of documents for review by the Panel prior to its annual meeting. During this time period of limited personnel resources, the continued preparation of timely documentation is noteworthy and indeed an accomplishment. The perspectives provided by environmental and other stakeholder groups have been valuable in past reviews, and we hope that such written comments will continue to be provided in the future.
- Communication and coordination has been an area of significant progress since Year 1 of the EWA. The weekly meetings of the EWA Team, the (b)(2) Interagency Team, the Data Assessment Team, and the Water Operations Management Team have continued to evolve in a positive direction. The ability to make timely, reasonable decisions in the presence of scientific uncertainty has become one of the hallmarks of the EWA program.
- Since the inception of the EWA there have been areas of scientific investigation and science-based management of particular note. One area has been the continuing advancement of understanding of Delta smelt ecology and incorporation of this information into models. This understanding has led to recent constructive scientific debate of alternative hypotheses of the Delta smelt life cycle and the importance of temporal and spatial variation in life stage specific mortality rates.
- An additional notable area has been the improvement in winter run Chinook salmon spawning estimates and the resulting effect on the estimation of the juvenile production index. In addition, the multi-agency, multi-disciplinary investigations of salmon distribution and mortality at the Delta Cross Channel have been a component of the recent success in avoiding “red light” conditions. These improvements, and others such as explicit incorporation of water quality concerns, are considered annually in changes to the salmon decision tree and show evidence of close coordination and refined thinking about the best deployment of EWA resources.
- While the Panel did not hear a report at the review workshop concerning the genetics work aimed at identification of true winter run Chinook salmon, a written summary of that work suggests substantial progress in refining identification of “genetic” winter run. The work seems to be leading managers to a re-evaluation of the timing, size criteria, and salvage mortality for winter run fish that could have consequences for pumping curtailments in the future. As the results of this and other new findings unfold, a rapid feedback between new research and consideration of potential management changes will heighten the effectiveness of the EWA.
- This year's report on the possible effect of EWA actions on winter run salmon mortality was an interesting and useful exercise. Two items of particular note were important. First, the report found that with four different models that incorporated

various sources of mortality and assumptions of relationships, the net improvement of salmon survival was about the same and small. Second, the report brought out the important finding that transfers of EWA water itself are a source of some mortality and, potentially in some years, could offset some of the gains from pump curtailment. This exercise was another example of the value of models and comparing alternative models that should spark additional investigation and refinement of the EWA and how one assesses the biological benefits of water management. Additional detailed comments, cautions and suggestions for improvement on these models are provided later in the panel report.

- Integration and communication between each of the environmental water programs (EWA, EWP, CVPIA (b)(2), and CVPIA WAP) has increased based upon both written material reviewed by the Panel and the presentations at the workshop. This year's EWA Review Panel workshop also included for the first time a presentation and discussion of the Ecosystem Restoration Program (ERP) and its relationship to the EWA. Increased collaboration between these two CALFED environmental water programs is critically important, because the science supporting both programs is inseparable. Although the ERP has yet to exercise its own authorized water purchase element, future implementation should further unite and expand the coordination of these two programs.
- One of the most encouraging steps in the organization of Bay-Delta science has been the conceptual agreement to integrate the Interagency Ecological Program (IEP) into the CALFED Science Program. For more than three decades, the IEP has developed and maintained the many monitoring programs that have made this one of the most data-rich estuarine systems in the United States. The IEP also has supported extensive problem-oriented investigations. The functional integration of IEP with the Science Program should not only bring about a mutually beneficial coordination of resources, but a greater transparency to how issues are prioritized and how decisions are made. How IEP monitoring priorities and support are meshed with the Science Program is of continuing interest to the Panel.
- Gaming was originally used as a tool to conceptualize, structure, and quantify the EWA program in the months preceding the ROD. In the past year, gaming and models were used to examine future EWA needs based on application of the existing decision tree criteria. The idea of using applicable gaming techniques, reasonable assumptions, and appropriate models to explore the long-term EWA program has substantial merit and should continue to be pursued. In a later section, the development and application of gaming and models for this purpose is discussed in additional depth.
- The issuance of the Science Proposal Solicitation Package (PSP) that will promote the expansion of applied scientific investigations in the Bay-Delta system. The recently issued Science PSP will generate proposals that will include rigorous peer review and thus the research will be likely to produce high quality scientific

information. The Panel understands that there may be some ability to tailor the call for specific research needs of the EWA in forthcoming Science PSPs. The ability for both general calls for proposals and tailored calls for proposals to address specific needs is a welcomed development. This flexibility, while maintaining the highest standards of peer review, addresses a need expressed by the Panel since the beginning of our reviews.

- Scientific information about Delta smelt has increased dramatically over the past four years. In particular, recent investigations have supported the transition from dimensionless indices to population abundance estimates. New insights have been incorporated into alternative models. Alternative models of Delta smelt populations have also fueled critical and creative thinking about the life cycle and the alternative hypotheses that can be tested. This cycle of increasing knowledge is forming the basis for more effective management.
- The management of Delta smelt has made substantial progress in moving away from simple take at the pumps as the primary management criteria. Management has incorporated the use of geographic distribution of the population, actions to avoid entrainment zones, and an increased understanding of relative vulnerability of different life stages to entrainment.
- As understanding Delta smelt life history has improved, the new information has been incorporated into updates and revisions of the decision tree. This rapid feedback link to management is particularly noteworthy and has been critical for maximizing benefits of restoration actions and for shaping future monitoring and research questions.

### **Systematic Approach to Program Integration**

Several of our prior Panel review reports have emphasized the opportunities for and the importance of integrating the EWA with other environmental water tools in the CALFED arsenal. As we noted in our second annual report, for example, the Ecosystem Restoration Program (ERP) and the EWA share a common biological goal of protecting and enhancing listed fish species. Although the ERP and EWA are designed to reach these goals through different mechanisms (habitat creation and management in the case of the ERP versus flow manipulation in the case of the EWA), the two programs can increase their biological effectiveness by coordinating their activities. The overall effectiveness of the CALFED Program also depends on the degree to which the EWA coordinates with other water assets available for Delta improvement. These assets include (b)(2) water, the Environmental Water Program (EWP) of the ERP, and the CVPIA WAP. A 2001 briefing paper for the EWP listed a number of important means by which the EWA and the EWP could work together in the acquisition and use of water resources.

A great deal of valuable coordination has already taken place. The managers of the various programs meet with each other and discuss opportunities for coordination. The CALFED Program often uses (b)(2) and EWA water conjunctively to reduce pumping operations, with the EWA water being used to reduce pumping at the State Water Project while (b)(2) water is used to reduce pumping at the Central Valley Project. The management agencies also have looked for ways of using EWA water to simultaneously reduce take at the pumps and achieve other fishery benefits such as increased flows in upstream areas and decreased water temperatures.

The CALFED Program, however, does not appear to have taken maximum advantage of integration opportunities. Some of the explanations for not fully attempting to integrate are specific to how individual water programs have progressed. For example, lengthy delays in starting up water operations under the EWP have postponed potentially valuable integration between the EWP and the EWA. More importantly, the management agencies do not appear to have taken a systematic approach to integrating the various environmental water programs. Integration to date has taken place on a largely case-by-case, opportunistic basis. To ensure that they are achieving the maximum benefits from integration, the management agencies should engage in a careful planning process in which they identify all opportunities for integrating the EWA with other environmental water tools; analyze the potential advantages, tradeoffs, and risks of using the EWA in each such setting; and establish operational guidelines for when integration should take place.

The CALFED Program also should better integrate its evaluations of the various environmental water tools at its discretion. Because the EWA focuses on actions designed to reduce "take" at the pumps, efforts to evaluate the EWAs contribution to the protection and restoration of listed fish species provides, at best, a partial picture. The benefits of EWA-specific actions cannot be fully evaluated without considering the benefits and actions of the other environmental water tools at CALFEDs disposal, the overall effectiveness of all of the tools, and the opportunities for synergistic coordination among the various tools.

### **Biological Consequences of Water Purchases**

In our prior annual review reports, this Panel has recommended that the management agencies consider the environmental benefits and costs of all of the EWAs various water operations in order to maximize the net benefits to listed fish species. The management agencies appear to be doing a good, although relatively ad hoc, job of doing this in deciding when and how to use the EWAs water assets. The EWA, for example, has released water upstream in various situations to increase flows or lower water temperatures during critical periods.

CALFED should also consider the biological consequences of its water purchases. Decisions regarding where, when, and how to acquire water can have consequences for listed fish species. Water that is purchased north of the Delta, for example, must be transported through the Delta in order to be of value in offsetting curtailments in

pumping operations. The movement of EWA water through the Delta can have both negative and positive consequences to listed fish species, and EWA managers should consider these consequences in deciding whether and when to buy water north of the Delta. Although CALFED might already factor such considerations into decisions regarding water purchases, we have not seen information that this is being done on a regular and systematic basis.

### **Increased Scrutiny**

The Panel believes that heightened program scrutiny is likely in the future and that the issue deserves further consideration in this year's report. In last year's (2003) review panel report we suggested that if new funding arrangements required water contractors to share the costs of the EWA, then increased scrutiny from stakeholders would likely follow. Heightened scrutiny will eventually lead to a demand for definitive documentation that the program was meeting the intended objectives (i.e., the protection and recovery of endangered species).

The EWA was initially designed as an experimental program to be evaluated at the end of four years. The initial policy design front-loaded the inspection process by providing a venue for review and cancellation should the program fail to merit continuation. As previously noted, the EWA has largely escaped critical public scrutiny since its first year when the winter run take exceeded the maximum levels. On the basis of improved methodologies, it subsequently appeared that the populations of interest were much larger and losses at the pumps much smaller than thought at the time. Without the dramatic stories of excessive fish losses to report, newspaper coverage of the EWA has been low-key during the last three years.

Open conflict attracts attention and scrutiny, while cooperation allows programs to operate below the radar of public examination. Other causes for heightened scrutiny of the EWA, besides the threats to secure water supplies, apparently were put to rest in 2000-2001 and have remained low. The highly visible clashes between fish agencies, water system operators, and urban and agricultural water contractors have abated. The EWA deserves credit for creating improved working relationships among stakeholders that were previously at odds. The deadline for a thorough reassessment of the EWA anticipated in the ROD to take place at the end of four years has been overtaken by events. Some form of EWA (perhaps differently financed and operated) is a critical element in the Delta Improvements Package through which increased pumping capacity will involve moving more water through the Delta to contractors south of the Delta. At this point in time, the EWA is the price contractors may be willing to pay in order to move past the objections environmental interests might otherwise raise that the balance between development and environment promised in the ROD was not being maintained.

Whether the EWA will be able to withstand greater levels of scientific scrutiny in the future depends largely on whether the program is able to provide credible evidence of success in protecting and restoring threatened and endangered fish species. The Panel

perceives that a subtle shift in the burden of proof and exposure to risk may be taking place. While at a previous point in time the EWA was a vehicle to attract environmental support for a program that removed any threat of supply shortfalls from the contractors, the long-term security of fisheries protection dependent upon the EWA may hinge upon scientific proof of the program's efficacy and efficiency.

At some point in the future it seems likely that the issues of overall efficacy and cost effectiveness of the EWA will emerge. While EWA is a small fraction of overall water project costs, the program is expensive to the taxpayers and operators who may share costs. Moreover, the State is a major participant in California water markets. Because competition drives up water prices, other buyers may raise questions. The Panel continues to be concerned about the extent to which the EWA can be held accountable for contributing to fisheries recovery. Here, the degree of science underlying the EWA becomes critical. Uncertainties still exist about precisely which protection and recovery actions are important and why. As the focus of EWA actions moves away from the pumps and towards upstream actions in tributaries to affect flows and temperatures, it becomes difficult to distinguish the EWA effects from that of other environmental restoration programs within the California Bay-Delta Authority. It may be difficult to defend the EWA program against increased scrutiny if it is not rooted in mechanistic scientific understanding.

## **IMPROVING THE EWA REVIEW AND IMPLEMENTATION PROCESS**

The following three sections address observations from the Panel on areas that may become problematic for the EWA if not addressed or that may improve the future implementation and review of the EWA.

### **Uses and Interpretation of Gaming**

Observation: The Panel was encouraged to see continued use of models and gaming in order to explore alternative future scenarios for the EWA. The gaming has been successful in the past, and is a powerful tool for planning and ensuring that agency and stakeholder participants understand how future decisions are made. However, if the gaming is not done with the utmost level of care and transparency, gaming (and modeling in general) can also lead to improper interpretation of results and misunderstandings about the scientific basis of decisions. The Panel heard several presentations that referred to the recent gaming exercise as "sizing the future EWA" and "determining fish needs". These presentations described the questions addressed by the gaming and how the simulations were done in similar, but not identical, terms. Extreme clarity in defining the questions to be addressed by the gaming, and describing exactly how the gaming simulations are done is critical for effective gaming. Loose labeling of gaming results and loose descriptions about the details of which factors were treated as adjustable for fish needs versus externally constrained by economics or water availability will likely lead to confusion about the results by those not intimately involved in the gaming exercise. The Panel believes gaming can, and should, play an important role in providing science-based results to decision-making about the future

EWA. Gaming will be most useful when careful statement of the questions and careful description of how the gaming was done accompany the gaming results.

Suggestion: Two areas for expanding, and potentially improving the gaming were noted by the Panel: inclusion of more biological information and explicit treatment of uncertainty. If it is anticipated that the gaming will be used for understanding and projecting the water needs of key fish species, we recommend that the biological basis of the gaming be established. Information on where in the ecosystem and when during the year additional water would benefit important life stages of key fish species is becoming available, and could be incorporated into the gaming to help put gaming results on a sounder biological basis. Gaming results used for middle- to long-term projections and planning (multiple years and decades) are increasingly subject to uncertainty due to simplifications imbedded in the models and our lack of knowledge about future conditions. There are methods available (e.g., Monte Carlo simulation) that could be adapted to the gaming that would allow explicit treatment of aspects of these sources of uncertainty. The Panel supports the past and ongoing gaming as an excellent tool for multiple parties to better understand the options and limitations of water availability and ecosystem needs, and as input to science-based decision-making. Expansion of the gaming to include a more rigorous biological basis and to explicitly treat uncertainty would increase the power and utility of the gaming.

### **Interpretation and Use of Models**

Observations: In general, the Panel feels that insufficient and in some cases, inappropriate, use is made of models to design strategies for using EWA resources or even for sizing the EWA itself. For example, models to assess the impact of pumping on salmon migration survival are overly simplistic and lack a biological basis. Another example is not utilizing existing models. Despite previous recommendations by the Panel, to the best of our knowledge, the hydrodynamics (DSM2) and particle tracking models (PTM) developed by DWR are not used in any real time fashion or *a priori* when EWA assets are being expended to evaluate what changes in Delta hydrodynamics might result from a planned action. Synthesizing particle-tracking model results with observations of Delta smelt larvae distributions would be a valuable exercise and useful for developing an adaptive management approach to asset allocation. Such modeling might also help identify which sampling locations provide the most valuable information in terms of forecasting or preventing entrainment.

Suggestion 1: As we have stated in each of our previous reviews, the Panel believes strongly that population models can play an important role in understanding the impacts of entrainment or, equivalently, the population-level benefit of preventing entrainment by EWA actions. This illustrates the valuable role that models can play in terms of synthesizing what is known and possibly providing alternative conceptual models of how a given stressor (e.g., entrainment) affects the population of a species like Delta smelt. For example, the matrix model described by Bill Bennett during the EWA review workshop suggested exports play a relatively small direct role in affecting Delta smelt

populations yet exports may have a relatively large indirect effect by essentially removing the “Olympians” who survive the other perils of making it from larvae to adult.

Suggestion 2: A valuable aspect of any smelt population model would be that it could be used in conjunction with a water resources model like CALSIM as an aid to sizing the EWA. For example, it might be possible to make a forecast of what actions might be taken in response to future physical conditions (precipitation, snowmelt, runoff, water temperature) derived from various models of future climatology (van Rheenen et al 2004). Rather than only replaying the past few years of the EWA, as was evidently done recently by DWR in their effort to provide rational criteria for sizing the EWA for the near-term, this coupled modeling activity might provide a useful alternative and play a role in the gaming activities. While the DWR analysis focused on the near-term is valuable, additional analyses focused on the long-term and using alternative models would provide important information on the robustness of conclusions.

Suggestion 3: Models describing the effect of EWA actions on salmon survival need a mechanistic foundation that characterizes the diversion and movement of juvenile fish into the inner Delta where they experience increased mortality relative to migration through the mainstem of the river. Calibration of these models will require increased understanding of the effects of tides, river flows and EWA operations on fish movements. Further analysis of the Delta Cross Channel and other tracking studies and implementation of a Delta wide PIT tagging program are encouraged.

Suggestion 4: The Panel is convinced that whatever modeling is done must formally take account of the inherent stochastic variability of the forcing variables and responses of the system. For example, any modeling done to size the EWA (whatever the approach used to define when EWA water would be expended) should explicitly construct probability distribution functions of water needs based on Monte Carlo-generated sequences of hydrologic conditions with specified statistics. These sequences of possible future conditions should also try to consider including the possibility of climate change (see van Rheenen et al. 2004). In a like fashion, any modeling done for the EWA should also explicitly recognize uncertainty in the forcing variables, and more importantly, recognize the uncertainty in model structure and parameter values. Such uncertainty can be “propagated” through the model to show its effect on the model predictions, thus making clear the likely certainty of model forecasts.

Suggestion 5: All models that are used should be clearly described, and most importantly, subjected to peer review. Ideally, this should take the form of publication in the peer-reviewed archival literature. While this may seem only appropriate for academic research, the Panel notes that the recent NAS report on the Klamath River makes clear that publication with peer review is the appropriate standard by which “best science” should be judged.

Suggestion 6: It seems clear that suggestions by the Panel in past years with respect to carrying out new research that needs to be done to provide the needed scientific information have yet to bear fruit. It is equally clear that staff resources (people and

expertise) do not exist within the agencies to accomplish what is needed. The Panel is encouraged by the fact that the current CALFED proposal solicitation is directed at addressing a number of the issues raised by the Panel in previous reviews. Nonetheless, the Panel recommends that the Authority institute a small program of seed proposals targeted at addressing specific issues and needs related to EWA. Responders to the seed proposal request would necessarily be composed of both agency and outside (e.g. university) scientists, and the aim of the proposed projects would be the eventual development of a full-blown proposal to the CALFED Science Program. Unlike what has often been the case with agency science funded to date, the proposed work that resulted from this effort would be itself subject to peer review before funding in order for the full-scale work to proceed, and should be subject to any other conditions (e.g. documentation, products that are delivered on an agreed to schedule, etc.) the Authority imposes on its grantees.

The purpose of this seed program would be to take advantage of the enormous base of system knowledge and expertise resident in the agencies, while also drawing on the expertise and skills of outside scientists unavailable inside the agencies. Moreover, the participation of agency personnel will help make sure that the results of the work are appropriate to the agencies' needs. This seed program also reflects the realities that: (a) the formulation of experiments aimed at providing the knowledge needed for the EWA requires a significant investment of time by interdisciplinary groups of scientists; and (b) this investment will not happen unless resources (i.e. funds) to support the efforts of people inside and outside the agencies are made available. In a sense, what we propose can be viewed as an extension of awarding points in the PSP review process for collaborations.

### **Improving the EWA Review Process**

In this, our fourth and final EWA review as a Panel, we thought it prudent to make some comments about the review process itself. We believe this to be timely because the nature and makeup of the Panel, as well as the purpose and objectives of the review, will likely change in the future. We offer several observations and suggestions concerning the review process that we believe will strengthen and improve the reviews.

Observation 1: There has been a discouraging trend over the years toward review workshops where topics and viewpoints appear to be limited to the same few presenters, covering the same few topics (including large amounts of historical perspective), with too much of the review devoted to listening to the same materials the Panel and others have read. In the immortal words of Yogi Berra, the meetings have become increasingly "Déjà vu all over again". This approach leaves precious little time at the review meetings for the Panel to interact directly with, and question, the presenters and to hear from the audience.

Suggestion 1: The review process must be as transparent as possible. All possible viewpoints are critical to the evaluation of the EWA. The Panel needs to hear the widest possible viewpoints on EWA science and policy during the review meeting.

Towards this end, the Panel is discouraged by the increasing trend of limited inclusion of non-agency stakeholder analysts at the review meetings. In our experience, the stakeholders offer alternative perspectives that are valuable to the review process.

Observation 2. The review meeting and preparing the Panel for the review could be more effective. We have found through time that the question and answer sessions often “cut to the chase” and lead to discussions and insights not possible to glean directly from the written materials or the presentations. The Panel has also received information and materials after the review meeting that are highly relevant to the review. Receiving these materials after the meeting complicates the review because it is very difficult for the Panel to thoroughly discuss these materials with each other and the stakeholders once the review meeting is over. The Panel believes this broad source of input is vital to an effective review.

Suggestion 2a: To address these issues, the Lead Scientist should consider a more extensive level of dialog with the Panel prior to the review. The Panel should be briefed prior to the meeting on any developments they may not be aware of that are especially relevant to an approaching EWA review. The Lead Scientist should make an effort to make sure that all review materials are forwarded to the Panel in advance of the review meeting, or at the latest offered during the review. Presenters should recognize that the Panel has read written materials and build their presentation around emphasizing key points, rather than regurgitating the written materials. Presenters should also try to write the review materials in a way that highlights the progress and new developments that have occurred between review meetings.

Suggestion 2b: It would be useful for the Panel to have more input into developing the agenda and the timing of future review meetings. The Panel has been asked for comments on the review charge and the agenda and been able to offer some limited input. The Panel would like to see the development of the agenda and the Panel's charge should become an iterative process between the Panel and the Lead Scientist. In the case of a new Panel, it may be difficult for Panel members to comment on a detailed agenda. Nevertheless, input from the Panel into developing the agenda and timing of future review meetings would serve two purposes. Increased input from the Panel would allow for more substance to be discussed at the review meeting, and would increase the transparency of the review process.

Observation 3: With past reviews by this Panel, the Lead Scientist has provided written feedback to the Panel after receiving the written EWA review report. The Panel recognizes that we may miss something or simply misinterpret some part of the review materials. This feedback has been useful to the Panel so that we know if there are details of which we may not be aware or where we are simply "missing the point".

Suggestion 3: Written feedback from the Lead Scientist should continue and become a formal part of the review process.

Observation 4: It is the Panel's perspective that our effectiveness has decreased over the last few years because of the lack of progress on key science issues related to the EWA. The Panel believes that without an influx of resources for addressing the research needs of EWA the annual reviews will become more and more redundant and less effective. The Panel recognizes that part of the problem is the "scramble" required by the agencies to participate in annual reviews. By the time one review is completed and digested, it is time to begin preparing for the next one with limited time to address issues raised in the previous review.

Suggestion 4: When EWA was an 'experiment', annual reviews were appropriate. Now that EWA is moving toward a long-term status a revised review process and schedule should be considered. Once the review of the current long-term planning needs are met, reviews should take place at two-year intervals to provide greater time for making progress in meeting the science objectives of the EWA. This will also reduce the "Déjà vu" effect for the Panel and all those participating in the review process. In off years, input from Panel members can be garnered through participation in special workshops or an annual EWA technical (not review) workshop.

Observation 5: After four years of review, the Panel notes that it is still unsure of the role that the CALFED Sciences Advisors are expected to play in the EWA and the Science Program, and in the processes of both science direction and science evaluation. Moreover, we perceive that many of the EWA participants are unsure of these relationships as well, which has, in our opinion, lead to what is increasingly viewed as a contentious relationship among the Advisors, agency participants, and stakeholders.

Suggestion 5: We suggest that the charge of the Sciences Advisors should be well defined within the context of the CALFED Science Program. The degree to which the Science Advisors are allowed to offer independent evaluation and analysis of data associated with EWA actions or science needs should be clearly stated.

## Summary and Concluding Remarks

This report is the review Panel's fourth annual evaluation of the EWA. The Panel cautions readers of this report to be aware that many of the recommendations and topics of concern made in the previous three Panel review reports, not repeated here, remain highly relevant to EWA operations in 2004 and beyond.

Many positive findings were noted for 2004: (1) EWA continues to provide a high level of water supply reliability while protecting fish, (2) there has been a continued high level of cooperation among agencies and stakeholder in supporting the EWA concept, (3) acquisition of water continues to be an effective element of EWA operations, (4) the progress and evolution of EWA has been well documented through many agency reports, meetings, and workshops (5) communication and coordination among the EWA team and their decision making has resulted in timely and reasonable decisions, (6) several key areas of EWA science has evolved to yield new hypotheses and better management of at-risk fish species, (7) the integration and communication among environmental water programs has increased, (8) the potential integration of the IEP and CALFED Science program is a positive step, (9) the use of gaming and exercises has evolved in a positive way as a sound basis for determining the feasibility of EWA actions, (10) the release of a new Science PSP is positive and will inject new science into the EWA process, and (11) the scientific understanding of Delta smelt biology has made significant progress in the last four years and has provided a better basis for managing Delta smelt based upon their biology rather than take.

As the EWA evolves from an 'experiment' to a formal long-term program many science issues continue to need attention if EWA is to be managed with a sound scientific basis, and to assure that EWA assets are efficiently and effectively used in conjunction with other environmental water assets. The Panel recommends that a systematic approach to program integration be considered. Programs with similar goals such as the ERP and EWA or that may overlap in their roles such as EWA, EWP and the CVPIA Water Acquisition Program should be reviewed and a strategy for developing a synergy among these programs and their goals considered. We suggest focusing on integration to achieve synergistic biological benefits, rather than on other aspects of the programs such as personnel or finances.

The EWA should fully consider the biological consequences of their water purchases. Movement and deployment of EWA assets may have consequences for listed species, and these consequences should be incorporated and justified as part of decisions to manipulate and deploy water assets within the system.

With EWA moving from a 4-year experiment to long-term operation, the Panel believes that the scrutiny of EWA science and water management practices will be heightened. The science and management rationale for use of EWA assets and the future costs and benefits for at-risk species should be documented.

The EWA implementation process can be improved and the Panel offers three recommendations towards that goal.

- 1) The use of gaming has been a powerful tool for the EWA and the Panel anticipates a continued reliance on gaming for addressing many future issues. The Panel suggests caution in the interpretation and use of gaming results.
  - The Panel suggests that future gaming include more biological information and explicit treatment of uncertainty. Implementation of these recommendations will increase the power and utility of future gaming exercises.
- 2) The Panel believes that extreme care must be used to document and clearly describe gaming exercises to ensure models are being used appropriately to address specific questions.
  - The Panel recommends that EWA carefully document gaming analyses and consider the use of population models and models of fish movement, in conjunction with water resource models, to broaden the interpretation and utility of the gaming. The Panel also recommends that the stochasticity and uncertainty be considered in the application of these models and that the results be peer reviewed to assure proper use and interpretation of results.
- 3) The Panel has been frustrated with the lack of progress in enacting measures to increase new research efforts in support of the EWA, but the Panel sees the possibility of light at the end of the tunnel with the new Science Program proposal solicitations.
  - The Panel suggests the Authority consider implementing an additional small program to complement the larger PSPs to help build a bridge between academic and stakeholder researchers and agency scientists. This small program would provide seed money to develop research proposals, and would require collaborations between agency and non-agency research scientists as a criteria for funding. These proposals would provide a stimulus to developing new projects focused on topics relevant to management needs, while strengthening the options for managers to access resources outside of their agencies.

The EWA review process can be improved and the Panel offers five recommendations towards that goal.

- 1) The review meetings and presentations have become somewhat redundant and less useful than they could be.
  - Credibility of the Panel and the review requires that the annual EWA review be as transparent as possible. The Panel recommends a format that encourages more stakeholder participation.
- 2) The Panel believes that the preparation of the Panel for the review could be more effective.
  - The Panel recommends a more extensive dialog between the Panel and Science Program on the details of the agenda prior to the annual review meeting. We also suggest that more rigorous guidelines be adopted for presenters at the meeting so that the review is focused and presentations are not simply a review of written materials. We also recommend that Q&A time be emphasized in planning the agenda.
- 3) The Lead scientist has provided a written response to Panel's comments in the past.
  - The Panel suggests this practice be a formal part of the review process.
- 4) The Panel's effectiveness is diminished if progress on key issues is limited between annual reviews.
  - The Panel recommends that once the long-term EWA is in place a biennial (every other year) review be considered to allow the program time to make significant progress on key issues.
- 5) The role of the science advisors is poorly defined within the EWA science program and this has ambiguity concerning their role in the science process and reduces the effectiveness of having science advisors.
  - The Panel suggests the role of the science advisors be well defined within the context of the CALFED Science Program and that their responsibilities be clearly outlined.

## Reference

Van Rheenen, N.T., A.W. Wood, R.N. Palmer, and D.P. Lettenmaier (2004), "Potential implications of PCM climate change scenarios for Sacramento-San Joaquin river basin hydrology and water resource," *Climatic Change* 62: 257-281.

**EWA Review Panel 2004**

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## **LEAD SCIENTIST'S RECOMMENDATIONS TO ADDRESS SCIENCE NEEDS OF THE ENVIRONMENTAL WATER ACCOUNT**

Described below are the activities being planned by the CALFED Science Program to address EWA science needs. The activities are divided between two periods: 1) near-term activities to be completed in 2005, and 2) mid-term, activities undertaken through the end of Stage 1 (December 2007). Overall, most Science Program's efforts are designed to clarify the state of knowledge, reduce uncertainties, and improve the science efforts applied to understanding how current and proposed Central Valley water management practices affect the environment and its living resources. However, the activities described here only maintain Science Program efforts to meet EWA science needs. Additional commitments of state and federal agency staff and funding are needed to advance the rate of progress in developing a strong science base for the EWA.

### **I. Near-Term Activities**

These are activities the Science Program will pursue and complete in 2005, given existing staff and funding. These activities are intended to address some of the most immediate needs of the EWA and continue the Science Program's commitment to the EWA.

Hold two technical workshops to clarify the state of scientific knowledge and areas of greatest uncertainty relevant to two technical issues: 1) the Delta Action Eight experiment examining the survival of salmon emigrating through the North Delta; and 2) fish predation at the State Water Project (SWP) and Central Valley Project (CVP) Delta export facilities. Workshop results will be documented and available for use by EWA scientists and managers in allocating EWA water. The results will also be useful to other environmental water programs and other CALFED programs.

Continue funding two Science Advisors to extend the breadth of expertise within the Science Program and maintain the ability to provide direct input into agency technical analyses and experiments aimed at understanding the effects of EWA actions. The advisors will take the lead in organizing the above workshops and preparing the workshop summaries. The advisors will also prepare technical papers on the environmental factors affecting winter-run Chinook salmon abundance and a review of science uses in the EWA.

Increase technical staff expertise within the Science Program to allow the program to maintain its involvement in the EWA and water operations and to make progress on issues such as the development of performance measures that could be used in the evaluation of EWA and other CALFED programs. Zach Hymanson has recently been appointed as the new Science Program manager, and two or three additional senior technical staff are expected to be hired this year to help achieve Science Program goals.

Complete the Delta smelt and Salmonid white papers. These white papers synthesize a great deal of information about these native fish species and their habitats. This information is of direct use in developing the scientific information base for EWA actions and proposals for a long-term EWA.

Develop an EWA-specific research agenda. The agencies and Science Program need to jointly establish a written statement of EWA research priorities. Research that addresses questions about the EWA will undoubtedly provide information relevant to questions about many other Delta Improvement Program (DIP) actions. This EWA-specific research agenda would comprise part of the updated Science Program research agenda, which will be developed with the assistance of the ISB during 2005. This updated research agenda would be reflected in the next Science Program proposal solicitation process (see mid-term activities).

Support Independent Science Board (ISB) 2005 activities. The ISB work plan (Attachment 3) includes activities that directly relate to the EWA. Through subcommittee activities, the ISB will examine the potential integration of environmental water programs, evaluate the application of science practices to the DIP, identify ways to improve modeling and monitoring tools, and develop guidance on the identification and use of program performance measures.

Pursue reformation of the EWA Technical Review Panel. The Panel has successfully completed its four-year obligation. The Lead Scientist will work with Panel and ISB members to propose a new technical review panel that could evaluate the technical basis of any proposed long-term EWA or consider technical issues related to environmental water programs more generally. The structure and function of such a panel is an issue the ISB Environmental Water subcommittee will address. The timing of subsequent reviews will depend on when the agencies complete analyses and develop detailed descriptions of a proposed long-term EWA.

Provide technical input into future gaming exercises. The EWA Panel recognized gaming as a powerful tool to explore the consequences of proposed changes to water management practices and the application of EWA assets. At the request of agency representatives, the Science Program will bring in outside experts who can advise on the set-up and interpretation of future gaming exercises. The Science Program is also willing to explore interest in a policy-level gaming exercise. This exercise would directly engage policy level agency representatives in the evaluation of alternative scenarios under the EWA or more generally the DIP. This exercise would help to determine what tools and information are most important to advancing the EWA or DIP, where uncertainty is largest, and what technical work is most needed in the next one to two years to inform near-term decision-making.

## II. Mid-Term Activities

These are activities the Science Program will pursue during the final years of Stage I (2005 through 2007). These activities could provide information useful to the EWA, but the activities are also intended to fulfill some of the Science Program's commitments to meet the broader CALFED Program needs.

Continue near-term activities. Continue to conduct technical workshops, support the Science Advisors, review the EWA, and support ISB activities.

Complete the Science Program Proposal Solicitation Process (PSP). The application period for the first Science Program PSP closed January 6, 2005. The main purpose of this PSP is to invest in projects that develop new knowledge about how water use and management activities interact with and affect key aquatic species and environmental processes across spatial and temporal scales. Many of the proposals are expected to offer new research directly relevant to the EWA. Research results from this PSP will be available between 2007 and 2009.

Initiate a new PSP each year to address the mid- and long-term (Stage II) information needs of the CALFED programs. For example, the next PSP could include a request for proposals to specifically address EWA research needs identified in an EWA-specific research agenda. The release of the next Science Program PSP is scheduled for early 2006, but any new PSP is directly dependent on future funding.

Evaluate mid- and long-term science needs across all CALFED programs. This information can be used to structure future Science Program PSP's. This information will also allow the programs to assess science needs in the context of the recently completed 10-year finance plan to determine if duplication or gaps exist in the science information needs.

Assist in the development of program performance measures. Working with the ISB in 2005, the Science Program expects to develop objective processes for the identification and use of program-specific performance measures. These processes will then be applied to the various CALFED programs to permit meaningful performance assessment. These processes will be shared with agency staff for use in the identification of performance measures for the EWA and other CALFED programs.

### III. Conclusions

The independent technical reviews of the EWA have identified concerns with the limited progress in developing a strong science base for the EWA. Moreover, the findings and conclusions of the EWA Panel also apply to several of the CALFED water management/fish protection actions described in the DIP.<sup>1</sup> This assertion is based on the fact that other programs described in the DIP will require much of the same scientific information needed for the EWA. The activities described here only maintain Science Program efforts to meet EWA science needs. Additional agency commitments of staff and funding are needed to advance the rate of progress in developing a strong science base for the EWA.

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<sup>1</sup> Delta Improvements Package Implementation Plan Regarding CALFED Bay-Delta Program Activities in the Delta. CBDA staff draft. August 12, 2004.

<sup>5</sup> Actions/products identified under the "Planned Activity" column in the table refer to specific deliverables as defined in the draft Operating Guidelines for the ISB. Abbreviated definitions for these six types of activities are provided at the end of table.

## 2005 Independent Science Board Work Plan

### Summary of December 2004 Authority/BDPAC Discussion

The 2005 ISB work plan was presented by ISB Chair, Dr. Tom Dunne, at the December 2004 joint meeting of the Authority and BDPAC. The next meeting of the ISB is scheduled for February 22-23, 2005. Because the ISB has not met since the last Authority/BDPAC meeting, there is no new information to report from the ISB to the Authority. Below is the 2005 ISB Work Plan as presented in December 2004.

### Work Plan Purpose

To articulate and communicate planned ISB activities for 2005, aid in planning future meeting agendas, and determine resources needed to support ISB activity.

### ISB Charge

The overarching charge to the ISB is to: "*Directly advise the Authority's governing body on the application of science and the effectiveness of science across the Bay Delta Program*".

### ISB Goals

The following four goal statements were derived from ISB discussions at its first meeting in October 2003. They are intended to summarize how the ISB will operate as an oversight board responsible for looking at science across the entire CALFED Program.

- Provide oversight on issues of science throughout the program.
- Promote integration across program elements.
- Focus on large scale, long term issues that affect the entire program.
- Identify scientific issues of fundamental concern to the program and provide recommendations on how they should be addressed.

### Work Plan

The attached table identifies planned activity and a proposed timeframe for several topics that the ISB anticipates working on in 2005. In addition to known listed topics, the ISB anticipates that it will be responding to questions and/or requests posed by the Lead Scientist or the Authority throughout the year.

Throughout their discussions of these issues, ISB will seek to identify the highest priority needs for science to support decision-making and report these to the Authority via their annual assessment of the Science Agenda. In all their work products, the ISB will explicitly consider future changes in the natural and human drivers of the system and new opportunities that arise including:

- Climate change and variability.
  - Population growth and development.
  - Availability of new technologies and approaches.
-

**2005 ISB Work Plan**

Topic	Planned Activity	Timeframe for Completion	Action Product <sup>5</sup>
<b>Performance Measures</b>	<ul style="list-style-type: none"> <li>Develop road map to guide development of performance measures</li> </ul>	Initial May 2005	Original Approach
	<ul style="list-style-type: none"> <li>Test and refine road map</li> </ul>	September 2005	Commentary
<b>Delta Improvements Package (Increased Pumping Rates/Long-term EWA)</b>  <b>Continuing activity – 2005 activities focus on two questions.</b>	<b>What science is currently being used to support decision making about delta improvements, and what could be used, both in the short-term and the long-term?</b> <b>Current</b> <ul style="list-style-type: none"> <li>Identify and appraise scientific foundation of source documents, e.g., IEP reports, draft EIS/EIR.</li> <li>Work with the WMSB to address efficacy of current methods for predicting water yield.</li> </ul> <b>Future</b> Work with CWEMF to plan workshop (Fall 2005) to explore use of modeling in anticipating whether increased pumping capacity can provide more flexible approaches to water quality management and ecosystem restoration.	Initial evaluation May 2005 Continue throughout EIS/EIR process  December 2005	Commentary  Original Approach
<b>Levees</b>	<ul style="list-style-type: none"> <li>Subcommittee to prepare ISB recommendation to CBDA based on work of Mount/Twiss/Keller.</li> </ul>	February 2005	Original approach
<b>Integrated Use of Environmental Water</b>	<ul style="list-style-type: none"> <li>Subcommittee to begin evaluation of use of current resources including EWP, EWA, CVPIA b2 &amp; b3 water</li> <li>Subcommittee to develop recommended approach for more detailed evaluation</li> </ul>	Update February 2005	Commentary
<b>Use of science in system-wide decision making</b>	<ul style="list-style-type: none"> <li>Continue survey of existing monitoring programs and assess their utility in addressing selected hypotheses underlying the program.</li> </ul>	February 2005	Original approach

	Explore the formation of technical panel to evaluate potential for an integrated observation and forecasting system for the Bay-Delta and its watershed.	Charge Feb 2005 Interim report December 2005	
<b>Water Quality</b>	<ul style="list-style-type: none"> <li>Board discussions to refine focus in early 2005.</li> </ul>	TBD	
<b>Lead Scientist/Authority Requests</b>	<ul style="list-style-type: none"> <li>To be determined.</li> </ul>	Throughout year.	TBD
<b>Legislative Directive</b>	<ul style="list-style-type: none"> <li>Individual Board members work with Science Program to develop plan for research to answer the Legislatures question regarding how much water is necessary for the full recovery of all delta dependent special status fish species?</li> <li>ISB defines its role in the strategy</li> </ul>	Prior to February 2005	
<b>ISB Annual Review of Science Program</b>	<ul style="list-style-type: none"> <li>Review and comment on science activity within the program.</li> <li>Comment on:                             <ul style="list-style-type: none"> <li>Science practices</li> <li>Planned investments</li> </ul> </li> </ul>	Plan Review in February 2005  December 2005	Review/Commentary
<b>ISB Annual Report</b>	Prepare annual report summarizing 2004/5 activity of the ISB.	Draft September 2005 Final December 2005	Original Approach

Actions/Products

**Consultation** - oral advice on a technical issue prior to having staff begin substantive work on that issue.

**Advisory** - written advice on technical works-in-progress.

**Review** - assessment on the application of science within CBDA, including how scientific reviews are being organized and how recommendations are being used.

**Commentary** - forward-looking comment in the form of a short communication.

**Original Approach** - original ideas and suggestions developed by the ISB regarding emerging or overarching scientific or technical issues.

**Briefing** - presentation and other information provided to the ISB regarding pertinent scientific and technical issues and activities.