2005 ISB Work Plan

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 Bay Delta 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[1]
Performance Measures	• Develop road map to guide development of performance measures	Initial May 2005	Original Approach
	• Test and refine road map	September 2005	Commentary
Delta Improvements Package (Increased Pumping Rates/Long-term EWA) **Continuing activity – 2005 activities focus on two questions.**	**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?** **Current** • Identify and appraise scientific foundation of source documents, e.g., IEP reports, draft EIS/EIR. • Work with the WMSB to address efficacy of current methods for predicting water yield. **Future** • 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
Levees	• Subcommittee to prepare ISB recommendation to CBDA based on work of Mount/Twiss/Keller.	February 2005	Original approach
Integrated Use of Environmental Water	• Subcommittee to begin evaluation of use of current resources including EWP, EWA, CVPIA b2 & b3 water • Subcommittee to develop recommended approach for more detailed evaluation	Update February 2005	Commentary

[1] 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.

Use of science in system-wide decision making	• Continue survey of existing monitoring programs and assess their utility in addressing selected hypotheses underlying the program. Explore the formation of technical panel to evaluate potential for an integrated observation and forecasting system for the Bay-Delta and its watershed.	February 2005 Charge Feb 2005 Interim report December 2005	Original approach
Water Quality	• Board discussions to refine focus in early 2005.	TBD	
Lead Scientist/Authority Requests	• To be determined.	Throughout year.	TBD
Legislative Directive	• 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? • ISB defines its role in the strategy	Prior to February 2005	
ISB Annual Review of Science Program	• Review and comment on science activity within the program. • Comment on: - Science practices - Planned investments	Plan Review in February 2005 December 2005	Review/Commentary
ISB Annual Report	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.

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Agenda Item: 9-8
Meeting Dates: February 9 and 10, 2005

JOINT MEETING WITH BAY-DELTA PUBLIC ADVISORY COMMITTEE

CONSIDERATION OF A RESOLUTION APPROVING THE NOMINATIONS OF DR. RICHARD ADAMS AND DR. WARNER NORTH TO THE INDEPENDENT SCIENCE BOARD

Summary: This resolution would appoint Drs. Richard Adams and Warner North to the Independent Science Board.

Recommended Action: Staff recommends that the Authority adopt the attached Resolution 05-02-01 which would continue the tradition of appointing internationally respected scientists to the Independent Science Board.

Background

The California Bay-Delta Authority Act states: "The Lead Scientist shall nominate, and the Authority shall establish, a board of independent scientists, to be known as the Independent Science Board, that shall advise and make recommendations to the Authority and the Bay-Delta Public Advisory Committee, as appropriate, on the science relative to the implementation of all program elements." The Independent Science Board (ISB) currently has 15 members. The original 13 members were nominated by the Lead Scientist and approved at the August 2003 Authority meeting. Dr. Sam Luoma and Dr. Tom Dunne were nominated by the Lead Scientist and approved as members of the ISB by the Authority at its August 2004 meeting.

The ISB was designed to be a standing board of distinguished experts (scientists and engineers) made up of individuals with a range of multi-disciplinary expertise balanced among those with local experience and those with relevant external expertise. The ISB will not pass direct judgment on the success or failure of the Authority's programs, but instead provide insights that can make the science underlying those programs, the application of that science, and the technical aspects of those programs the best they can be.

It is expected that the ISB will grow to address the additional needed expertise and that this process will occur as more programs begin to use advisory and review panels. While the ISB intends to maintain the necessary expertise to address the breadth of the issues confronting the State and federal agencies implementing the CALFED Program, the ISB also intends to be no larger than approximately 25 members total.

Discussions with the Lead Scientist and the Authority, and within the ISB, have resulted in the identification of the following disciplines as those of interest to be added to the ISB:

- Resources Economics
- Risk and Decision Analysis
- Social Geography
- Organization Design, Innovation and Change
- Environmental/Water Law

At this time, the Lead Scientist is nominating two additional individuals for consideration by the Authority as ISB members to address the first two disciplines listed above.

Dr. Richard Adams is a Professor of Agricultural and Resource Economics at Oregon State University. Dr. Adams has spent the past 20 years focusing on the interface between agriculture and the environment and will bring this expertise to the ISB.

Dr. Warner North is President and Principal Scientist of NorthWorks, Inc., and a consulting Professor in the Department of Management Science and Engineering at Stanford University. Dr. North specializes in decision analysis and risk analysis for electric utilities, petroleum and chemical industries, and for government agencies with responsibility for energy and environmental protection.The additions of Drs. Richard Adams and Warner North will add to the expertise currently found on the ISB (Attachment 1)

Fiscal Information

Funding for the ISB is part of the CALFED Science Program budget. ISB members are compensated for their time as is standard when participating on a standing board or technical panel.

List of Attachments

Attachment 1 -- Brief Biographies for Drs. Richard Adams and Warner North
Resolution 05-02-01

Contact

Dr. Johnnie Moore Phone: (916) 445-0463
Lead Scientist

BRIEF BIOGRAPHIES OF INDEPENDENT SCIENCE BOARD NOMINEES

Dr. Richard Adams and Dr. Warner North

Richard Adams, Ph.D.

Professor of Agricultural and Resource Economics, Department of Agricultural and Resource Economics Oregon State University

Dr. Richard Adams holds a Ph.D. from the University of California, Davis and his research for the past two decades focuses on the interface between agriculture and the environment. Specific resource areas include economic analyses of climate effects on agriculture and agricultural resources, water resources management (quantity and quality), effects of environment degradation such as air quality on crops and forests, the design of regulatory policies to correct agricultural externalities, and the valuation of nonmarket goods. Dr. Adams has published over 150 journal articles, book chapters, and other peer-reviewed publications. He has served on numerous governmental panels and committees addressing agricultural and environmental issues. In the past he served in various editorial capacities for several journals including American Journal of Agricultural Economics, Journal of Environmental Economics and Management, and Water Resources Research and has served on several peer review panels including U.S. Environmental Protection Agency (USEPA) Photobiology Peer Review Panel, USEPA Air Ecology Peer Review Panel, Congressional Panel, Global Climate Change, and US Dept. of Energy Peer Review Panel on Environmental Economics. Dr. Adams has received professional recognition from the American Agricultural Economics Association, U.S. Environmental Protection Agency, Water Resources Research, and Western Agricultural Economics Association.

Dr. Warner North, Ph.D.

President and Principal Scientist of NorthWorks, Inc., and consulting Professor in the Department of Management Science and Engineering at Stanford University.

Over the past thirty years Dr. North has carried out applications of decision analysis and risk analysis for electric utilities in the US and Mexico, for the petroleum and chemical industries, and for government agencies with responsibility for energy and environmental protection. He has served as a member and consultant to the Science Advisory Board of the USEPA since 1978, and was appointed by the President to the US Nuclear Waste Technical Review Board (1989-1994). Dr. North is a co-author of many reports dealing with environmental risk for the National Research Council of the National Academy of Sciences, including “Risk Assessment in the Federal Government: Managing the Process” (1983), “Improving Risk Communication” (1989), “Science and Judgment in Risk Assessment” (1994), and “Understanding Risk: Informing Decisions in a Democratic Society” (1996).

Dr. North is a past president (1991-92) of the Society for Risk Analysis, a recipient of the Frank P. Ramsey Medal from the Decision Analysis Society in 1997 for lifetime contributions to the field of decision analysis, and the 1999 recipient of the Outstanding Risk Practitioner Award from the Society for Risk Analysis. Dr. North received his Ph.D. in operations research from Stanford University and his B.S. in physics from Yale University.

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Agenda Item: 9-8
Meeting Date: February 9 and 10, 2005

CALIFORNIA BAY-DELTA AUTHORITY
RESOLUTION 05-02-01

APPROVING THE NOMINATIONS OF DR. RICHARD ADAMS AND DR. WARNER NORTH TO THE INDEPENDENT SCIENCE BOARD

WHEREAS, the California Bay-Delta Authority Act requires the Lead Scientist to nominate, and the Authority to establish, a board of independent scientists, to be known as the Independent Science Board, to provide advice and recommendations to the Authority and the Bay-Delta Public Advisory Committee on science issues related to all CALFED Program elements; and

WHEREAS, the Independent Science Board currently has 15 members, with the original 13 members nominated by the Lead Scientist and approved at the August 2003 Authority meeting, and the latter two nominees approved at the August 2004 Authority meeting; and

WHEREAS, the Lead Scientist has nominated Dr. Richard Adams and Dr. Warner North as individual experts to serve on the Independent Science Board based on, among other things, their scientific stature, advisory experience, technical publications, relevant knowledge, people skills, reputation for achieving balance, and interdisciplinary skills;

NOW, THEREFORE, BE IT RESOLVED that the California Bay-Delta Authority approves these nominees as official members of the Independent Science Board.

CERTIFICATION
The undersigned Assistant to the California Bay-Delta Authority does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the Authority held on February 9 and 10, 2005.

Dated: _____

_____
Jamie Cameron-Harley
Assistant to the California Bay-Delta Authority

California Bay Delta Authority
Independent Science Board Meeting
UC Davis, Buehler Alumni Center, Davis, CA
Wednesday, November 10, 2004, 1:30 p.m.– 5:30 p.m.
UC Davis, PES Building, Davis, CA
Thursday, November 11, 2004, 8:30 a.m.– 5:00 p.m.
Friday, November 12, 2004, 8:00 a.m.– 12:00 p.m.

Action Items

ISB Activities

1. All members of ISB send suggested names for fish ecologist slot to Lead Scientist by Dec. 15.
2. Lead Scientist's response to Legislative Directive regarding water requirements for fish will incorporate an implementation strategy that provides for interaction with the ISB over the long term. Cummins and Rose will facilitate the ISB's review of this plan prior to January 10th. In addition, Cummins and Rose will draft a letter that endorses the plan and affirms ISB's role in the implementation of the plan. This letter will be sent to ISB members for comment before being finalized.

Water Supply

3. Water Supply Fact-Finding Team (Luoma and Freyberg) will draft a request to the Water Management Science Board requesting that this Board consider assumptions and current methods of projecting water yield, supply and pumping. This request will be presented to the ISB at the February 2005 meeting.

Modeling

4. Modeling Fact Finding Team (Melack & Koseff) will continue to work with CWEMF to explore the use of modeling to address the question: Will increased (pumping) lead to management flexibility and thus better water quality and increased ecosystem function?

Monitoring

5. Monitoring Fact Finding Team (Glaze & Meyer) will continue fact finding and will draft charge for proposed Observation and Forecasting Technical Panel prior to Feb 1.

EWA-ERP Integration

6. EWA-ERP Integration Subcommittee (Rose, Patten, Freyberg, Cummins, Ingram) will draft an outcome report including recommendations. In addition, they will develop a charge for a follow-up Subcommittee with the broader purpose to consider integration across the four environmental water programs. This charge will be submitted to the Lead Scientist and to the ISB prior to the February ISB meeting.

Levees

7. Levees Fact Finding Team (Mount & Twiss) will finalize report and submit to ISB (via staff). Board agrees to accept the report as is.

8. [New] Levee Subcommittee (Ingram, Freyberg, Reed, Keller) will draft recommendations for the CALFED Authority based on the analysis in the finalized report and present these draft recommendations to the ISB at the February 2005 ISB meeting.

Performance Measures

9. Performance Measure Subcommittee {Cummins, Meyer, Keller, Twiss, (Ingram)} will convene working group to develop "PM Road Map" and draft decision-tree template (March 2005) and will pilot this template with the Science Program (Sept 2005).

DIP

10. DIP Fact-Finding Team (Reed, Meyer) will identify and appraise scientific foundation of source documents, *e.g.*, IEP reports, draft EIS/EIR and present an initial evaluation to ISB in May 2005.

Science Agenda

11. Lead Scientist to compile the elements of the Science Agenda that should be reviewed, *i.e.*, structure of Science Agenda prior to Jan 1. Science Program Review Team (Glaze & Dunne) will develop a straw proposal about how review will be conducted and present this to the ISB in February.

Staff Tasks

12. Staff will send link to CMARP to ISB.

Agenda for February 22–23 ISB meeting

The ISB members discussed a desired agenda for the next meeting and arrived at the following preliminary list of potential topics:

– VAMP
– Performance Measures Task Subcommittee report
– Monitoring Team report
– EWA/ERP Subcommittee report
– Levees Subcommittee report
– Modeling opportunities with the Modeling Forum and WMSB
– Review of Science Agenda

The Chair and Vice-chair will work to further develop the agenda.

Future Meeting Dates

ISB 2005 Meeting Schedule

– February 22–23 (Tuesday–Wednesday)
– May 10–12 (Tuesday–Thursday)
– September 20–22 (Tuesday–Thursday)
– December 5–6 (Monday–Tuesday)

Other Meetings

– Authority, February 9–10
– BDPAC, March 10
– Authority, April 13–14
– BDPAC, May 12
– Authority, June 8–9
– BDPAC, July 7
– Authority, August 10–11
– BDPAC, September 8
– Authority, October 12–13
– BDPAC, November 10

– Joint Authority and BDPAC, December 7–8

Handouts

– *Preliminary Thoughts on a Baseline Aquatic Monitoring Program for CALFED* (Brown)
– *Thoughts on CMARP: An Annotated Outline for the CALFED Independent Science Board* (Brown)
– *2005 ISB Work Plan*, Draft 11/11/04 (Reed)
– *Environmental Monitoring Program Review and Recommendations Final Report*, March 25, 2003; Interagency Ecological Program
– *EWA/ERP Report to ISB, November 12, 2004* (Rose)
– *Designing and Implementing Monitoring Programs*, in Managing Troubled Waters: The Role of Marine Environmental Monitoring, 1990
– *Grist for Modeling* (Twiss)

Presentations

– *Performance Measures Subcommittee: Observations* (Cummins)
– *Lead Scientist Report to the Independent Science Board November 11, 2004* (Moore)
– *Preview of EWA Technical Review Panel Report November 10, 2004* (Rose)
– *EWA/ERP Integration Subcommittee Report to ISB November 12, 2004* (Rose)
– *Water for Fish and Wildlife Resources, from Guinee* (Rose)
– *Integrating Observations and Simulations Towards Decision-Making: The Columbia River Experience* (Baptista)
– *Director's Update* (Wright)
– *Monitoring Team Draft Workplan* (Glaze)

– Meeting Summary, November 11, 2004

ISB Members in attendance

Ken Cummins, Ph.D.	Jack Keller, Ph.D.	Kenny Rose, Ph.D.
Tom Dunne, Ph.D.	Sam Luoma, Ph.D.	Duncan Patton, Ph.D.
David Freyberg, Ph.D.	Judy Meyer, Ph.D.	Bob Twiss, Ph.D.
Bill Glaze, Ph.D.	Jeff Mount, Ph.D.	
Helen Ingram, Ph.D.	Denise Reed, Ph.D.	

Independent Science Board Members not in attendance

Jeff Koseff, Ph.D.

CBDA Staff

Zach Hymanson	Tim Ramirez	Patrick Wright
Ladd Lougee	Rhonda Reed	
Johnnie Moore, Ph.D.	Kim Taylor, Ph.D.	

Support Staff

Kateri Harrison	Diana Roberts
Maryann Hulsman	Elizabeth Soderstrom, Ph.D.

Other

Antonio Baptista, Ph.D.	Randy Brown, (retired DWR)	Ginnie Cahill (CA DOJ)

Welcome (Dunne)

Meeting convened 8:35 a.m.

Jack Keller was selected by Scientific American as one of fifty Americans benefiting science and technology, for his role in delivering appropriate technology for the benefit of the world's poorer farmers. Dunne brought a notice for meeting attendees to read.

Soderstrom discussed meeting logistics, including the procedure for public comment.[1] Some implementing agency and CBDA representatives will be invited to participate in discussions.

Schedule for 2005 ISB meetings was announced. Three-day meetings include a half-day for subcommittee meetings. At two-day meetings, subcommittees may choose to meet for a half day preceding the meeting.

Review Agenda

The meeting's topics were designed to address the question or whether monitoring and modeling have a broader utility throughout CALFED beyond water quality. The ISB will determine next steps, including developing 2005 workplan, based on discussions and presentations from Randy Brown (CMARP), Antonio Baptista (monitoring and modeling on the Columbia River), Dunne (ERPSB investigations into science questions of concern to policy makers), and subcommittee reports.

Potential Conflict of Interest disclosures are available on the ISB webpage on the CBDA website. Members who have not yet updated their information were requested to do so.

[1] As usual, public comment for items not on the agenda will be heard towards the end of the meeting as shown on the agenda. Public comments for topics that are listed on today's agenda may be heard during the presentation/discussion, upon completion of a blue card.

Approval of ISB's September 2004 Meeting Summary
Meeting summary was approved, pending change of incorrect references to month of meeting.

Director's Update (Wright)

Federal Funding Authorization
Congress has authorized $400 million for new CBDA projects.[2] California will support federal legislation. This is the greatest degree of financial security that CALFED has seen to date.

10-Year Finance Plan
The 10-Year Finance Plan will be given to the Authority for approval in Dec. 2004. Because bond monies will run out in the next few years, new sources of funding are needed.[3] Current science funding is primarily for the Interagency Ecology Program (IEP) and the Science Program (SP). The IEP budget expects an increase of $15 million, with an approximately equal split between federal and state.

Ecosystem Restoration Program (ERP)
ERP has extended its commitments under the 2000 ROD.[4] The commitment depends on $150 million/year for ERP budget.

Environmental Water Account (EWA)
EWA has been extended for another three years as a pilot project.

San Joaquin River
The 2004 court decision on Friant Dam's operations[5], together with the realization that upstream water is insufficient to meet downstream needs, has aroused political interest in the San Joaquin River, uniting environmental and Delta interests. Implementing agencies are working toward a restoration plan, which needs a science component.

Water Quality
The Delta provides two-thirds of the state's water supply, but despite its importance, development of a vision for protecting water quality has been hampered for several reasons, including the diversity of constituents, lack of central responsibility, and late start of CBDA's water quality program relative to other CBDA programs. A central vision is needed.

Water Management
Bulletin 160 an update of the *California Water Plan* by DWR will be issued, probably in Spring 2005. It is expected to contribute to a more integrated approach with respect to water sources and to match regional needs with regional potential[6].

Levee Program
Two recent events have focused attention on the need for a reliable levee program. First, DWR was sued successfully and now has financial liability for the whole levee system, and second, Jones Tract failed. CBDA and other groups are now approaching flood control and levees from a more complete perspective, considering fiscal, policy, and scientific concerns, including modeling.

[2] Most projects are already authorized; new projects include the Corps' state levees program.
[3] There is disagreement about who should have primary responsibility for funding programs: the public or water users, still under discussion.
[4] The extension is based on the assessment that ERP is making good progress toward its goals
[5] U.S. District Court Judge Lawrence Karlton heard the case.
[6] See DWR website at http://www.waterplan.water.ca.gov/b160/indexb160.html for more information.

Delta Improvements Package (DIP)

DWR and the Bureau of Reclamation are developing a draft plan to increase pumping of water from the south Delta (*8500 plan*). The working hypothesis is that increased flexibility in pumping will simultaneously increase water supply reliability and allow for maintenance and improvement of ecosystems and water quality.[7] An underlying premise of the ROD and DIP is that sending water through the Delta, increasing flexibility, and improving science, will make it possible to successfully juggle complex water demands without building a large dam. Wright hopes that the SP and the ISB will devise a plan to inform this debate. The ISB could sponsor white papers, panels, and workshops. The challenge is to send a message in such a way as to effect change.

Discussion

With the proposal to pump more water, the burden of demonstrating environmental compliance[8] rests on DWR and the USBR (through the NEPA/CEQA process). Doubling available water could enable experiments to investigate both water supply and fish populations. However, serious consequences on fish populations and other ecosystem concerns might not be immediately obvious. Specific concerns expressed:

- If too little data exists on whether increased pumping affects fish adversely, the lack of evidence could be used to enable the program to proceed.[9]
- A DWR team is writing a white paper on floodplain management throughout the state[10], which focuses more on the state's liability issue and less on regional issues and potential system-wide changes. The ISB will watch for the paper's appearance, expected early in 2005.
- The assumption is that increased pumping will also increase water supply reliability. However, Luoma noted the Environmental Defense Fund data indicates diversions may interact with increased pumping. This cross-cutting question could be explored by the ISB.[11]

The Water Management Science Board (WMSB) has appropriate skills[12] and will discuss this question at their January 2005 meeting. Keller will report at the February 2005 ISB meeting. Also, the EWA panel has knowledge of the south Delta Improvements Package and could provide valuable input and play an important role in this investigation.

The question of increased pumping is not solely a water management problem, but a whole system problem.[13] If the WMSB does not sponsor a formalized aquatic habitat analysis, the ISB needs to find another group to do so.[14] Freyberg and Luoma will draft the charge for the WMSB, to consider this issue.

Science Program Update (Moore)

Moore noted the following:

- 2004 Annual Report is nearing completion.

[7] Stakeholders have differing perspectives. The water supply perspective is supportive, expecting large benefits. The environmental perspective is concerned, maintaining that the Bay-Delta system is already under stress, and pumping more water will increase that stress.

[8] Specifically, they must demonstrate that increased pumping will not harm species of significance, particularly fish.

[9] This is particularly likely because water supply data is fairly definitive, whereas scientific information for interpreting biological data is still being developed.

[10] CALFED has provided comments on the paper, but it is unclear how the comments will be used.

[11] Questions to investigate could include current diversions and potential trends in diversions under the new regime, hydrographs under different weather years, potential changes to these hydrographs under a regime of increased pumping, potential for water conservation to play a role, and effects on biology.

[12] Modelers, conveyance, storage.

[13] For example, diversions are not concerned with velocities, which are of great importance for ecosystems, affecting among other factors sediment and temperature. Other questions include potential changes to the hydrograph under varying annual weather and flow regimes.

[14] Cummins noted that any study should consider the fact that species have evolved a lifecycle to match the historic stochastic flow and environmental regime (including daylight), and humans have introduced an altered regime that they are not adapted to.

- 10-Year Finance Plan is nearing completion.
- SP Strategic Plan is needed to help provide a broader view of core issues and a more concrete understanding of specific goals and objectives. Advice from the ISB will be sought.
- EWA planning is underway to modify charge and panel membership for the next three years and for the longer-term EWA.
- Science Boards are organized such that the ISB has direct access to the Authority. Other science boards report directly to the programs that sponsor them, but there is an informal link between these other boards and the ISB for direct communication. See org chart in Moore's power point presentation.
- New positions for the Science Program have been requested but have not yet been approved including: a Science Program Manager, an administrator for contract processing, and up to four scientific staff. Moore hopes that the additional personnel will allow the SP to do its own science in addition to guiding scientific explorations of other organizations.
- The CBDA Science Conference sponsored 240 presentations and 185 posters, with 1,100 attendees from academia to implementing agencies. Abstracts are available on the SP website.
- Moore encouraged ISB members to submit articles to the On-Line Journal called *San Francisco Estuary and Watershed Science*[15] which is indexed by abstracting services.

SP PSP

The SP's first PSP has been issued: $18-20 million available to develop new knowledge about the interaction of water use and management activities with key aquatic species and environmental processes, across spatial and temporal scales. Due date for proposals is January 6, 2005. The SP needs reviewers to evaluate proposals; ISB members were asked to inform colleagues.

Moore proposed an institutional annual cycle of SP grants perhaps, $15–18 million annually over next ten years.

Workshops

In 2004, the following workshops were held:

- Making Science Work for Suisun Marsh. Summary on website http://science.calwater.ca.gov/workshop/past_workshops.shtml#suisun.
- Gravel Introduction Workshop (aka Rivers, Rocks, and Restoration. See website at: http://science.calwater.ca.gov/workshop/workshop_071304.shtml). Produced in conjunction with ERP.
- EWA. Review of first four years in October 2004. All documents are on EWA website at http://science.calwater.ca.gov/workshop/ewa.shtml.
- Contaminant Stressors in the Bay-Delta. Science Program Staff (Machula) is developing a white paper on this workshop's outcomes.

Topics for future workshops: levees, introduced species, rivers, landscapes, system change.

Conflict of Interest Guidelines (Ginny Cahill, DOJ)

Cahill and Chris Stevens have investigated ways to comply with the Bagley-Keene Open Meeting Act 2003 while conducting subcommittee and ISB business, in particular while working remotely.

Teleconferencing is possible if a meeting is publicly noticed and the space from which each phone-in call originates is designated a public meeting space. Communicating electronically is not legal because a judge has declared that not everyone has equal access to the Internet.

[15] View the Journal at the following website: http://repositories.cdlib.org/jmie/sfews/

Workshops pose potential conflict-of-interest problems for science board members. Holding two separate meetings—one workshop on content and a separate workshop or meeting on recommendations—will temporarily address this issue.

In November's election, voters approved an initiative that puts open meeting guidelines in the California Constitution.

Legislative Directive Update (Moore)

The California Legislature has requested the CBDA to develop a plan for a research agenda, due January 10, 2005, to answer questions about water needs for full recovery of threatened and endangered fish species, including amount and timing.

The strategy for answering the Legislature's directive is under development by SP staff. Staff's approach may be similar to the approach used by the ERP to study mercury contamination[16] with a series of three public workshops beginning in 2006: (1) current state of knowledge, (2) gaps not currently addressed, and (3) public comments on draft agenda. Workshop budgets and PSP funding will be consistent with 10-Year Finance Plan.

The response to the Legislature will discuss the following contextual issues.

- The SP, including the goals and objectives of the ERP and the SP's role in addressing ERP's goals and objectives. CBDA workshops and PSPs have been focusing on the question of water needs for full recovery of threatened and endangered fish species for some time.
- Regulatory issues such as endangered species [and other special status species] including Delta smelt, winter and spring Chinook, steelhead.[17]
- Environmental context will provide background information for those readers unfamiliar with CBDA and those who may not understand how changes in the system from its historical state constrain the possibilities for its current and future function. Big-picture landscape questions will be noted.

The SP hopes for feedback from science board members on the draft, projected to be available mid-December. Ramirez stressed that a clear workplan would likely minimize future Legislative requests. The workplan should include ISB appearance at Authority meetings.

Fact-Finding Teams—Status Report to ISB

Monitoring Team (Glaze and Meyer)

Glaze and Meyer are studying monitoring as it is used for real-time decision-making and how it could be incorporated into adaptive management (AM) for CALFED.[18] They developed a draft plan for 2005 ISB monitoring investigations, including the following steps.

- Identify agencies that have monitoring data.
- Catalog historical and current water quality and monitoring efforts by different agencies in the California Bay-Delta and relevant environs.
- Correlate these monitoring programs to the CBDA programs to which they apply.[19]

[16] At the public workshops, experts from around the country developed the workshop's product with staff support. The resulting agenda was commented on by the public and accepted by Authority; it is now being implemented.
[17] Luoma noted that the ERP Plan notes many other species of concern as well functions that are essential to the system. The response to the Legislative directive must mention the other species (for example, the Sacramento splittail) explicitly so they are not ultimately overlooked.
[18] The SP has developed guidelines for components that should be in a monitoring program, including a specification that funding be budgeted for periodic review, analysis, and special studies.
[19] This activity will follow the IEP review.

- In light of the appearance of new technology that enables new kinds of studies, investigate whether all parameters that could be monitored are being addressed.
- Explore BDAT and other data management systems. Karl Jacobs spoke with the Monitoring Team about BDAT, a data management system linking monitoring data from member organizations in a relational database, accessible via customized interfaces through the internet. Accessing monitoring data is essential to comprehensive monitoring.
- Coordinate with the Modeling Team.

See *Use of Science in System-Wide Decision-Making Including Monitoring and Modeling*, below, for implementation plans.[20]

Modeling Team (Melack)

Koseff and Melack[21] discussed with Nigel Quinn the possibility of CWEMF (the Modeling Forum) and the ISB working together on modeling.[22] ISB members could contribute to CWEMF's annual conference at Asilomar in May, including contributions to the agenda. Luoma noted that the Modeling Forum is principally internally focused, with modelers communicating primarily with other modelers. An ISB-sponsored working subcommittee or task force could help them have influence outside their immediate circle.

Discussion

Current modeling efforts emphasize water and fluid dynamics and lack a strong biology and fish-modeling component. A joint ISB/Modeling Forum group should include fish model experts and should take a whole-system approach. A possible activity of this group would be a workshop.

Most modeling does not address low-level policy questions. However, coarse-grained or "low resolution" modeling can address these questions. (See Low-Resolution Modeling below.) David Groves of RAND University will attend the Dec. ERPSB meeting for an informal workshop on low-resolution modeling, providing a possible opportunity for discussion between ISB and ERPSB members. The outcome and recommendations for next steps will be provided to Moore. Melack and/or Rose were invited to attend the next ERPSB meeting.

Background on CMARP by Randy Brown, Guest Speaker

Randy Brown was Chief of Environmental Services for DWR and headed the Comprehensive Monitoring Assessment and Research Program (CMARP). CMARP was an initiative of CALFED to design a system-wide monitoring program, staffed by representatives of the USGS, San Francisco Estuary Institute (SFEI), and the Interagency Ecological Program (IEP).[23] CMARP was created partly in response to the Department of the Interior's requirement that CALFED develop a program to measure its success in improving water supply reliability.[24]

CMARP's main focus was to understand the impacts of state and federal water projects, including impacts on fish populations, water supply (avoiding construction of the peripheral canal), and water

[20] Possibilities include developing a larger task subcommittee and hiring consultants through the SP to carry out this work (contracts could be made by April 2005).
[21] Twiss participated informally at various junctures.
[22] The workshop might address the specific question of whether increasing the south Delta pumping capacity (8500 plan) will increase flexibility in meeting CALFED's goals to increase water quality.
[23] CMARP's mandate can be found at http://iep.water.ca.gov/cmarp/reports/cmarp.doc and http://www.iep.water.ca.gov/cmarp/groups/toc.html.
[24] Two other programs have been established for monitoring: the Terrestrial and Amphibian Monitoring Program (TAMP) and the Aquatic Monitoring Program (AMP): http://calwater.ca.gov/ProgramPlans_2004/Ecosystem_Restoration_Program_Plan_7-04.pdf.

quality such as agricultural nitrogen in the estuary. The original CMARP steering committee contained state and federal staff and representatives from environmental agencies.

Many of CMARP's appendices from its final report are still used by experts. However, no monitoring program remains as a legacy.

In the past, CMARP was criticized for having too large a scope and "trying to be everything to everybody." The report on aquatic baseline recommendations lacked a conceptual framework.

Discussion

Brown suggested that high priority should be placed on monitoring for the following areas: water quality in relation to both drinking water and environmental water; fish habitat, including river and ocean; Suisun Marsh and its contribution to the larger Delta system. A great deal of data should be gathered for all fish species of concern; funding for fish monitoring is needed.

Devoting 5 percent of the CALFED budget to fund a monitoring system, particularly a large-scale comprehensive baseline monitoring system, might be hard to justify politically. It was suggested that before monitoring can be successful, performance measures should be established.

If funding and carrying out a comprehensive monitoring program is intractably difficult, the ISB has a responsibility to recognize this and notify CALFED.

Funding smaller geographic scale "comprehensive"[25] monitoring programs could be both feasible and effective; for instance, setting up a monitoring system on the watershed scale in a region that is data-rich. Cummins noted a National Water Quality Assessment Program (NAQWA), in place for 15 years in northern California, has both temporal and spatial components.

Integrating Observations and Simulations Towards Decision-Making: The Columbia River Experience, Antonio Baptista, Guest Speaker

Baptista is Professor and Department Head of the Department of Environmental and Biomolecular Systems at the Oregon Graduate Institute. He discussed Columbia River Estuary Real-Time Observation and Forecasting System (CORIE), a project of the Center for Coastal and Land-Margin Research (CCALMR), that has implemented monitoring and modeling on a large scale on the Columbia River and its coastal margin.

Background

"CORIE is a pilot environmental observation and forecasting system (EOFS) for the Columbia River"[26], part of an effort to understand the complex and vulnerable area where land and river meet ocean. Sustainability of coastal margin systems depends on correctly predicting system performance under a range of possible conditions. CORIE is funded at approximately $1 to $1.5 million yearly. Storms such as hurricane Frances in 2004 cause enough damage to justify the cost of monitoring and modeling on a sustained basis.

CORIE combines monitoring data (some real-time) with modeling to forecast salinity of the Columbia River and its plume into the eastern North Pacific Ocean. CORIE's purpose "to advance the emerging field of environmental information systems and the understanding of river-dominated estuaries and plumes"[27] is consistent with the purpose of Integrated Ocean Observing Systems (IOOS), identified by the U.S. Commission on Ocean Policy and the National Ocean Research Leadership Council as "a high

[25] "Comprehensive" in the sense of monitoring a wide range of factors, from chemical constituents in the water to fish populations
[26] http://www.ccalmr.ogi.edu/CORIE/about.html.
[27] ibid.

priority for interagency cooperation on ocean science and technology"[28]. This program will eventually create a number of permanent regional ocean observation systems across the country.[29] CORIE could eventually be integrated into a large-scale IOOS observation and forecasting system.

Monitoring

CORIE's observation network includes 20 stations that automatically collect data such as salinity and water levels and a field staff that services 20 additional monitoring stations. Automatically collected monitoring data is posted within one minute to the CORIE's website. After data is added to the database, it is analyzed to determine its quality.[30] A graphic representation of data is automatically generated for data for the previous 15 days.

Modeling

The CORIE team views modeling as a tool to obtain a deeper understanding of the system. Stand-alone models are not sufficient for this purpose. Rather, modeling *systems* are needed. For instance, CORIE models address systems from the river to continental shelf to open ocean.[31]

Modeling in CORIE has been primarily based on physical and hydrodynamic processes rather than biological, although some biological studies have used CORIE data.[32]

Discussion

Standards and protocols at the national level must be established in order to integrate small regional systems into one framework. To proliferate adherence to these standards, granting agencies could make adherence a prerequisite for receiving project funding.

For large-scale restoration programs, some evidence from Chesapeake Bay and Louisiana restoration suggests that smaller, integrated models can be more successful than large models. Smaller models are particularly important for some biological levels, for instance, food webs.

Water Modeling and Monitoring—Use in Decision-Making (Dunne)

Targeting Topics for Modeling

Four suggestions were made for how to identify topics for modeling within CALFED.[33]

1. Use existing CALFED documents containing goals and objectives not yet modeled.
2. Use the science boards to sift and prioritize targets.
3. Consider what could belong in a comprehensive long-term plan for CALFED, rather than depending on policy-makers to describe the future.[34]
4. Base targets on science not yet assimilated by the public and policy-makers.[35]

[28] http://www.ocean.us/ioosdevplan.jsp.
[29] Funding is expected to come from NOAA and states.
[30] *E.g.*, quality of bio-fouling data is determined by regressing temperature and salinity data in the local context.
[31] CORIE's modeling is currently primarily physics- and hydrodynamics-based.
[32] For instance, NOAA fisheries has used channel monitoring data to correlate with long-term biological surveys to characterize the environments where most fish are caught.
[33] It is important both to articulate possible uses of modeling, but also to indicate that using modeling to predict specific outcomes—such as fish population numbers—is unrealistic.
[34] For example, in 1963, in response to USACOE's plans to fill the SF Bay, Twiss projected their impact in the year 2020. His analysis had not been requested by policy-makers. This projection led to the Save the Bay movement, a very different outcome than could have been expected if scientists had followed policy rather than led.
[35] OCAP Workshop 1, for example, has not yet been assimilated into CALFED culture.

Societal Implications for Modeling

Appropriately complex models for complex systems can "buy time" for decision-makers and politicians to develop a mature agenda for managing the system. Ingram recommended that CALFED not develop and make use of overly simplistic models.[36]

Low-Resolution Modeling

ERPSB is currently interested in "low-resolution modeling." This approach is designed to point to robust policies by identifying the sensitivities of factors with respect to desired outcomes. At the Dec. 2004 meeting, they will begin evaluating this approach with "scenario generation": they will develop scenarios (for example, with or without the cross channel) for a static Delta, then compare predicted scenarios against a range of changed conditions (for example, sea-level rise).[37,38] The ERPSB intends to use this process to identify needs for models of higher resolution.

ISB-Sponsored Modeling Effort

The ISB will sponsor a modeling effort[39] involving the California Water and Environmental Modeling Forum. The purpose of the modeling effort will be to advise the Authority on useful modeling applications[4041]. A possible outcome will be ISB-sanctioned guidelines and examples to demonstrate the strengths and potential pitfalls of modeling. It is unclear whether the group will have a longer-term advisory and vision responsibility. Melack agreed to contact the Modeling Forum to gauge their interest in participating and to discuss recruiting biologists to complement the existing hydrodynamic modelers.

Reed and Dunne suggested the ISB articulate a specific question that can be informed by modeling such as whether increased pumping (8500 plan) will increase flexibility in environmental maintenance and restoration, as well as water supply.[42] The 8500 plan rests on the hypothesis that changed pumping in the Delta will increase flexibility.[43] Glaze suggested that such a question could inspire the modeling and monitoring efforts to merge at a later date to facilitate a broader understanding of the Bay-Delta System. Wright noted that a (high resolution) model is being developed on the water flow engineering side to test this hypothesis. Models to address the environmental perspective such as low-resolution models[44] or other appropriate resolution are needed

[36] A study on how water managers use modeling in the Chesapeake region demonstrated this (Ingram et al.).

[37] The following are examples of questions that the ERPSB hopes to answer.
Given the current Delta configuration, what would result from an earthquake in Antioch?
- What flow models currently exist that can inform the low-resolution modeling process?
- ERP should have hydrographs that that would help determine the effect of changed conditions, for instance on fish.

[38] Ingram suggested that resulting policies might be more robust because the process promotes agreement among the participants. Reed and Patten agreed, noting that decision-makers might be more interested in the trajectory of a given policy than in the actual figures a high-resolution model would generate.

[39] It was suggested but not resolved that this topic be expressed in terms of data gathering and forecasting.

[40] Board member suggested that modeling is useful to explore relationships among factors and to play a role in a scientific process that includes measurement, analysis, thinking scientifically, and modeling.

[41] A goal is to encourage modeling to be used to evaluate science issues related to CalFed.

[42] Moore formulated the hypothesis in these terms: changes in net flow of water in the Delta combined with other changes will have significant but unknown effects on ecosystem and fish populations in the Delta.

[43] A vision of nested and interconnected models to forecast potential benefits and risks of DIP to water quality, ecosystems, and water supply. Low-resolution modeling could be part of a layered modeling approach.

[44] However, Luoma suggested that because the model rests on intuition, clear criteria should be developed to ensure its proper scientific use and avoid special-interest misuse. Low-resolution modeling incorporates a political/policy component not part of traditional modeling.

Fact-Finding Teams—Next Steps

Monitoring Team (Glaze and Meyer), Modeling Team (Melack)

The Monitoring Team will do an overview of monitoring within CALFED, using San Francisco Estuary Institute's (SFEI's) catalog of monitoring projects, then study whether monitoring is currently structured appropriately to answer CALFED questions.[45]

Glaze and Meyer proposed a working group guided by but organizationally independent from the ISB. (See *Use of Science in System-Wide Decision-Making, Including Monitoring and Modeling* below.) The ISB would develop the working group's charge and scope and determine products and schedules. The SP would convene the group, which would report directly to the SP. Glaze and Meyer will confer with Moore on specifics, such as interaction of working group with the ISB. Moore will discuss contract possibilities with Kate Hansel, likely through ABAG.

The working group would focus on (1) understanding the major monitoring systems currently in existence, and (2) investigating the potential use of monitoring and modeling to understand entire Bay-Delta system. The working group's major initiative[46] would be to develop an observation and forecasting paradigm. This initiative could be very long-term; the working group membership should be relatively stable.

It was recommended that the Monitoring Team should interact with the Modeling Team and the Performance Measure Subcommittee. A future workshop or other mechanism can facilitate this interaction. Exploration of innovative approaches is encouraged.

Levees Team (Mount and Twiss)

Mount presented the paper on levees at an Authority meeting. It was well received. The Authority asked what they should do to help solve the problem. The topic has generated a great deal of scientific, policy, and public[47] interest and is expected to continue to do so.

A new ISB Levees Subcommittee will be convened before the February ISB meeting (possibly via conference call) to determine next steps. (See *Levees* below.) They will develop recommendations based on the analysis presented in the Fact-Finding Team's report (to be completed by Mount and Twiss).[48,49] Moore noted that the Subcommittee will spawn long-term activity because of widespread interest and suggested the Subcommittee identify any data gaps and if needed, host a workshop. This long-term activity could take place within the SP, within an ISB subcommittee, within the WMSB, or in a group established by the Authority.

Adjourn

[45] CALFED goals are vague, so hypotheses underlying the ROD and new scientific understanding will be used.
[46] This is analogous to the initiative described by Baptista in today's presentation.
[47] The paper was presented at the CBDA Science Conference and will be reported on in the Contra Costa Times.
[48] The paper should specifically consider the fact that landscape change creates a different environment than that previously expected under static conditions.
[49] A major point of discussion will be whether catastrophic levee failure spells certain conversion to shallow-water habitat, or whether the possibility exists that funding would be available for repair of levees.

Meeting Summary, November 12, 2004

ISB Members in attendance

Ken Cummins, Ph.D.	Jack Keller, Ph.D.	Kenny Rose, Ph.D.
Tom Dunne, Ph.D.	Sam Luoma, Ph.D.	Duncan Patton, Ph.D.
David Freyberg, Ph.D.	Judy Meyer, Ph.D.	Bob Twiss, Ph.D.
Bill Glaze, Ph.D.	Jeff Mount, Ph.D.	
Helen Ingram, Ph.D.	Denise Reed, Ph.D.	

Independent Science Board Members not in attendance

Jeff Koseff, Ph.D.

CBDA Staff

Zach Hymanson	Tim Ramirez	Patrick Wright
Ladd Lougee	Rhonda Reed	
Johnnie Moore, Ph.D.	Kim Taylor, Ph.D.	

Support Staff

Kateri Harrison	Diana Roberts
Maryann Hulsman	Elizabeth Soderstrom, Ph.D.

Other[50]

Gary Bobker (BDPAC)	Sarah Ann Dow	Roger Guinee
Christie Hanson	Campbell Ingram	Jerry Miller
Rowena Swenson (TNC)		

Welcome (Dunne)

Yesterday's main topics and decisions were summarized and agreed on.

Flowchart for Developing ISB-Sponsored Technical Groups

Moore developed a flowchart to guide the ISB process for developing technical groups to investigate selected topics in varying degrees of complexity and duration. He proposed that the ISB first establish a small working group to explore the issue. After their report, the full Board could determine whether more work is needed, both in the shorter and the longer term. If so, the issue would be referred. Possible target groups include an ISB working group, another CBDA Science Board, a CBDA Panel, and an outside advisory panel convened for this purpose.

EWA Review Panel—2004 Findings (Rose)

Background

The Panel's written report will be available in early 2005. Rose presented a power point slide show and noted that EWA is a cooperative effort to protect fish in the Bay-Delta Estuary. It is funded directly from Proposition 204 and Proposition 50 funds. Its funds are used to purchase water credits to allow flexible redistribution of water to benefit species and habitat.

[50] Partial list of audience members

EWA undergoes technical and scientific review yearly by the EWA Technical Review Panel[51], whose charge is to evaluate EWA's use of science. This fourth meeting marks the final meeting of the initial phase of EWA. It has been extended for another three years as a pilot project and is likely to be extended beyond that time. Funding will probably shift from government grants to some proportion of funds from user fees. This indicates increased scrutiny of EWA to determine whether it is providing good value.

The Panel found that science is not being used optimally by EWA. The following are some of the causes.

- Inadequate staffing.
- Mismatch between available scientists and needed expertise.
- Collaboration is mostly within and between agencies, involving few outside scientists.

EWA Technical Review Panel Report

The EWA Technical Review Panel (Panel) found that the EWA has been very successful in some areas and needs improvement in others.

The following are some areas of success identified by the Panel.

- Water supply is generally reliable. Most stakeholders are satisfied with EWA's performance.
- Conflict among stakeholder groups has been reduced.
- Knowledge about water acquisition and utilization has advanced greatly since EWA's inception.
- The quality of interagency communication and documentation has improved.
- Research on Delta Smelt has been improved—alternative models about lifecycle have been developed, decision trees have been revised and documented, and a BO was completed.

The Panel found reason for concern[52]. Major decisions about the EWA appear to be made without transparent scientific debate. There is little collaboration with scientists outside the EWA. Aspects of EWA's functioning other than science could also benefit from interaction with non-agency individuals and groups. The relative amount of money invested in science is very small in comparison to the money spent on water. Responsibility for making science a priority rests on top management.

The Panel made suggestions that could improve EWA's ability to make the best use of science for decision-making.

- Decisions should be informed by a wider range of viewpoints and evaluated more consistently through peer review.
- Science needs to be integrated into short-term decision-making.
- EWA should pursue integration with other environmental water programs systematically, both for political and for scientific reasons.
- Costs for water purchase should take into account not just price, but also biological costs and benefits. The current driver for water purchase is purchase price.
- More personnel are necessary.
- The Panel saw several areas for improvement in the use of modeling. Although EWA uses modeling in increasingly beneficial ways for prediction, little interest exists in using it to synthesize information to yield deeper understanding. Few models are used, limiting EWA's ability to evaluate model performance. Models are sometimes applied to situations for which they were not designed. Consistent peer review of model use and performance is lacking.

[51] Membership: Anderson, Chesney, Cowan, Erman, Freyberg, Ingram, Monismith, Rhoads, Rose, Thompson.
[52] Panel members mentioned that the burden of proof was shifted to those responsible for fish protection. The question of risk is unclear.

The needed infusion of science should come from the CBDA Science Program, as EWA-related staff are overworked. Success would depend on support from agency representatives. A short-term investment of a small number of people will have long-term benefits.

If EWA receives no influx of science funding and science, there will be no continuing need for the EWA Technical Review Panel. Should the panel continue, it should meet in six months to help with long-term planning, then again in two years, and thereafter on a yearly basis. Smaller groups could meet in off years to consider technical issues.

Subcommittee Recommendations

EWA/ERP Integration (Rose)

The EWA/ERP Subcommittee[53,54] was convened to evaluate current and possible future coordination (communication) and integration (joint decision-making) among the four major environmental water programs and to report findings to the EWA Technical Review Panel. They recommended that a longer-term Environmental Water Integration Subcommittee be established to determine how further integration would improve environmental water use for all parties.

Roger Guinee, Dan Castleberry, and Campbell Ingram provided a summary report of the four major environmental water programs: EWA[55], EWP[56], b2[57], and b3[58] (or WAP).[59] Together they manage decisions for more than 1,000,000 acre-feet of water, buying water and water credits with funds. Interactions among the environmental water programs were evaluated to assess social and political effectiveness according to inclusiveness, transparency, and accountability. To estimate possible integration, the committee considered shared tools, shared goals, shared vision, managed flow regimes, restoration versus protection, funding, monitoring and the use of monitoring data.

The EWA/ERP Integration Subcommittee found that coordination is widespread, but integration is opportunistic rather than systematic. To bring together water management and restoration, the ISB should establish a new longer-term Environmental Water Integration working subcommittee with the following charge:[60,61]

- Assess possible interactions among all four environmental water programs and related tools.
- Help develop a systematic approach for integration.
- Identify successes and bottlenecks.
- Encourage exchange of knowledge.

[53] Kenny Rose (co-chair), Duncan Patten (co-chair), Ken Cummins, David Freyberg, Helen Ingram.

[54] Because the ISB has a broad view, it is in a good position to identify larger issues (including water storage issues, water use efficiency, instream water use efficiency, and integrating real-time water management with real-time ecological needs) and to bring together groups who could benefit from closer interaction.

[55] "The EWA is a multi-objective program that prioritizes protection of listed species in the Bay-Delta estuary beyond the regulatory baseline through environmentally changes in the SWP/CVP operations, at no uncompensated cost to the project's water users." (From *More Self-Conscious Integration of the Environmental Water Account with Other Environmental Water Programs and Tools for Environmental Restoration*, report in response to 2003 EWA Review Panel's Report, Recommendation #3.) Its purpose is to provide flexible protection (rather than regulatory protection) for fish.

[56] EWP is part of the CBDA's Ecosystem Restoration Program. It acquires water from willing sellers on streams to improve instream habitat, with an upstream focus.

[57] B2 is a CVPIA program with the primary purpose of protecting fish, wildlife, and habitat, meeting post-1992 ESA requirements, and meeting WQCP.

[58] B3 is a CVPIA program similar to b2, with a greater emphasis on anadromous species.

[59] These four environmental water programs have interest in some or all of the following areas: salmon, steelhead, Delta smelt, other fish, riverine habitat, and WQCP.

[60] A cross-cutting issue involving b2 and b3 water is water supply, as both have obligations in this area. Another cross-cutting issue is the question of who should pay for and who should get the credit for any benefits.

[61] It was suggested that the group consider first the ecological priorities that drive the need for integration, and then the mechanisms and responsibilities for implementing actions.

The current EWA/ERP Integration Subcommittee will consider what form this new subcommittee should take[62] and send its initial recommendation to Moore. (See *Use of Environmental Water* below.)

Performance Measures (Cummins)

CALFED has a recognized need for a performance measures program to demonstrate and evaluate its performance. Other programs in the nation, such as Chesapeake Bay, have performance measures programs. CALFED needs performance measures that evaluate whether an action or actions have "made a difference."[63] Requirements of performance measures include the following.

- Both natural science and social science performance measures are needed.
- Measuring compliance with the law is useful but not sufficient. Compliance with the law is important for a legal audience, such as a governmental group that grants funds. However, compliance with the law does not imply success of a resource. Using a compliance metric to measure performance of a resource would not answer the question whether an action "made a difference" to a resource.
- Social science performance measures could include relationship measures (such as poor cooperation versus active collaboration), the number of lawsuits, or increasing development of small watershed groups in basins.
- Performance measures should be simple, strategic, and intuitive. Simple measures are good at indicating trends, and they are persuasive for the public.[64]
- Monitoring at a very large scale is needed because of the signal-to-noise ratio. For example, salmon runs showed an increase over three years, but 20 years of data would be needed for a valid measure.

Several obstacles must be overcome to develop CALFED performance measures (PMs). Poorly articulated goals and goals that may potentially conflict with each other complicate development of PMs. Too little funding and too few staff are currently dedicated to measuring and monitoring performance. Different audiences have different needs and expectations of PMs.

CALFED needs a process to evaluate promising PMs.[65] This Subcommittee proposes a decision tree. Nodes in the decision tree would indicate the following.

- Critical goals and issues of importance.
- Simplicity.
- Availability of data.
- Signal-to-noise ratio.
- Time period over which the PM should be assessed.

The Subcommittee proposes developing a pilot PM such as development of hydrograph water budget approach. Ingram (social science) and Keller (water management) as well as a biological specialist are needed. Whether to focus on a broad scale or a specific area is to be determined. This Subcommittee will (1) collaborate with Science Program and other CALFED staff to develop a generic process for vetting PMs, and (2) pilot this process with the Science Program.

<u>Work Plan 2005</u>

- January–March 2005. Convene working meeting, identify early actions, develop draft decision tree template, distribute template to CALFED programs for feedback.
- April–June 2005. Pilot template with Science Program to develop key PMs.
- July–September 2005. Revise and finalize template based on pilot and feedback.
- October–December 2005. Distribute template to other programs, draft implementation plan.

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[62] Possibilities include ISB-internal subcommittee, technical review panel, or SP-sponsored working group. Moore noted that a technical review panel would need to differentiate itself from the EWA Technical Review Panel.

[63] Other performance measures used by CALFED in the past have been easier to define:

(1) Was the action implemented or the project built?

(2) Was the action successful in its expected purpose?

This subcommittee proposes that the performance measures evaluate a more difficult question:

(3) Did the action make any difference?

This question usually involves the impact on a resource and can be harder to answer.

[64] For example, two simple maps for the Everglades showed where sugar cane appeared and where grass appeared, demonstrating clearly to the public and to decision-makers that the Everglades had a problem.

[65] Lists of indicators can be useful to inform the process, but are in themselves not a priori good performance measures.

Discussion
Examples exist within CALFED in which conceptual models are adequate and data is available. One of these would be a good test case for the "road map." A successful similar venture was the ERP Science Board test of the DRERIP vetting process. Some PMs could possibly be identified without going through monitoring and modeling process.[66] However, a conceptual model might be necessary for other (and perhaps most) cases.[67]

Ideally agencies will cooperate in gathering data to be used as a PM. To obtain agency buy-in, PMs must fit into learning models so that the agencies benefit regardless of outcome. Performance measures must be useful in the policy realm. Policy-makers and the public must be able to understand PMs, and PMs should accurately reflect people's intuition. Such PMs would be useful for policy-making and would have public education benefits.

Public Forum Comments (for items not listed on agenda).

No public comments.

Draft Summary of Projected 2005 ISB Activities and Schedule (Reed and Soderstrom)

The ISB identified the following primary areas of activity for 2005.

Levees
A new Levees Subcommittee was formed (Helen Ingram [Chair], David Freyberg, Denise Reed, Jack Keller.) Mount and Twiss will finalize their earlier paper on levee integrity. The new task Subcommittee will refer to the report while developing recommendations for next steps and present recommendations to the ISB at the February 2005 meeting.[68]

ISB Evaluation of Science Agenda and CBDA Science Program
CALFED is a management and governance experiment about how organizations and agencies collaborate and integrate science in their programs. Its science component, both the science agenda and the Science Program, is supposed to be evaluated yearly by the ISB[69]. A working group (Dunne and Glaze) will present a straw proposal[70] at the February 2005 meeting. The review will be complete by December. More clarification may be available from CBDA in May.

ISB Annual Report
Dunne and Reed will present a draft report at the Sept. 2005 ISB meeting, to be finalized in Dec. 2005.

New ISB Members
Moore has identified two candidates in the fields of Resource Economics and Risk Analysis for possible inclusion in the ISB and will announce them after their acceptance. ISB members will send recommendations for a fish biologist (not necessarily salmonid expert) to Moore.

Performance Measures
The Performance Measures Subcommittee (Rose, Meyer, Twiss, Keller, Ingram) will convene a working subcommittee to develop a "Performance Measures (PM) Road Map" and a draft decision-tree template

[66] For example, maps of Charlotte's River Estuary showing sea grass, which is important to sea trout, served as a PM that also convinced the public of the estuary's health.
[67] For instance, in Chesapeake Bay, the presence of bay grass was in itself not a sufficient PM.
[68] One possibility discussed was to hand the levees issue to the WMSB. Another is to keep it within the ISB.
[69] Moore later noted that the ISB Charge does not require evaluation of the science program.
[70] This may include hiring an outside group to conduct part or all of the analysis to avoid potential conflicts of interest for ISB members applying for CALFED grants. Whether an outside group would be subject to Open Meeting Act rules is to be determined.

by March 2005, and a pilot template by Sept. 2005. The decision tree will evaluate scientific and process results. The working subcommittee should also consider organizational PMs.

DIP

At some point in 2005, the program-wide vision for the Delta will need to be considered. This will involve reviewing existing vision statements, identifying the basis for the current vision, and potentially recommending a process of revision. This effort could be led by either the DIP Subcommittee[71] or the Dip Team (Reed and Meyer) and they will identify and appraise scientific foundation of source documents, *e.g.*, IEP reports, draft EIS/EIR related to projects listed in DIP by the May 2005 ISB meeting.

Freyberg and Luoma will draft a request to the WMSB to review assumptions and projections on water supply and pumping and deliver the draft to the ISB members for comment at the February ISB meeting. The finalized request will be delivered to the WMSB via the SP.

Use of Environmental Water

The EWA/ERP Integration Subcommittee will draft a final report on their findings (author Rose), consulting with Keller and Moore, including recommendations and charge for an expanded technical panel or working group. This report will be complete by the February 2005 ISB meeting. The new Subcommittee will finalize a report by Dec. 2005.

Use of Science in System-Wide Decision-Making, Including Monitoring and Modeling[72]

The Monitoring Fact-Finding Team (Meyer, Glaze) will develop a charge for a proposed Observation and Forecasting Technical Panel by the February 2005 ISB meeting.

Glaze and Meyer proposed a program of activities with mileposts for 2005. By the February 2005 ISB meeting, Meyer and Glaze will (1) identify different agencies/entities involved in monitoring in the CBDA and relevant environs and (2) catalog historical and current water quality and biological monitoring efforts by different agencies/ entities, beginning with a survey of the SFEI database. They will report to the ISB with a written report. By the May 2005 ISB meeting, the Technical Panel will (1) relate the identified monitoring programs to stated goals and objectives of the CALFED program and (2) identify changes in the monitoring programs that would increase their usefulness for CALFED, *e.g.*, new technologies, parameters. They will report to the ISB with a written report. By the Sept. 2005 ISB meeting, the Technical Panel will explore how BDAT and related data management systems could be used more effectively to meet CALFED objectives. They will report to the ISB with a written report. An interim report on the Panel's findings will be finalized by Dec. 2005.

The Modeling Fact-Finding Team (Melack and Koseff) will consult with the CWEMF on possibilities for collaboration. In the long-term, the ISB would like CalFed to model how water supply flexibility would be affected under the proposed 8500 plan, and what impacts on ecosystem values and water quality would result. Biologists should be included in these modeling efforts.

Water Quality

The ISB will study water quality from an environmental standpoint, activities TBD. Moore will clarify Wright's point of view and report to the ISB.

Response to Legislative Directive

Moore will send the draft to all members of the ISB by Dec. 10. Cummins and Rose will develop and send an official response stating the Board's approval.

Meeting adjourned 12:00 p.m.

[71] DIP Subcommittee includes Reed, Patten, Luoma, Rose, and Freyberg.
[72] Taylor requested that a small number of ISB members investigate how IEP could use the SP to assess science in IEP.

California Bay Delta Authority
EWA/ERP Integration Subcommittee Meeting
UC Davis Walter A. Buehler Alumni & Visitors Center, Davis, CA

Wednesday, November 10, 2004, 2:00 p.m.–5:00 p.m.

ERP/EWA Subcommittee Members Present

Duncan Patten, Ph.D.
Kenneth Rose, Ph.D.
David Freyberg, Ph.D.

Guests Present

Dan Castleberry	CBDA-ERP
Roger Guinee	USFWS
Jim White	DFG
Campbell Ingram	FWS
Jim Wieking	DWR
Gerald Miller	CDFA

Consultants

Kateri Harrison	Kleinschmidt
Jonathan Pederson	Kleinschmidt

RESULTING ACTION ITEMS

- Staff to provide Subcommittee members with a copy of the recent VAMP Report.
- ERP/EWA Subcommittee should morph into 'Environmental Water & Restoration Subcommittee'. This Subcommittee will not address water quality. May request additional expertise to address water management issues.
- New Subcommittee will address "synergisms" between EWA/ERP/B2/B.

Meeting convened at 2:00 p.m.

Introductions

Rose welcomed everyone to the Subcommittee meeting and reviewed the agenda.

Overview Discussion about Staff Report

- Several providers supply water including EWA, CVPIA, EWP
- Let's consider these providers and think about interaction among water suppliers
- EWA/ERP shared goals, shared tools
- Degree to which science from ERP informs EWA

Patten suggested Nine Questions:

1. Fish?
2. Flow?
3. Additional fish flows?
4. Other environmental water management, are their goals appropriate to enhancing fish survival?
5. Coordination opportunities?
6. How much water is available?
7. Can water be used/released to enhance in-stream benefits for fish/riparian?
8. Hydro-managed flow regimes?
9. EWA assets and budget?

The Subcommittee Members discussed the following:

- "Pecking Order" – Who supplies water, when, to whom?
- Conceptual model/design to help ERP in project planning
    - Model to show interaction of water suppliers.
- Decision Tree for guiding which agency comes forth to supply water, and when

Presentation by agency staff (summary of report) by Dan Castleberry and Roger Guinee

Castleberry provided a power point presentation as shown in Attachment 1. Castleberry noted that CalFed ecosystem restoration activities are guided by "The Strategic Plan". Castleberry's slide presentation noted the following points:

- "Restoration" function of EWA. Is it the prevention of individual or pop fish loss, or a true restoration?
- EWA has dual objective
- Single blueprint. Management of framework covers regulatory activities and management/agency decisions
- Shared science for Eco-restoration peer review, workshops, conceptual models
- Monitoring of winter-run Chinook salmon (via carcass counts) is funded by ERP $ from bond acts. CUAA, CVIPA. In future, shares of money from Feds, water users.
- Conceptual models such as big model paper or Fleming's Delta Smelt paper. Quantitative models.
- ERP Planning documents articulate a shared vision: multi-species conservation strategy, milestones
- Example of Shared Vision: Lower American River water temp for Chinook salmon spawning, seven programmatic actions and grants, tool is EWA
- EWP – Campbell, Ingram
- Management framework for EWA/ERP
    - Share implementing agencies (USFWS, DFG, NOAA Fisheries)
    - Updates to BDPAC subcommittees
    - First to have science panels
    - Tied to regulatory compliance

    - DWR staff attend water management subcommittee, Roger and Jim attend to describe eco-restoration, BDPAC subcommittees report to BDPAC
- American River example. (Other tools) Seven programmatic actions include structural fixes to Folsom Dam, cold water release from Dam. Solutions could be a bigger picture.
- Several targets for the Lower American River, including water temperature (maintain water temps below 60 F beginning in early October for Chinook Salmon spawning)
- 7 Programmatic Actions: ERP grant contributing to structural restoration while EWA contributing to water management

Discussion among the Subcommittee on Castelberry's presentation focused on the following points:

- There are several ways to maintain water temp below 60 degrees, why use EWA water on the Lower American River? To create peace. EWA power credits applied first year. Opportunistic.
- What is the best mix of water supply? Different mix for different years?
- Long-term fixes for temperature needs is not in-place. Planning stage/modeling.
- Expectation is that if water needed, then EWA will supply – Dam bypass workings, shutters 60° October, but 56° need in November for eggs in gravel.
- The analysis used to establish 60 degrees F as a threshold dates from the 1950's and is still used as the standard. Monitoring of the effectiveness of this standard is done indirectly through egg survival studies as a result of gravel bed restoration, etc., not necessarily exclusively water temps.
- Future issues with measuring tradeoffs of EWA water. Apples/Oranges.
- Less power generated. Long-term component of temperature considerations. Design to use warm water from top or cold from bottom. Temperature control device would minimize need for mixing/shutters at front of penstock.
- Shutters only work to a point; they can't bring up cooler water from the very bottom, below the thermocline.

Guinee provided a power point presentation focusing on relationships between and differences among the four environmental programs – EWA, ERP, CVPIA b(2), CVPIA b(3). In his presentation Guinee noted the following:

- Coordination=discussion of what to do.
- Integration=planning and deciding.
- Four environmental programs – EWA, ERP, CVPIA b(2), CVPIA b(3) –
  All are category A
- Tier 1 – production before CalFed
- EWA – Delta fish
  EWP – water for salmon restoration
  b(2) – Manage 800,000 Acre/feet of CV water
  b(3)
- EWA buys water from Yuba and other rivers, restores in-stream flows.

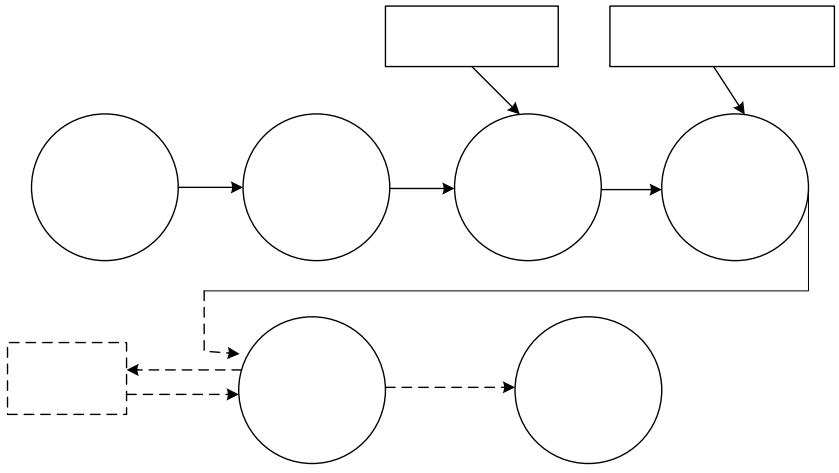
- EWP water for salmon spawning and juvenile survival; restore critical in-stream and channel-forming flows; provide flow and habitat conditions for fish protection and recovery
- Juvenile salmon out migration to ocean
- It is unknown how many Delta smelt larvae are removed by pumps; best they can do is measure mortality rate of 20+ mm (and larger) caught in fish screens.

EWP

- Tier 1 streams: Clear, Mill, Deer, Butte Creeks, and Tuolumne River—smaller streams with at-risk species present in environment
- B-2 (slide) CVPIA Section 3406 (b)(2) water purpose: dedicate and manage 800,000 AF annually of CVP water for the primary purposes of fish, wildlife, and habitat restoration; to assist meeting the WQCP, and to help meet post-1992 ESA obligations
- Encompasses anadromous species
- Subcommittee discussion noted that mitigation, enhancement established due to impacts of CVPIA – Riverine system, the whole system
- Needed information (gaps) is obtained by ERP and though comments provided by ERP on the Science Program's PSP
- EWP has science peer review. Example – Clear Creek reviewed by subcommittee of ERP SB
- EWP Tier 1 streams have salmon or other at-risk fish
- Suggestion – One water management agency not needed if well coordinated
- Fish needs identified based on limiting factors established primarily by agency biologists, and some stakeholder biologists; 1995 Anadromous Fish Working Paper -- "Reasonable Suite" of actions. Determined that mimicking natural hydrograph was not reasonable. "Reasonable" also based on willing seller/buyer. Flow objectives are similar in AFRP and ERP. To achieve doubling of andromous fish

b(3)

- Delta decision support model for water acquisition



- Model wasn't originally designed for these types of real time decisions.

- Water use for spawning is much different.
- EWA can plug into decision support system for upstream.
- Water can be used more than once. Upstream flows down to Delta.
- WAP – Water Acquisition Program
- Release tagged salmon and see if water releases improve migration for smolts
- What are consequences of up/down ramps on hydrograph flow chart? Do side channels get dewatered?
- VAMP is b(3) water plus b(2) water, plus EWA. But EWA is only for portion of pumping
- San Joaquin – This is a model of how it can be done. VAMP – determine whether it benefits fish.
- EWA success story is between and within agency collaboration and information sharing.
- Stream priorities are based on several factors including: species in streams; anadromous fish in streams, presence of hatchery; fish behavior; fish needs; water availability; presence of willing water sellers; and funding.

Subcommittee discussion noted the following points:

- Ramp-up triggers natural pulse processes, bring all streams up to ½; but can these be maintained? Eco-fair share? No politics.
- Lower Ramp up = tinker with stream processes?
- How are the effects of tinkering captured? Monitoring? Behavior of channels? Models? Some models do evaluate probability of stranding.
- Is annual monitoring data studied or archived? Used to make models.
- VAMP is a 12-year program and proposed to delay analysis till end?
- Hard to understand how a CALSIM2 model can be used for the application of the science to model smaller time-scales.
- Battle Creek as a success story of this program.
- Questions regarding conceptual model (two models in the main report)
- How to integrate these programs (B1, 2, 3,) Tier 1 -- across the baseline
- What role should ISB play?
- Opportunities for EWA water upstream?
- DIP 8,500 cfs – part of reason for increased capacity is to pump EWA water to the south?

Previously, staff had asked if EWA should assume the role of oversight for all environmental water activities related to the Env./Restoration four programs – EWA/ERP, b(2), b(3).

- Overview of success and failures
- Exchange of knowledge
- Underlying science, X amount of water needed in system
- Synergies among four programs.

Meeting adjourned at approximately 5:00 p.m.

# #

California Bay Delta Authority
Independent Science Board
Performance Measures Task Force Meeting
UC Davis, Buehler Alumni Center, Davis, CA
Wednesday, November 10, 2004, 1:30 p.m.– 5:30 p.m.

Committee Members in Attendance

Ken Cummins, Chair
Helen Ingram
Jack Keller
William Glaze
Denise Reed
Judith Meyer

Staff

Elizabeth Soderstrom, Facilitator
Julie Leimbach

Meeting Agenda

– Discuss history and background of CALFED performance measures
– Develop a charge for the group
– Discuss other PM programs in the country
– Observations and recommendations
– Next steps for the workplan 2005

Summary

Working group members made the following general observations about performance measures.

– A clear need exists for CALFED to demonstrate and evaluate performance.
– Poorly articulated goals can be a problem in developing Performance Measures.
– It is important that performance measures go beyond compliance and ask, "Did it make a difference?"
– Performance measures must be simple.
– A need for a high signal-to-noise ratio argues for monitoring at a bigger scale.
– A a process for evaluating performance measures is needed.
– The Science Program can play a role in deriving a process for selecting appropriate performance measures.
– Introducing new performance measures procedures requires an effective process (discussed below).
– Performance measures should include evaluation of social successes and opportunities for collaborative learning.

Working group members made the following recommendations.

– Develop a decision-tree template with decision nodes. Nodes to include:
    1. Is the candidate performance measure linked to a critical goal/issue of importance to CALFED?
    2. Is the candidate performance measure simple?
    3. Are data available?
    4. What is the signal-to-noise ratio?
    5. Over what time period should the candidate performance measures should be assessed.

– Consider early actions such as development of a hydrograph water budget approach (Water Management Board) and GIS mapping.

Proposed Workplan

January–March 2005
– Convene working meeting to outline "PM Roadmap;" identify early actions including use of mapping techniques and water balance modeling; and develop draft decision-tree template.
– Distribute template to other CALFED Programs for initial feedback.

April–June 2005
– Pilot template with Science Program to develop key PMs.

July–September 2005
– Revise and finalize template based on pilot and feedback.

October–December 2005
– Distribute template to other programs.
– Draft implementation plan.

The pilot phase must be transparent. During the pilot phase (April-June), there will be two "shop around" periods. In the first, the initial template will be distributed to agencies to ask whether the approach makes sense. In the second, the pilot will be distributed with the request that the programs using it with their projects. This feedback should help determine whether the template is a good candidate for selecting performance measures.

NOTE: it was proposed that, in the decision tree, one of the notes query whether data exist. About half the candidate performance measures will be eliminated on this criterion alone.

Performance measures must be incorporated into annual reporting and the annual report. The annual report cycle happens to coincide with the federal fiscal year. A revised performance measures process should be ready for inclusion in the next annual report.

Background on CALFED Performance Measures

Performance measures at CALFED have historically answered the first two questions of a three-question hierarchy:

1. *Was the action done*?
   Examples: How many actions were undertaken? How much money was spent on actions?
2. *Was the action successful*?
   Examples: How should changes in the environment be measured? Did the program do what it was intended to do?
3. *Did the action make a difference*?

The first two questions more readily facilitate performance measure design. The third question usually involves the impact on a biological resource and can be harder to answer. However, the public and funders are interested in the third question. Further, the answer to the third question is a stronger indicator of system performance.

This Performance Measures task force needs to break new CALFED ground by asking the third question in the context of the long-term goals of restoration and rehabilitation (did it make a difference?). Taking as an example a project to build a barrier to protect fish populations, the performance measure should indicate progress toward an articulated goal related to fish population, rather than simply whether the barrier was built or whether its local performance is as expected. Rather, the question should be, "What effect did the barrier have on the fish?"

Definitions

What is a *performance measure*? It is an *indicator* of progress toward a *goal*, *objective*, or *target*. What each of these terms designates, however, varies greatly with the audience. Goals as currently declared in ERP are poorly stated. For instance, what is "recovery?" If recovery is not defined, it is not possible to assign a performance measure to it.

Even when a goal is clearly defined, it is necessary to define whether a performance measure *assesses goal attainment* or *tracks change.*

The scale of a performance measure is also important. Measuring CALFED progress on small scale can be fairly precise, but the larger the scope, the "fuzzier" the performance measure will be. Unfortunately, small-scale performance measures do not as readily answer the question whether CALFED is "making a difference" in the Bay-Delta region.

CALFED

CALFED needs several sets of performance measures to measure the impact of a range of CALFED programs, rather than one general set that should analyze the program as a whole. No CALFED entity is clearly endowed with responsibility for tracking performance and developing performance measures. In particular, lines of authority are clearly delineated. Because each program knows its own goals best (as well as the relative clarity and "fuzziness" of their goals), each program is best equipped to track its own performance.

The 2002 plan had limited impact. The various programs were involved in designing the plan but it was not implemented. Two types of problems have hindered implementation programs: technical and communication. Communication problems include a lack of common language: engineers and scientists work with different concepts and are in general not familiar with the language and orientation of the other group.

Lessons from other performance measure programs

Performance measures and program goals

In the Everglades, performance measures have been related to program goals. Their performance measures are indicators, such as an index of biotic integrity, which combined form a report card. They developed a database of GIS maps containing data relating to the performance indicators. Now it is possible to query the database to find out what impact an action has on an area (such as a forest in the Everglades), yielding data that can be fed to performance measures.

When goals are clearly articulated, it is possible to develop clear performance measures. It is difficult to create performance measures when no goals exist that can be translated into specific targets (such as with specific references to geology or timeline). When goals are not clear, rearticulating (and clarifying) them may be necessary so that performance measures that relate to them can be formed. CALFED's DRERIP is rearticulating ERP's goals.

Performance measures and scale

In Chesapeake Bay, early performance measures were narrowly based on the Bay. With time, however, it became clear that the wrong data were being collected in the wrong place.[1] Data should have been collected on a watershed scale to measure impact, not only on the Bay.

Performance measures of compliance with regulations

EPA created an index of watershed indicators from which they derived each watershed's compliance with regulations. This measure yielded poor correlation between compliance and resource health.

Simplicity and performance measures

Indicators that are simple get greater buy-in from a large audience than indicators that are difficult to understand. For instance, in Chesapeake Bay, the well-known indicator of turbidity (and thus of other ecosystem performance) is whether a person can see his sneakers when he wades into the water. This indicator also demonstrates the subtlety and complexities involved in performance measures: whether the water clarity is tested against new tennis shoes or old tennis shoes.

Perhaps CALFED has not captured the interest of Californians because the system is so complex, or at least is represented as so complex, that no one clear and simple performance measure has been identified. NOTE: the danger exists of oversimplifying, however, for instance focusing on the Bay in Chesapeake Bay, whereas the problem was in the larger watershed.

Process for developing performance measures

The DRERIP program is successful in large part because of its robust process in which information feeds successive stages. The performance measures working group can follow its general process. First, develop initial guidelines. Outline decisions that need to be made. For a decision tree, identify its nodes. Strong leadership with a strong energy and time commitment is essential.[2]

Observations and recommendations

The Bay-Delta region is supposedly data-rich, which would seem to favor development of performance measures. However, not all of the data are in a form that could be input into a database. Much of the data are site-specific, or on the other hand very general. Much of the data have been collected for specific goals that do not have general significance. Taking existing data as a precondition for developing performance measures could be very limiting.

The signal-to-noise ratio is critical in a complex system such as the Bay-Delta. Absolute measures may not be useful because of this problem.

A GIS approach to performance measures could map stressors against a resource. For instance, endangered species occurrences could be mapped, and a map of stressors superimposed. The overlay reveals which resources are the most critical and where stress is the highest, indicating where to allocate funding. The drawback to this approach is its reliance on enough data and good enough data being available.

A political science perspective on developing performance measures follows.

– Because personnel and funding resources are limited, "busy work" must be minimized.

[1] The Everglades faced a similar realization.

[2] DRERIP benefited from Denise Reed's commitment—two to three days a month with follow-up telephone calls and email traffic.

– Performance measures do not necessarily need to be complete. If nobody cares about the information, there may be no reason to measure it.
– The audience—*who* cares about what is being measures—must be considered, and strategic ways to measure with respect to the audience must be developed.
– Simple, tractable examples on large or subsystem scales will facilitate development.
– When goals come into conflict because of mutually exclusive concerns, the goals become fuzzy with respect to performance measures.
– Changes in the real world change goals.
– Compliance doesn't always mean that goals are being met; it means the law is being met.
– People cannot be expected to gather and submit information on performance if that information might have bad consequences for them (for example, an agency in danger of receiving reduced funding). Unless motivation such as learning or a reward is offered to them for providing the information, people will not cooperate. If this is to be a useful exercise, people must be convinced that performance measures will be helpful to them.
– In order to gain political support for this program, performance measures must be simple. General indicators that track key measures must make intuitive sense,

Charge for the working group

The Performance Measures working group agreed on the following charge.

1. Work with staff and other CALFED programs to develop generic and objective (vetting) processes and decision tree nodes for vetting performance measures, using the Science Program as a pilot. NOTE: the product of this working group will be (1) to develop a road map for developing performance measures and (2) to identify some key indicators for each program, rather than to develop a full set of performance measures for CBDA.
2. Distribute early template for feedback to other programs.

Central tenets

Central tenets will be developed to guide performance measure development. Examples:

– Water budget as overarching framework.
– Keep it simple.
– Know your audience.

These tenets can give context and direction to using the decision-tree tool. Hydrologic budgeting and social structure are possible fundamental starting places. Basic tenets should be overarching concerns, rather than nodes in the decision tree.

Recommendations

The following recommendations were distilled from discussion.

1. Start with water budget approach on a sub-basin level.
2. Use decision tree for indicators (formal vetting process), developed with in-house staff and ISB members with some consultants. The decision tree should include social and natural science performance measures. Indicators should have the following characteristics:
   - Simple.
   - Data should be easily accessible.
   - Signal-to-noise ratio appropriate to scale.
   - Related to issue of importance—linked to critical goal.

3. Include vegetation map.
4. Develop water quality map over time.
5. Develop performance measures that measure qualitative and quantitative successes.
    - Collaborative learning.
    - Social science performance in terms of geographic areas.
    - Performance measures for different audiences.
6. Develop overall road map for performance measures.

Applicability

Primary motivations for developing CALFED performance measures are (1) to respond to public pressure to demonstrate success and (2) to demonstrate to the legislature how funds are allocated and what has resulted from investments. If CALFED is unable to show its success, funding may wane. The public wants to know whether CALFED is failing in major areas and whether it is making a positive difference.

This working group identified developing a "roadmap" and a formal vetting process for performance measures as the most effective contribution it can make. An approach for scaling indicators might also be important; no process existed in the past for scaling indicators. They have been prioritized based on interests.

Performance measures must "pick up" big successes and failures in the system. Big science breakthroughs in CALFED include the Delta cross channel and Delta smelt.

Performance measures should address the following questions among others:

– How much water was used for Delta smelt under the old regime and how much is used now under the current regime?
– Did the fish get more water?
– What was the timing of that water?
– From the fish perspective, what was done with the amount of water?

Possible starting points for the development of performance measures include (1) big picture analysis, followed by focusing on smaller segments, (2) critical elements such as diagnostics; for example, a metric such as vegetation cover or water budget.

This group wants to identify the "right" performance measures, rather than defaulting to those for which data are currently available. (If data are identified as needed but do not yet exist, the decision-tree process should identify that gap and direct the appropriate program to gather the data.) Data used to assess an indicator must have a clearly understood relationship to goals. In-house staff and consultants should develop operational performance measures from data and indicators. The decision-tree approach can build confidence and buy-in because it minimizes subjective decision-making.

A concern is whether the same roadmap would be useful for all programs. An ecological program might work for many areas, but will it work for levees? Further, different indicators for different time and opportunities may be useful. The roadmap will be a set of questions, but whether one set of questions can be developed that will apply across programs is still to be determined.

Decision-tree nodes

Possible nodes for a decision tree include the following.

– Do data exist for the proposed performance measure?
– (If no data exist, the next node would ask "Is it possible to get these data?")

– How can existing data be molded into a question which measures performance? (For instance, temperature is a subtle indicator of fish population performance.)
– Is this a measure of something that matters to the public/ decision-makers or is otherwise important?
– On what geographic scale do the data operate?
– On what temporal scale do the data operate?

Natural science and social science indicators

CBDA performance measures could track both natural science and social science indicators. Natural science indicators should measure key indicators against a well-defined and possibly quantifiable goal. Social science indicators should involve a feedback process with the audience to demonstrate how they are benefiting from CALFED and from the performance measures from a range of metrics.

Natural science indicators

A water balance sheet would be a valuable tool; historical data exist and tracking trends would be straightforward.[3] From the water management perspective, the system can be expressed in hydrographs of supply (water stored or pumped) and demand (ecological, agricultural, urban, etc.).[4] Excess demand is "outflow;" ecological needs could be layered onto hydrologic data as "outflow under demand." In such a study, a statewide balance would not be a useful study; regional balance such as Sacramento or San Joaquin would be appropriate. This would provide a physical way to look at the big picture, but does not answer the question whether actions "make a difference."

GIS maps, to the extent GIS information is used in performance measures, would be useful to track indicators for specific sites, particularly when a goal for that area is clearly defined. However, it would need to be made clear how they could be useful for big-picture questions.

Mapping vegetation (and other things that do not move) could be useful. Possible uses include (1) mapping shaded riverine habitat, (2) mapping hotspots for water quality parameters such as mercury, (3) limiting factors analysis, (4) trends through time, (5) relationship to water temperature map. This approach could analyze potential cost effectiveness of possible actions.

Concerns about natural science performance measures include the following.

– Ecological demands are hard to define. Adaptive management can inform the performance measure development process.
– Defining the relationship between water flow and water quality is difficult.
– Interannual variability in the supply of water is fairly large. A performance measure on an annual basis would not be meaningful; 15–20 years of data would be required to quantify an impact. CALSIM is built on that assumption. Similarly, human behavior and the water market change over fairly long periods of time. It is important that users of performance measures have appropriate expectations.
– Projections of population change and climate change are very uncertain because future response to these changes cannot be known. This complicates development of performance measures.

Social science indicators

Human systems are a fundamental component of CALFED; one of CALFED's priorities is to facilitate greater inclusiveness and cooperation. Performance measures to track success in this area should be developed, particularly because this has been one of CALFED's arenas of greatest success. CALFED needs to be able to document and explain its successes in this area.

[3] Some of the best data available is hydrologic data.

[4] Water budget analysis offers a formal way to handle the signal-to-noise ratio. The water management process should be a basic building block.

Social science indicators would measure performance with respect to social organization.[5] For example, in the case of agricultural water use efficiency, social progress was gridlocked until the environmental and agricultural communities together accepted that more flow was needed in the river. The old approach involved following best management practices with the assumption that would ensure adequate flow, which turned out to be incorrect. The social system was made to work when an objective measure was used. Social science performance measures should indicate things that break social bottlenecks.

Issues that could be addressed are the following.

– Have stakeholder buy-in and longevity increased on a watershed level?
– If so, does that translate to similar progress at the basin-wide level?
– What new arenas for local participation have emerged? What is their success?
– Are there portions of the solution area that are feeling better served than previously?

People can be expected to gather and submit information on performance only if motivated to do so. Learning, a reward, or opportunities for new work should be part of the performance measure evaluation process. The question was asked whether the Performance Measures task force should build this into the Science Board's recommendations, or whether its work should focus on technical components.

Collaboration with other groups

Other groups will be heavily involved in developing and implementing performance measures. The Science Program will be the first group involved to pilot the vetting process. Development of the vetting process will be iterative between the SP and the PM task force.

After initial development, other programs and agencies will review the pilot. They must be involved with the development process to help assure similar ways of thinking, identify areas of divergence, and ensure buy-in. Transferring the vetting process between organizations will also test its robustness.

The intent of this work group is to develop a roadmap for a generic process that can be transferred throughout the system. This will involve training Science Program staff to convey the message clearly to other programs and agencies. Performance measures must be simple, clear, and of general enough utility that it is easy to transmit them between people without any loss of understanding.

Next steps for the workplan 2005

It was proposed that Keller, Ingram, Cummins, D. Reed and a few others initiate the process by meeting to develop initial components of the "roadmap," which would then go to ERP for vetting. Staff will play a large role in the process.

The DRERIP process is a good example of how Science Board members can develop a process and hand it off to a CBDA program for further development and implementation. D. Reed could offer strategies for how Science Board members invest their time most effectively in this effort.

[5] These may or may not be linked directly to a resource.

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January 28, 2005

CALIFORNIA BAY-DELTA AUTHORITY AND BAY-DELTA PUBLIC ADVISORY COMMITTEE

Two-Day Joint Meeting
February 9 and 10, 2005
Sacramento Convention Center
1400 J Street, Room 315
Sacramento, California

AGENDA

At the discretion of the Authority and the Bay-Delta Public Advisory Committee, all items appearing on this agenda, whether or not expressly listed for action, may be deliberated upon and may be subject to action. Order of agenda items is subject to change.

February 9, 2005 - 9:00 a.m.

1. Introductions and Opening Remarks

2. Roll Call and Establishment of Quorums

3. Meeting Summary - The Authority will consider adoption of the December 8 and 9, 2004 Meeting Summary (Action Item)

4. Director's Report

5. Proposed State Legislation (Information Item)

6. Flood Management Issues (Information Item)
   A. Department of Water Resources' Report to the Legislature - "Flood Warnings: Responding to California's Flood Crisis
   B. Update On Comprehensive Program Evaluation: Levees in the Sacramento-San Joaquin Delta

7. Subcommittee Reports (Information Item)
   - Ecosystem Restoration Subcommittee: Prospect Island Update

8. Lead Scientist's Report (Action Item)
   - Nomination of Independent Science Board members (Action Item)
     Resolution 05-02-01: Approving the Nominations of Dr. Richard Adams and Dr. Warner North to the Independent Science Board.

9. Environmental Water Account Technical Review Panel Report (Information Item)

10. Delta Improvements Package Update (Information Item)

11. Proposal Solicitation Process, and Grant and Contract Approvals (Action Items)

    A. Water Use Efficiency Program - State Water Resources Control Board, Water Recycling Funding Program.
    Resolution 05-02-02: Concurring with the State Water Resources Control Board's Adoption of Water Recycling Funding Program Competitive Project List (Project List included as Agenda Attachment 1A). (Proposition 50, Chapter 5, Section 79540: $42,000,000).

    B. Water Quality Program - State Water Resources Control Board. Agricultural Water Quality Grant Program.
    Resolution 05-02-03: Recommending that the State Water Resources Control Board Adopt the Agricultural Water Quality Grant Program Proposed Recommended Project List. (Project List available at the meeting). (Proposition 50 Chapter 5: $29,500,000).

    C. Ecosystem Restoration Program - California Bay-Delta Authority. Ecosystem Restoration Program (ERP) Grant Amendment.
    Resolution 05-02-04: Consideration of a Resolution Approving an Ecosystem Restoration Program Grant Agreement Amendment with Yuba County Water Agency and Authorizing the Director, or Designee, to Process the Approved Amendment. (Proposition 204: $4,254,967).

12. Water Supply Reliability Program - Department of Water Resources and State Water Resources Control Board. Status of Proposition 50 Integrated Regional Water Management Grant Program (Information Item) (Proposition 50, Chapter 8, $380,000,000).

13. Public Comment

4:00 p.m. Adjourn

February 10, 2005 - 9:00 a.m.

1. Introductions and Opening Remarks
2. Roll Call and Establishment of Quorums
3. Recap of Previous Day
4. Ecosystem Restoration Program – Battle Creek Salmon and Steelhead Restoration Project. (Information Item)
5. Updating the Multi-Year Program Plans: Process and Schedule (Information Item)
6. Finance Plan Implementation Strategy and State and Federal Budget Updates (Information Item)
7. Public Comment

1:00 p.m. Adjourn

- Members of the public shall be provided an opportunity to address the California Bay-Delta Authority and Public Advisory Committee on any agenda item except closed session items and those items for which the public has already been afforded such an opportunity at an earlier meeting. Comments during the public comment period shall be limited to matters within the Authority's or Committee's jurisdiction, but not on the agenda. Reasonable time limits may be established for public comments (Government Code Section 11125.7)
- Additional information, including Procedures for Authority Meetings, can be found on the California Bay-Delta Authority website at http://calwater.ca.gov. If you have any questions, please contact Jamie Cameron-Harley at (916) 445-0620.
- If you have questions or need reasonable accommodation due to a disability, please contact Pauline Nevins, California Bay-Delta Authority at (916) 445-5511, TDD (800) 735-2929.

California State Water Resources Control Board

CPL Adopted 1-20-05

Water Recycling Funding Program Competitive Project List (CPL)[1]

Exhibit B

PIN	Agency	Project Name	County	Project Cost ($Million)	Category[2]
3274	Calaveras County Water District*	Copper Cove Water Recycling Project	Calaveras	3.20	1
2378	Central Basin Municipal Water District	Montebello Loop, Phase I	Los Angeles	11.00	1
3122	City of American Canyon	American Canyon Recycled Water Program	Napa	14.05	1
2704	City of Benicia	City of Benicia Water Reuse Project	Solano	15.00	1
2864	City of Chino Hills	High Zone Recycled Water System	San Bernardino	3.50	1
3156	City of Ontario	Milliken Avenue Recycled Water Pipeline - RW 1	San Bernardino	0.52	1
3226	City of Ontario	Guasti Park Recycled Water Pipeline - RW 3	San Bernardino	0.44	1
3236	City of Ontario	Philadelphia Street Recycled Water Pipeline - RW 4	San Bernardino	0.41	1
3316	City of Ontario	Wineville Avenue Local Recycled Water Lines - RW 2	San Bernardino	0.36	1
3136	City of Palo Alto	Mountain View/Moffett Area Water Recycling Facility Project	Santa Clara	16.79	1
2398	City of Redlands	City of Redlands Recycled Water Transmission Main Extension	San Bernardino	1.70	1
3390	City of Redwood City	Redwood City Recycled Water Project	San Mateo	84.00	1
3324	City of Riverside	City of Riverside Recycled Water Agricultural Program	Riverside	25.00	1
2556	City of San Diego*	South Bay Water Reclamation Plant Piping, Storage and Pump Station	San Diego	3.50	1
2656	City of San Diego*	North City Reclamation System, Phase II - Black Mountain Ranch	San Diego	17.60	1
3398	City of San Jose*	South Bay Water Recycling Zone 3 System Improvements	Santa Clara	15.00	1
3222	City of San Leandro	City of San Leandro Recycled Water Project	Alameda	3.76	1
2636	City of Santa Maria	City of Santa Maria Water Recycling Project	Santa Barbara	10.00	1
2896	City of Willows	City of Willows Wastewater Treatment Plant Improvements	Glenn	6.30	1
2874	Cucamonga Valley Water District	Satellite Wastewater Treatment Plant - Central Park	San Bernardino	22.50	1
2878	Cucamonga Valley Water District	Satellite Wastewater Treatment Plant - Red Hill Park	San Bernardino	17.50	1
2956	Cucamonga Valley Water District	Recycled Water Distribution Facilities - Zone 1 - 4th Street to I-10 Freeway	San Bernardino	0.36	1
2958	Cucamonga Valley Water District	Recycled Water Distribution Facilities - Zone 1 - Milliken Avenue to Rochester Avenue	San Bernardino	1.40	1
2962	Cucamonga Valley Water District	Recycled Water Distribution Facilities - Zone 1 - Milliken Avenue to Haven Avenue	San Bernardino	1.30	1
2978	Cucamonga Valley Water District	Recycled Water Distribution Facilities - Zone 1 - Haven Avenue to Archibald Avenue	San Bernardino	1.10	1
2980	Cucamonga Valley Water District	Recycled Water Distribution Facilities - Zone 1 - I-15 to Etiwanda Avenue	San Bernardino	1.05	1
2764	Delta Diablo Sanitation District	Pittsburg Golf Course and Urban Landscape Recycled Water Project	Contra Costa	4.60	1
3320	Delta Diablo Sanitation District	Highway 4 Landscape Recycled Water Project	Contra Costa	2.00	1
3328	Delta Diablo Sanitation District	City of Antioch Urban Landscape Recycled Water Project	Contra Costa	7.00	1
3234	East Bay Municipal Utility District	Camanche South Shore Recycling Project	Calaveras	3.50	1
3296	East Bay Municipal Utility District	EBMUD/ChevronTexaco Richmond Advanced Recycled Expansion (RARE) Water Project	Contra Costa	40.00	1
3298	East Bay Municipal Utility District	Satellite Recycled Water Treatment Plant Project	Alameda	0.73	1
3300	East Bay Municipal Utility District	San Ramon Valley Recycled Water Program Phase 2	Alameda	22.00	1
3304	East Bay Municipal Utility District	East Bayshore Recycled Water Project Phase 1B	Alameda	23.00	1
2680	Eastern Municipal Water District	Temecula Valley Effluent Pipeline	Riverside	32.00	1
3240	Eastern Municipal Water District	Eastern Municipal Water District Recycled Water System Pressurization and Expansion	Riverside	15.40	1
3342	El Toro Water District	ETWD/MNWD Joint Recycled Water Treatment and Distribution System Project	Orange	31.25	1
3408	El Toro Water District	ETWD, IRWD and MNWD Recycled Water Project	Orange	11.90	1
2944	Elsinore Valley Municipal Water District*	Canyon Hills Recycled Water Project	Riverside	2.54	1
3230	Elsinore Valley Municipal Water District*	Elsinore Valley Municipal Water District Wildomar Recycled Water Project	Riverside	16.20	1
1830	Inland Empire Utilities Agency	Regional Recycled Water Distribution System Phase - 2	San Bernardino	40.00	1
2336	Irvine Ranch Water District*	Recycled Water Distribution System Expansion	Orange	4.351	1

[1]CPL placement is not a commitment to fund

[2]Category placement is based on applicant submittals and is subject to change pending complete review

*As of 12/1/04 Water Rights fees are not paid

California State Water Resources Control Board

CPL Adopted 1-20-05

Water Recycling Funding Program Competitive Project List (CPL)[1]

Exhibit B

PIN	Agency	Project Name	County	Project Cost ($Million)	Category[2]
3038	Irvine Ranch Water District*	Recycled Water Supply Expansion Project	Orange	33.00	1
2086	Lake County Sanitation District	Full Circle	Lake County	8.40	1
3040	Las Virgenes Municipal Water District	Restoration of Native Flows in Malibu Creek - Decker Canyon Recycled Water Facilities	Los Angeles	6.50	1
2946	Long Beach, City of, Board of Water Commissioners	Long Beach Recycled Water System Expansion Phase 2	Long Angeles	13.59	1
3016	Long Beach, City of, Board of Water Commissioners	Long Beach Recycled Water System Expansion Phase 3	Los Angeles	4.313	1
3184	Long Beach, City of, Board of Water Commissioners	Long Beach Recycled Water System Expansion Phase 4A	Los Angeles	15.60	1
3378	Long Beach, City of, Board of Water Commissioners	Long Beach Recycled Water System Expansion Phase 4B	Los Angeles	17.54	1
2150	Los Angeles Department of Water and Power*	Hansen Area Water Recycling Project - Phase I	Los Angeles	9.10	1
2960	Los Angeles Department of Water and Power*	Hansen Area Water Recycling Project - Phase 2	Los Angeles	6.20	1
2964	Los Angeles Department of Water and Power*	South Valley Water Recycling Facilities Project	Los Angeles	20.00	1
2856	Napa Sanitation District	Napa State Hospital Recycled Water Pipeline	Napa	17.10	1
2860	Napa Sanitation District	Stanley Ranch/South Los Carneros Recycled Water Pipeline	Napa	12.10	1
3360	North Coast County Water District	Pacifica Water Recycling Project	San Mateo	5.50	1
3376	Olivenhain Municipal Water District*	Northwest Quadrant Recycled Water Program	San Diego	4.00	1
3384	Orange County Sanitation District	Activated Sludge Rehabilitation Project (P1-82)	Orange	40.00	1
3400	Orange County Sanitation District	Rehabilitation of Activated Sludge Facilities for Secondary Treatment Upgrades(P2-74)	Orange	12.91	1
2008	Otay Water District	Recycled Water 30-Inch Transmission Main, 450-1 Reservoir, and 680-1 Pump Station	San Diego	30.00	1
2162	Pajaro Valley Water Management Agency*	Watsonville Area Water Recycling Project (WAWRP)	Santa Cruz	47.30	1
3210	Rancho California Water District	Phase II Recycled Water Project for Agricultural Areas	Riverside	5.00	1
3198	San Bernardino County Special Districts	Huston Creek Recycling Project	San Bernardino	7.00	1
3336	San Bernardino County Special Districts	Lytle Creek North Recycling Facilities	San Bernardino	2.90	1
2916	San Juan Capistrano	Recycled Water Distribution System	Orange	30.00	1
3276	San Timoteo Watershed Management Agency	Recycled Water Facilities Phase I	Riverside	36.00	1
3120	Santa Clara Valley Water District*	South Santa Clara County Recycled Water Service Expansion	Santa Clara	7.40	1
2406	Santa Margarita Water District	RW Program Expansion Group 3 Facilities	Orange	8.56	1
2812	Santa Margarita Water District	Oso WRP Capacity and Service Area Improvements	Orange	3.10	1
2876	Santa Margarita Water District	Chiquita WRP Phase IV Expansion	Orange	17.40	1
2880	Santa Margarita Water District	Seasonal Recycled Water Storage Reservoir	Orange	24.60	1
2888	Santa Margarita Water District	Ortega/Chiquita Canyon Phase 1 RWDS Expansion	Orange	23.70	1
2778	Saticoy Sanitary District	Saticoy Regional Recharge Project	Ventura	7.60	1
3352	Sonoma County Water Agency	North San Pablo Bay Restoration and Reuse Project	Marin	250.00	1
3268	Triunfo Sanitation District	Calleguas & Malibu Creeks Regional Recharge Project	Ventura	30.00	1
2434	Upper San Gabriel Valley Municipal Water District	San Gabriel Valley Water Recycling Project - Phase IIA	Los Angeles	7.22	1
3060	Victor Valley Wastewater Reclamation Authority	Green Tree Subregional Reclamation Facility	San Bernardino	22.50	1
3096	Victor Valley Wastewater Reclamation Authority	Apple Valley Subregional Reclamation Facility	San Bernardino	22.50	1
3098	Victor Valley Wastewater Reclamation Authority	Upper Narrows Subregional Reclamation Facility	San Bernardino	29.80	1
3330	Victor Valley Wastewater Reclamation Authority	Hesperia Subregional Reclamation Facility	San Bernardino	22.50	1
3382	Walnut Valley Water District	North Side Line Replacement	Los Angeles	3.40	1
3402	Walnut Valley Water District	WVWD Recycled Water Reservoir and Pump Station	Los Angeles	1.50	1
2090	West Basin Municipal Water District	Madrona/ Palos Verdes Lateral	Los Angeles	27.56	1

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California State Water Resources Control Board

CPL Adopted 1-20-05

Water Recycling Funding Program Competitive Project List (CPL)[1]

Exhibit B

PIN	Agency	Project Name	County	Project Cost ($Million)	Category[2]
3036	Western Municipal Water District	Tertiary Upgrade and Nonpotable Connection for March WWRF	Riverside	2.04	1
3204	Western Municipal Water District	Nonpotable Pipeline to Meridian Business Center	Riverside	0.17	1
3208	Western Municipal Water District	Nonpotable Pipeline to Martin Luther King High School	Riverside	0.37	1
2702	Yucaipa Valley Water District	Non-Potable Water Infrastructure Project	San Bernardino	22.00	1
			Sub Total Category 1	**1451.74**	
1850	City of Crescent City	Crescent City Wastewater Treatment Plant Upgrade	Del Norte	20.00	2
3394	City of Fillmore	Park Irrigation	Ventura	26.00	2
2998	City of Healdsburg*	Wastewater Treatment Plant Upgrade Project	Sonoma	25.00	2
3278	City of Petaluma	Phase II Recycled Water Program	Sonoma	10.23	2
3260	North Marin Water District*	NMWD Water Recycling Project - Phase 1	Marin	4.00	2
3326	North Marin Water District*	NMWD Recycled Water Project - Phase 2	Marin	3.00	2
3348	Sonoma County Water Agency	Sonoma Valley Recycled Water Project	Sonoma	35.00	2
3350	Sonoma County Water Agency	North Sonoma County Agricultural Reuse Project	Sonoma	250.00	2
			Sub Total Category 2	**373.23**	
2696	El Dorado Irrigation District*	El Dorado Hills Seasonal Storage Reservoir	El Dorado	36.00	3
2698	El Dorado Irrigation District*	Deer Creek Seasonal Storage Reservoir	El Dorado	36.00	3
3138	El Dorado Irrigation District*	EDHWWTP Recycled Water Upgrades	El Dorado	16.70	3
3180	El Dorado Irrigation District*	Deer Creek Pipeline to El Dorado Hills	El Dorado	7.00	3
3200	Graton Community Services District	Graton Zero Discharge Project	Sonoma	3.00	3
2518	Lake Arrowhead Community Services District	Recycled Water System Phase I	San Bernardino	10.00	3
3202	Ramona Municipal Water District	Santa Maria Spray Fields	San Diego	3.50	3
2716	Sacramento Regional County Sanitation District	SRCSD-SCWA-TNC Water Recycling Facilities	Sacramento	51.05	3
3242	San Bernardino County Special Districts	Helendale Water Recycling Project	San Bernardino	1.25	3
2496	Tomales Village CSD	Tertiary Treatment and Recycling Project	Marin	0.36	3
			Sub Total Category 3	**164.86**	
3380	West Valley Water District	Aquifer Supply Reclamation Project, Phase II	San Bernardino	1.49	4
3406	City of Galt	City of Galt WWTP Reclamation System Expansion	Sacramento	0.30	5
3262	River Pines Public Utility District	River Pines Water Re-use	Amador	0.24	6
			Total All Categories	**1991.86**	

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*As of 12/1/04 Water Rights fees are not paid

Monitoring Team Progress Report
February 2005 ISB meeting
Bill Glaze and Judy Meyer

Monitoring programs are designed to fill one of several objectives such as: compliance with regulations; developing a fundamental understanding of natural and engineered systems within the CBD system; real-time decision-making by water management agencies; assessing effectiveness of specific actions (*e.g.*, a particular restoration project); adaptive management; assessing program performance (Is CALFED making a difference?). We have focused our attention on this last objective (as has the Performance Measures Subcommittee).

Inspired by Bob Twiss' suggestion at the November 2004 ISB meeting to "use hard copy", we are in the process of identifying goals and underlying assumptions in the ROD to allow us to focus on the status and possible future design of monitoring programs that could be used to assess progress toward meeting CALFED goals. For example, an underlying assumption in the ROD is that aquatic and terrestrial habitats can be increased and improved to support sustainable populations of diverse and valuable plant and animal species. Another is that there is adequate water in the system (Bay-Delta) to satisfy the demands of all beneficial uses.

At this early stage in our analyses, we offer the following observations (numbers in parentheses refer to documents/websites listed at the end of this report):

- The desirability of having a comprehensive monitoring, assessment and research program (CMARP) for the entire CBD system was recognized in 1998 (1). The resulting organization consisting of representatives from most of the key stakeholders in the Bay-Delta area developed an elegant plan for such a program. Task 3 within the CMARP was the design of a monitoring program, with four sub-elements: (a) construct an inventory of existing monitoring programs [A total of 622 were identified (2). A brief overview of seven of the larger long-term monitoring programs with annual budgets totaling $11 million is available (3).]; (b) develop specific monitoring elements needed to respond to the CALFED goals; (c) develop a process for data management; and (d) develop a process for data assessment and reporting.

- We have not seen an integrated conceptual model that could guide a comprehensive monitoring program to assess CALFED's progress toward meeting its goals. CMARP (1) proposed a logical three step sequence of events leading to the development of a monitoring program: clarify CALFED goals and objectives, develop a conceptual framework, and design a monitoring program. One appendix of the CMARP report includes 37 pages of detailed goals and objectives from over 80 CALFED sub-programs (4), and a workshop (5) on conceptual models was held; but we have found little evidence that the ultimate goal of this exercise was achieved.

- The Terrestrial/Amphibious Monitoring Plan (TAMP) (6) is based on a conceptual framework and presents monitoring recommendations resulting from previous reports and several workshops. Its focus is on terrestrial and wetland habitats and on monitoring to evaluate progress towards the goals of the Ecosystem Restoration Program. It addresses

"what" should be monitored and "why", but the specifics of "where, when and how often" were not developed. TAMP provides a step toward a more comprehensive and coordinated monitoring effort, but is obviously limited in its scope and not yet implemented. Similar planning documents could benefit monitoring efforts in other CALFED habitats and programs and could assist integration of monitoring programs throughout CALFED.

- One component of a successful monitoring program is that the resulting data are publicly available. The goal of the Bay/Delta and Tributaries Data Management System (BDAT) is to create an infrastructure for managing and sharing environmental data sets which are available to subscribers through quick and easy access (7). Fifty databases are in BDAT's distributed database system covering primarily the Bay/Delta, although only about ten of the hundreds of monitoring programs (2) have their data in BDAT. It is our understanding that there is a large amount of monitoring taking place that is not integrated into this database, including data on delta water used downstate in agricultural and urban settings. This information is also highly relevant to the management of the Bay-Delta system and should be integrated in any future monitoring system. Few monitoring programs work with BDAT in advance so that their data can be easily incorporated into this database, and too few potential users of the data know enough about BDAT to effectively use it.

- One section of a recent DWR review (8) asks whether current water quality monitoring is providing an adequate baseline for evaluating CALFED's progress toward meeting its goals. The report identifies some sites where there is duplication of monitoring efforts, recommends greater coordination among programs and increased use of continuous recorders, and calls for development of a CALFED monitoring program using documents such as the CMARP report as a starting point.

- Integration of monitoring and modeling is not addressed the monitoring documents we have seen.

Based on these observations, we make the following suggestions for ISB discussion:

- A diverse and extensive array of monitoring programs are in place in San Francisco Bay Delta and its tributaries; yet coordination and communication among programs appears to be limited. A workshop (or series of workshops) on monitoring in the CALFED region could enhance communication and coordination, and could aid in assessing CALFED's progress toward its goals. Such workshops contributed to the development of the CMARP and TAMP planning documents. A workshop focused on designing a monitoring program to assess CALFED progress toward meeting a subset of its goals would probably be more productive than one considering the entire program. Workshop participants should include both representatives of on-going monitoring programs in California as well as individuals familiar with the design and implementation of monitoring programs elsewhere.

- A Technical Panel on Observation and Forecasting should be established. See attached document for further details.

Documents considered to date (with help from Kleinschmidt and Jones and Stokes personnel):

(1) A proposal for the development of a comprehensive monitoring, assessment and research program (CMARP) (Stage I report) (1998) (summarized at http://calwater.ca.gov/programs/science/cmarp/execsum.html) as well as presentation by Randy Brown at November 2004 ISB meeting.
(2) CMARP database of monitoring projects compiled by San Francisco Estuary Institute (~1999)
(3) CMARP status and trends monitoring report (December 1999), Appendix VI of CMARP report (1 above).
(4) CALFED Program Goals and Objectives (June 1998). Appendix IV of CMARP report (1 above).
(5) Use of conceptual models in the design of a comprehensive monitoring, assessment and research program for CALFED (June 1998). Appendix V of CMARP report (1 above)
(6) Terrestrial/Amphibious Monitoring Plan (TAMP) Executive Summary (May 2002)
(7) Presentation by Karl Jacobs (DWR) to ISB Monitoring Team on BDAT program (November 2004)
(8) Delta Water Quality Program Review, Department of Water Resources, September 2000.
(9) Sacramento-San Joaquin River Delta Water Quality Issues (G. Fred Lee, September 2004 ISB meeting handout)
(10) Environmental Monitoring Program Review document (March 2003)

DRAFT

CBDA INDEPENDENT SCIENCE BOARD

CHARGE TO A TASK FORCE TO DESIGN A COMPREHENSIVE OBSERVATION & FORECASTING SYSTEM FOR THE CALIFORNIA BAY-DELTA SYSTEM

The purpose of this task force is to design a comprehensive observation and forecasting system (BDCOFS) for the California Bay-Delta System (CBDS)[1]. The purpose of BDCOFS would be to provide a unified, enduring base of reliable information on the status of water movement, water quality, habitat condition, and ecological functioning within the CBDS to assist managers in achieving the goals of the CALFED Record of Decision. The task force is charged to prepare a detailed description of such a system including:

1. A proposed network of monitoring stations to obtain the desired information for the CBDS on a timely basis, preferably in real time, considering the diverse needs for such data now and to the extent possible, anticipating future information needs;
2. A real-time data management system that will facilitate the assurance of data quality, store the monitoring information and make it available in optimum forms and formats that will be useful to CBD managers, analysts, and other users;
3. A real-time data assimilation, interpolation, and forecasting system incorporating state-of-the-art hydrodynamic, physicochemical, and biological models of the CBDS calibrated with the monitoring data from the CBD monitoring network.
4. A website and other methods for communication of the [CBCOFS BDCOFS?] data base, models, and modeling products to the general public, and within the research, management and policy analysis communities in California.
5. An estimate of the cost of such a system including the cost of its construction, and annual costs for its maintenance and operation.

As it pursues its charge, the task force will seek the advice and active cooperation of the diverse state, federal and private entities that already operate monitoring networks and/or are involved in modeling and forecasting for various elements of the CBDS, and will determine to what extent these existing capabilities can be utilized or expanded within the desired BDCOFS. It will also attempt to determine from these and other relevant entities the types of information that would be most useful for their purposes both now and in the future as they pursue their respective goals within the CBDS. Consistent with the goals of the CBD Authority, the task force will also be receptive to input from all other stakeholders who have an interest in the Bay-Delta system, including operating a website or mechanisms to make its work transparent to the public.

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[1] In this charge, the term California Bay-Delta System and its acronym CBDS refers to the combination of natural and constructed water bodies within the Sacramento River and San Joachim River water sheds, the rivers themselves and the Bay-Delta region extending through San Francisco to its terminus at the Pacific Ocean, plus the series of natural and constructed water conveyances that are used to export water from the Delta to other locations in California. Subsurface water is included in this definition to the extent that it is relevant to goals of the ROD.

Composition of the BDCOFS Task Force. The task force will consist of qualified specialists in water quality and biological monitoring, sensor design, networking, information systems, modeling and any other areas that are deemed to be needed to design the BDCOFS. Priority will be given to the appointment of experts who have direct experience with observation and forecasting networks. The task force will have a total of no more than seven members including a chair, all appointed by the CBDA Lead Scientist for a period of one year. Other persons may be invited to participate in the work of the task force as resource experts. If deemed to be desirable by the CBDA Lead Scientist, the task force may continue to operate after its report is complete, in order to monitor the operation of the BDCOFS and offer any advice to the CBD Authority regarding its operation.

Timeline and Deliverables. The task force is expected to complete its work within one calendar year. It will provide quarterly progress reports to the CBDA Independent Science Board and the Lead Scientist and when available, a final report suitable for presentation to the CBD Authority Board. The task force will be assisted by a member of the staff of the office of the Lead Scientist or by a qualified contractor.

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

JOINT MEETING WITH BAY-DELTA PUBLIC ADVISORY COMMITTEE

DELTA IMPROVEMENTS PACKAGE UPDATE

Summary: The Delta Improvements Package Implementation Plan was adopted by the California Bay-Delta Authority in August 2004. Authority and State and Federal agency staff will provide an update on activities described in the Delta Improvements Package, and an update on project and program schedules.

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

Background

The Delta Improvements Package (DIP) outlines actions related to water project operations in the Delta that will result in increased water supply reliability, improved water quality, environmental protection and ecosystem restoration, protection of the Delta Levee system, and analyses and evaluation to support improved real-time and long-term management.

State Response to the U.S. Department of Interior November 22, 2004 letter

At the December 2004 joint meeting of the Authority and the Bay-Delta Public Advisory Committee (BDPAC), the Authority and BDPAC discussed the November 22, 2004 letter sent from the U.S. Department of Interior (DOI) (specifically U.S. Bureau of Reclamation (USBR) and U.S. Fish and Wildlife Service to the California Departments of Water Resources (DWR) and Fish and Game and (DFG). Attachment 1 is the response from DWR and DFG, dated January 14, 2005. State and Federal agency staff will again be available to answer questions about this exchange of letters.

As discussed at the December 2004 joint meeting, USBR will provide an update on its proposed schedule to address the issues raised in the November 22, 2004 letter to the State agencies.

Incorporating the DIP Actions into the Multi-Year Program Plans

Attachment 2 is the updated Delta Improvements Package Summary of Schedules. Any new information is shown in underline. The original dates, including strikeouts, are from the version of the DIP adopted by the Authority at its August 2004 meeting.

During the next six months, the agencies will explicitly identify the actions listed the DIP in their revised Multi-Year Program Plans. This will ensure that each action listed in the DIP is matched with a responsible agency, and that the activity also has a budget and accurate timeline. Once the Multi-Year Program Plans are completed in June 2005, Authority staff will revise the DIP Implementation Plan so that each action shown in the Summary of Schedules also has an estimated budget.

A Comprehensive Overview of Water Quality, Fisheries, and Levees Issues in the Delta

There was also a request made at the December 2004 joint Authority and BDPAC meeting for a briefing on Franks Tract. The State and Federal agencies are mindful of the relationship between the evaluation of Franks Tract and the investigations of the Delta Cross Channel operation and the Through-Delta Facility. The issues associated with Delta water quality, fisheries, and levees are central to the determinations that must be made by the State and Federal agencies at the end of Stage 1 as described in the CALFED Record of Decision. Given the significance of these issues, the agencies are planning a briefing for the April 2005 joint meeting of the Authority and BDPAC. This briefing will include an update on the Franks Tract, Delta Cross Channel, and Through-Delta studies, related water quality and fisheries evaluations in the Delta, and a status report on the Comprehensive Levee Program Evaluation.

List of Attachments

Attachment 1 -- DWR/DFG Response to DOI November 22, 2004 letter
Attachment 2 -- Delta Improvements Package Revised Summary of Schedules
Attachment 3 – Letter from Senator Sheila Kuehl and Assemblymember Fran Pavley to Secretary Mike Chrisman, Secretary Terry Tamminen, and Gary Hunt dated December 20, 2004
Attachment 4 – Letter from NOAA Fisheries to Gary Hunt dated December 20, 2004

Contact
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JAN 1 4 2005

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Sacramento, California 95825-1846

Integration of Central Valley Project Improvement Act Actions with the Environmental Water Account

This is in response to your November 22, 2004 request that the Environmental Water Account (EWA) be managed in close integration with the environmental water assets as set forth in Section 3406 of the Central Valley Project Improvement Act (CVPIA). We concur with your objective of better integrating EWA and fisheries actions in CVPIA and to achieve this integration while maintaining and perhaps improving fisheries protection and recovery objectives.

The EWA was established by the CALFED Record of Decision in August 2000 to achieve two general objectives; water supply reliability for Central Valley Project (CVP) and State Water Project (SWP) operations in the Delta and added protection for at risk fish species dependant on the Bay/Delta Estuary to achieve a trajectory toward recovery of these species. These objectives are achieved with (1) the existence of the regulatory baseline consisting of existing regulatory actions and CVPIA resources, and (2) EWA plus an adequately funded Environmental Restoration Program.

The EWA was initially established as a four year program to test its viability. Over the past four years the five agencies that manage EWA (Bureau of Reclamation (Bureau), United States Fish and Wildlife Services (USFWS), National Oceanic and Atmospheric Administration Fisheries (NOAA), Department of Fish and Game (DFG) and Department of Water Resources (DWR) collectively referred to as EWA agencies) has made EWA into a flexible water and fisheries management tool to achieve its objectives.

During these first four years we have integrated actions under the CVPIA 3406b(2) with those of EWA. In fact, about 175,000 acre-feet of water was used by EWA for actions that would have normally been conducted by b(2) actions except that the b(2) resources were not sufficient in these years to provide that protection. This collaboration can continue because the EWA agencies extended the existing EWA program in September of 2004 for an additional three years.

Based on the discussion at the California Bay Delta Authority meeting on December 8, 2004, we believe the issue the Department of Interior (DOI) is addressing with this proposal is that the current b(2) policy as recently modeled for the Operation Criteria and Plan consultation shows the 800,000 acre-foot b(2) account limit may be exceeded in about 40 percent of the years. The model assumptions for b(2) actions represents DOI's staffs best efforts to reflect current court decisions. However, concern has been expressed by some water users that the effect of this exceedance is reduced water supply reliability for the CVP water users and that such exceedances may exceed legal authority. Your letter suggests there may be an opportunity to address these water supply reliability impacts through means that would be consistent with the intent of the CALFED Record of Decision. DFG and DWR are interested in evaluating and implementing your proposal to determine if it or some other alternative can achieve your intended purpose without affecting our Conservation Agreement with the State and federal fishery agencies and the 2004 Biological Opinions for the current operations of the CVP and SWP and potentially for future project operations.

We believe several activities need to take place to fully evaluate and potentially implement your proposal. First, we understand that DOI will develop the proposed change in the accounting year for the 3406 b(2) water to a calendar year by a formal revision to the May 2003 b(2) decision. Once a draft of the revision is developed we understand that it will undergo public review that is estimated to last a minimum of 60 days. In our view, this public review process is very important to allow interested parties time to consider your proposal and to potentially propose alternatives.

Second, we feel that the implementation aspects of the proposed policy should also undergo technical review by EWA agency staff and interested stakeholders related to its possible impacts on EWA resources. Your letter made it clear that your proposal was not intended to reduce the fishery protections currently provided but to improve water supply reliability to the CVP related to the implementation of the provisions of the CVPIA. Our preliminary analysis indicates that this change could place an added burden on EWA in some years

but with the right tools we could greatly reduce this burden or even provide benefits to EWA. We need to make a concerted effort to understand these potential effects in a more comprehensive analysis of your proposal and the tools and resources needed to accomplish its goals. Determining if the present level of fisheries protection can be maintained with your proposal requires careful evaluation. This evaluation should be done over the next few months by the agencies with public input. We suggest that this evaluation also seek feedback and guidance from the CBDA Science Program including to the extent possible representatives of the EWA science review panel.

Third, your proposal highlights the need to develop and clearly define new tools for EWA to enable it to assist in implementation of your proposed change in the b(2) accounting year. Potential tools should be evaluated, refined and then implemented through the revision of the EWA Operation Principles and Protocols. Our initial evaluation indicates these tools include:

Borrowing Water from the CVP - DWR has agreed to allow the EWA to borrow water assets from the SWP between years if needed, provided this borrowing does not affect project deliveries. No such arrangement currently exists for the CVP. We suggest that an EWA protocol be developed to allow EWA to borrow from CVP reservoirs up to 200 TAF in any year and carry up to 300 TAF of water debt between years. The borrowed water could be used for any EWA purpose upstream and could be exchanged in the Delta with the SWP for use as Delta outflow with appropriate credit by the SWP at Banks. The payback of the water borrowed would parallel the existing EWA Operating Principles, applicable to SWP borrowing, of no net water cost to the CVP.

Banking b(2) Water with EWA - The current b(2) policy allows for the banking of b(2) assets but specific rules to accomplish this have not yet been developed. Banking rules need to be formalized to allow b(2) assets in one year to be banked with EWA to use to better protect fish in a future year. Once this water becomes EWA water it would take on the attributes of EWA assets including all the benefits of carryover and liabilities spill that EWA has in SWP facilities. For example, the water could be carried for multiple years, would be the first water spilled and would be carried at no cost to EWA, but would receive no power credits.

Aggressive Use of 3406 b(1). The State suggests that DOI evaluate more aggressive use of b(1) to accomplish the purposes of the CVPIA. There may be opportunities when the CVP can reoperate its water releases from CVP reservoirs to provide better protection for fish downstream and capture all or a

part of this water in the Delta with no adverse effects on CVP water supply. The SWP does this regularly and does not seek EWA to cover these costs. We request that, as part of this better integration of CVPIA actions and EWA resources, the CVP aggressively take advantage of b(1) opportunities before charging the b(2) account and thereby minimizing the possible need to use EWA resources because the b(2) assets have been exhausted. If your proposal or any similar alternative is to be implemented, we believe it is essential that there be an increase in the transparency and clarity of b(2) accounting methods being used as well as improvement in the timeliness of updating and sharing the accounting results. Clear and reliable knowledge of the status of b(2) and EWA assets will be even more critical than in the past if further integration of these two environmental protection tools is to succeed.

Fourth, we are willing to consider the possibility of using the EWA, revised as necessary, as a means to accommodate the water supply reliability concerns with the current b(2) policy, while maintaining fisheries protection. This is one of the benefits of a flexible EWA. As such, we suggest that DOI include in any revision to the current b(2) policy a commitment to maintain EWA or a functional equivalent.

If you are in agreement with moving forward with the evaluation of your proposal and the associated issues discussed above, we suggest that the EWA agencies immediately begin developing EWA protocols defining the tools listed above and any other tools that our respective staffs determine are needed and are feasible. An exercise to evaluate use of these tools in conjunction with the proposed change in the b(2) policy should begin as soon as possible to test these concepts. This can be done while you pursue the proposed change to the existing b(2) policy suggested in your letter. These actions will assist our discussions about implementing these changes quickly and in our evaluation of a long-term EWA. We look forward to our continued cooperative approach of providing both the fishery protections and water supply reliability envisioned in the CALFED Record of Decision.

Sincerely,

Lester A. Snow
Director
Department of Water Resources

L. Ryan Broddrick
Director
Department of Fish and Game

cc: See attached list.

cc: Mr. Gary Hunt
Chair
California Bay Delta Authority
650 Capitol Mall, 5th Floor
Sacramento, California 95814

Mr. Jim Lecky
NOAA Fisheries
Assistant Regional Administrator for Protected Resources
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

SUMMARY OF SCHEDULES
Updated January 24, 2005

WATER SUPPLY ACTIONS AND SCHEDULES

SWP/CVP Integration Plan

Schedule:

- Complete SWP/CVP Operations Criteria and Plan Biological Opinion and early consultation on intermediate actions to improve CVP/SWP operation coordination by ~~Summer~~ Fall 2004 **(completed)**
- Completion of appropriate Response Plans required by D-1641 for use of Joint Point of Diversion by August 2004 **(completed)**
- Complete NEPA/CEQA analyses and public review of interim SWP/CVP operation actions by early 2005
- Initiate formal consultation or request confirmation of preliminary Biological Opinion on interim SWP/CVP operation actions by early 2005
- Implement intermediate SWP/CVP operation actions during 2005

SWP/CVP Intertie

Schedule:

- Complete draft environmental documents (EA/IS) by the ~~Summer~~ November 2004 **(completed)**
- Initiate construction of the 400 cfs intertie by ~~late 2004~~ October 2005
- Operation of the 400 cfs conveyance capacity ~~by late 2005~~ in 2006
- ~~Obtain federal construction authorization to increase intertie conveyance capacity to 900 cfs by November 2006~~
- Initiate federal feasibility study to increase intertie conveyance capacity by October 2006

San Luis Reservoir Low Point Improvement Project

Schedule:

- Complete Appraisal Study by ~~September 2004~~ May 2005
- Complete Draft EIR/EIS by ~~May 2005~~ March 2007
- Obtain funding and authorization for construction in ~~June 2006~~ October 2007

South Delta Improvements Project/Increase SWP Pumping to 8,500 cfs

Schedule:

- Final SDIP EIS/EIR and Record of Decision and Notice of Determination ~~by Mid-~~ ~~October~~ December 2005
- Transitional implementation of 8500 cfs, dredging/diversion improvements, 200~~5~~6-2007
- Complete Construction of permanent operable barriers by December 2007
- Fully operate under 8,500 cfs by January ~~1,~~ 2008

WATER QUALITY ACTIONS AND SCHEDULES

South Delta Improvements Project/Permanent Operable Barriers

Schedule:

- See Schedule above for SDIP/Increase SWP pumping 8,500 cfs

San Joaquin River Salinity Management Plan

- Coordinated Drainage Strategy

  Schedule: Ongoing

- Salt Load Management and Reduction

  Schedule:
  - The San Joaquin River Salinity Management Group to begin study of refuge salinity management by summer 2004

- Recirculation

  Schedule:
  - Ongoing
  - Initiate studies for specific recirculation scenarios by fall 2004

- Voluntary Water Transfers and Exchanges

  Schedule: Ongoing

- Real-time Monitoring

  Schedule: Ongoing

- Coordination of East Side Tributary Operations

  Schedule:
  - Initial draft of potential actions for coordination by October 2004

- Introduction of Potential High Quality Wastewater Treatment Plant Flows

  Schedule:
  - Develop draft options by March 2005

- Westside Groundwater Management

  Schedule: Ongoing

Vernalis Flow Objectives

- Schedule: Ongoing

San Joaquin River Dissolved Oxygen

Schedule:

- Complete the RWQCB Phased TMDL and Basin Plan Amendment by ~~December 2004~~ January 2005
- Complete monitoring and modeling studies by June 2007
- Design, construct and operate a demonstration aeration system, fall 2005-2008
- Evaluate other control projects and mitigation strategies, April 2004-December 2008
- Complete Final TMDL/Basin Plan Amendment for long-term control by 2009

Old River and Rock Slough Water Quality Improvement Projects

Schedule:

- Complete construction of Veale and Byron tracts drainage improvements by December 2005
- Complete construction of first phase Canal lining project by December 2006

Franks Tract

Schedule:

- ~~Complete water quality and fish studies and make recommendations by April 2005~~
- Develop program plan March 2005
- Complete pre-feasibility study ~~Summer~~ June 2005
- Construct and monitor pilot projects, January 2006 - January 2008 (currently under reevaluation)

Delta Cross Channel Program

Schedule:

- Complete evaluations and make recommendations on reoperation by November 2005 (currently under reevaluation)
- Implement reoperation recommendations by January 2006 (currently under reevaluation)

Relocation of M&I Intake

Schedule:

- Complete evaluation of water quality improvements (date to be developed)

Through-Delta Facility

Schedule:

- Complete evaluations, determine TDF technical viability, and recommend projects for implementation by November 2005 (currently under reevaluation)
- Seek funding and initiate EIR/EIS for project implementation by January 2006 (currently under reevaluation)

ENVIRONMENTAL PROTECTION ACTIONS AND SCHEDULES

OCAP ESA Consultation

Schedule:

- OCAP Biological Opinions issued by ~~Summer~~ Fall 2004 **(completed)**

SDIP ESA Consultation

Schedule:

- SDIP Biological Opinion issued by ~~January 15,~~ August 2005

Update of CALFED ROD Programmatic Regulatory Commitments and Programmatic Biological Opinions

Schedule:

- Complete assessment of the efficacy of the EWA and progress toward achieving the milestones~~,~~ by August 2004 **(completed)**
- Update Programmatic Regulatory Commitments by September 30, 2004 **(completed)**
- Update Programmatic Biological Opinions by September 30, 2004 **(completed)**

Environmental Water Account (EWA)~~.~~

Schedule:

- Decision on continuing short-term EWA by September 30, 2004 **(completed)**
- Draft EIS/EIR on long-term EWA by ~~June~~ December 2005
- Final EIS/EIR on long-term EWA by December 200~~5~~6

Delta Regional Ecosystem Restoration Implementation Plan (DRERIP)

Schedule:

- Complete development and peer review of species life history and ecosystem element conceptual models by ~~December 2004~~ December 2005
- Evaluate Delta ERP Actions and approve priority setting process by ~~May 2005~~ May 2006

- Complete final DRERIP in ~~December 2005~~ December 2006

DELTA LEVEES ACTIONS AND SCHEDULES

Schedule:

- Implement the Levee System Integrity Multi-Year Program Plan (Years 5-8)

SCIENCE ACTIONS AND SCHEDULES

Independent Science Board

Schedule: Ongoing

Environmental Water Account Independent Reviews

Schedule:

- EWA Science Panel review in November 2004 **(completed)**

Focused Study on South Delta Hydrodynamics, Water Quality, and Fish

Schedule:

- Conduct pilot investigations on South Delta hydrodynamics, fisheries, and water quality between May 2004 and ~~July~~ December 2005
- Conduct detailed scientific study on feasibility of using new SWP/CVP operations strategies to reduce fishery impacts between ~~March 2005 and July 2007~~ January 2006 and December 2007
- Report full results and whether new operations strategies are feasible as soon as possible, but no later than 2008

Focused Study on Delta Smelt and Fish Facilities

Schedule:

- Evaluate fish survival in the existing CHTR process between April 2004 and June 2007
- Recommend implementing CHTR improvements for delta smelt by July 2008

Science Program PSP~~.~~

Schedule:

- Proposal Solicitation Package will be available October 2004 **(completed)**

SWRCB Periodic Review

Schedule:

- Periodic review proposed to start in fall of 2004

South Delta Fish Facilities

Schedule:

- Maintain and improve existing fish facilities. Ongoing.
- Conduct alternative facility configurations and operational studies, July 2004 to July 2006 (currently under reevaluation)
- Recommendation on new fish facility alternatives (with SDIP 10,300) by July 2006 (currently under reevaluation)

Performance Evaluation and Monitoring Program

Schedule:

- Final Conceptual Plan by January 2006
- Final Implementation Plan for Comprehensive Monitoring Plan by July 2005~~5~~6

ATTACHMENT 3

PRINCIPAL CONSULTANTS
SYRUS DEVERS
BILL CRAVEN

ASSISTANT CONSULTANT
TAM MA

COMMITTEE ASSISTANT
PATTY HANSON

STATE CAPITOL, ROOM 407
SACRAMENTO, CA 95814
TEL (916) 445-5441
FAX (916) 323-2232

California Legislature

Senate Committee on Natural Resources and Wildlife

SHEILA JAMES KUEHL
CHAIR

December 6, 2004

Mike Chrisman, Secretary
Resources Agency
1416 Ninth Street
Sacramento, CA 95814

Terry Tamminen, Secretary
California Environmental Protection Agency
1001 I Street
Sacramento, CA 95814

Gary Hunt, Chairman
California Bay-Delta Authority
4450 Capitol Mall
Sacramento, CA 95814

Re: November 22 Letter from the Department of Interior Regarding Water for Environmental Restoration

Dear Secretary Chrisman, Secretary Tamminen, and Chairman Hunt:

We have received a copy of the November 22 letter from the Department of Interior to state agencies regarding the management of CALFED's Environmental Water Account (EWA) and water dedicated to restoration under federal law. As your agencies develop a response to Interior's request, we ask that you consider several additional questions.

How do you propose to ensure an open, public process, pursuant to the spirit of the CALFED program, to ensure that questions and concerns regarding Interior's proposal

are fully addressed? During the past year, we have heard several reports of agencies failing to fully engage CALFED and stakeholder groups prior to making key water management decisions. We believe that the open, public process used by CALFED ensures not only full public participation, but also the best possible management decisions.

How do your agencies propose that the EWA be funded for the coming several years? We note with some concern that the most recent federal appropriations bill includes only one million dollars for the Environmental Water Account. California taxpayers are bearing the majority of the cost of funding the EWA. As this effort moves forward, water users should bear EWA costs related to meeting mitigation requirements. State taxpayer funds will not be used to repair damage caused by federal environmental rollbacks.

Has the EWA met the water targets in the ROD? Before state and federal agencies expand the EWA, they must first determine if it is adequately performing the water supply reliability and restoration work for which it was originally intended.

Is the Interior proposal consistent with the CALFED ROD? Several concerns have been raised regarding the consistency of this proposal with the CALFED Record of Decision. As CALFED implementation move forward, it is important that the commitments made in the ROD be respected.

How will this proposal affect the CALFED ecosystem restoration program? We understand that Interior's proposal could reduce the amount of water available to implement ecosystem restoration efforts. Obviously, we must avoid a situation where state investments of hundreds of millions of dollars in ecosystem restoration are undermined by federal agency actions. In addition to the current proposal, have your agencies performed an analysis of the cumulative ecosystem restoration impacts of federal actions, since the ROD was signed, regarding the management of environmental water, the EWA and the implementation of the Endangered Species Act?

What impact could Interior's proposal have on requirements related to ESA compliance at the Delta pumps and, by implication, on water supply reliability for the 20 million Californians who drink Delta water?

How would Interior's proposal affect progress toward resolving Delta water quality issues and developing a South Delta Improvement Project (SDIP)? State and federal law require that CALFED's Delta strategy include a solution to serious water quality problems in the Delta. Further, CALFED agencies are working to develop a long-term Delta strategy, often referred to as the SDIP, that is likely to require reliable funding, a stable Environmental Water Account, a credible baseline and environmental benefits.

We urge you to resist rollbacks of environmental protections that would harm the Bay-Delta ecosystem, particularly those that were so carefully incorporated into the CALFED Record of Decision. The CALFED Program promised an open, public process and steady progress regarding water supply reliability, water quality and ecosystem health.

We are committed to those goals and look forward to working with you to ensure a balanced program.

We look forward to your responses to the above questions. Please keep us informed regarding your response to the Department of Interior.

Sincerely,

Senator Sheila James Kuehl

Assemblymember Fran Pavley

Cc: Lester Snow
Ryan Broddrick
Patrick Wright

ATTACHMENT 4

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Sacramento Area Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4706

December 14, 2004

In Reply Refer To:
151400SWR1999SA5950:JSS

Mr. Gary Hunt
Chairman, California Bay-Delta Authority
650 Capitol Mall, 5th Floor
Sacramento, California 95814

Dear Mr. Hunt:

Thank you for your letter requesting support of the California Bay-Delta Authority's (CBDA) Delta Improvement Package (DIP), which has recently been developed by the State and Federal agencies that are signatories to the CALFED Record of Decision (ROD).

The National Marine Fisheries Service (NOAA Fisheries) supports implementation of the DIP, based upon our understanding of the projects as currently described. NOAA Fisheries recognizes that the DIP is a general plan and does not describe specific projects in sufficient detail to determine their potential effects upon listed salmonids. Therefore, NOAA Fisheries' support of the DIP does not represent a final decision on the impacts of the respective segments of the DIP to be implemented; rather, as plans for specific projects described in the DIP reach maturity, NOAA Fisheries, as well as the other State and Federal regulatory agencies, will make regulatory decisions based on the project's description and record at that time.

NOAA Fisheries looks forward to continuing our relationships with State and Federal agencies as we move forward to implement the CALFED Record of Decision. If you have any questions regarding these comments, please contact Jeffrey Stuart in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Stuart can be reached by telephone at (916) 930-3607, or by FAX at (916) 930-3629.

Sincerely,

Michael E. Aceituno
Supervisor, Sacramento Area Office

cc: NMFS-PRD, Long Beach, California

Delta Improvements Package

Public Workshops

May 27, 2004

CALIFORNIA BAY-DELTA AUTHORITY

Workshop Agenda

- Introductions
- Workshop Purposes and Approach
- CALFED Bay-Delta Program Overview
- Delta Improvements Package Overview
- Questions and Answers with CALFED Agency Panel
- Public Comments on DIP and Draft MOU
- Adjourn

CALIFORNIA BAY-DELTA AUTHORITY

Workshop Purposes

- Explain
  - Relationship of DIP key elements to overall implementation of ROD
  - Inter-relationship of DIP key elements
  - Implementation schedules
- Receive public comments

CALIFORNIA BAY-DELTA AUTHORITY

Public Comments on DIP and Draft MOU

- Draft MOU and supporting documents that comprise the DIP were posted on California Bay-Delta Authority web site May 21
- Authority to discuss DIP and MOU at June 10 meeting
- Comments received today and in writing by June 2 will be distributed to Authority members before meeting
- Authority will summarize comments in staff report
- Comments received between June 2-9 will be distributed to Authority members at meeting

CALIFORNIA BAY-DELTA AUTHORITY

Comment Process at Workshops

- Submit any written comments today
- Oral comments captured on flip charts and computer notes
- Clarify and correct your comment at flip charts after the meeting if needed
- Staff report will summarize comments for CBDA—available at June 10 meeting
- No plan to respond in writing to all workshop comments

CALIFORNIA BAY-DELTA AUTHORITY

Delta Improvements Package

Water Supply Reliability

- Implement SWP/CVP integration plan
- Design & construct SWP/CVP intertie
- Increase SWP permitted pumping rates to 8,500 cfs

Ecosystem restoration

- Update programmatic regulatory commitments (including ERP)
- Launch expanded, long-term EWA with combination of public and user funding

Water Quality

- Permanent operable barriers
- Develop San Joaquin River Salinity Management Plan
- Reduce agricultural drainage/relocate intakes
- Address Stockton dissolved oxygen problem
- Develop strategy to improve Frank's Tract

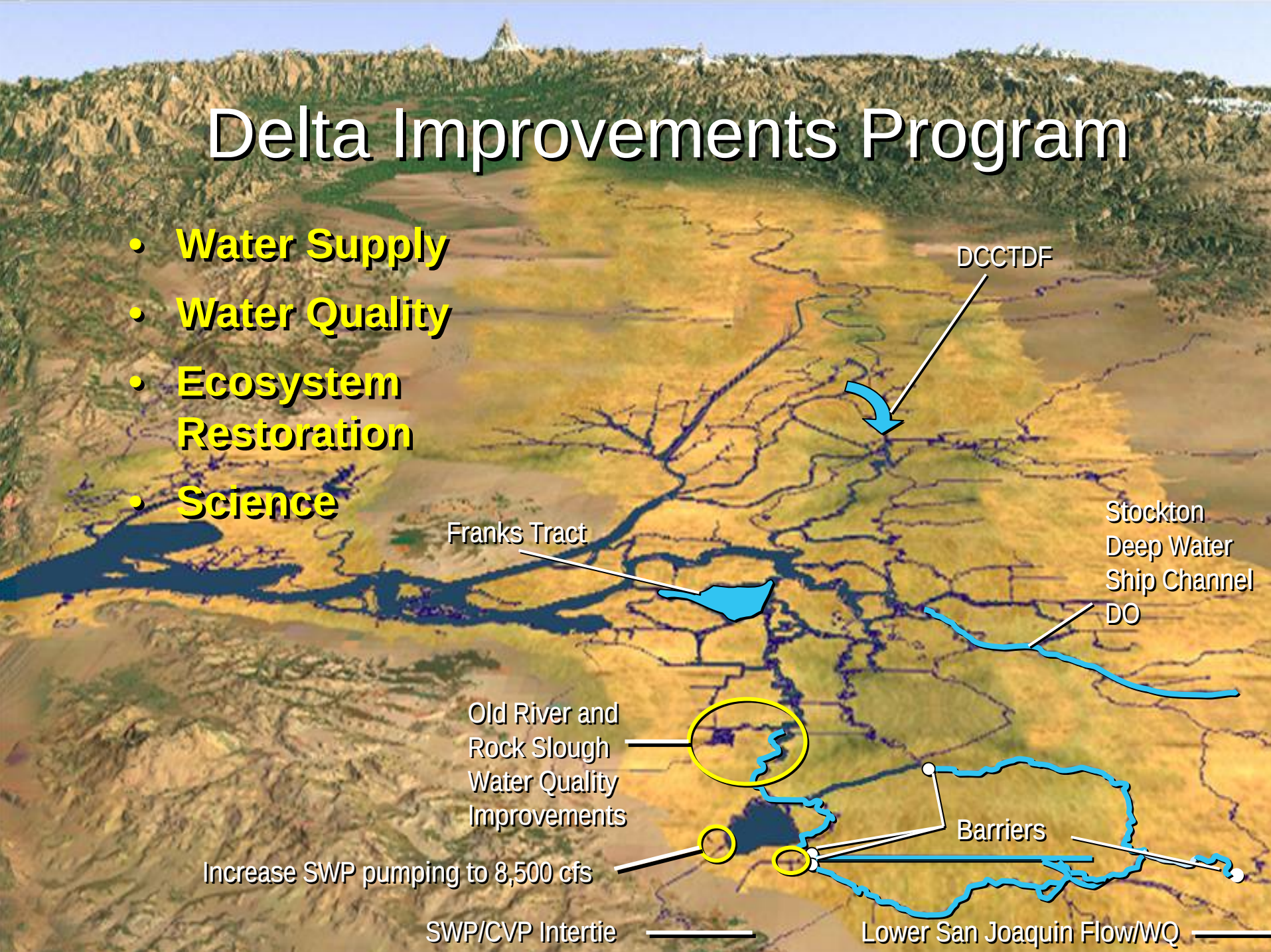
Science

- Independent reviews of specific actions, including the EWA, and focused research monitoring, and assessment to inform decision-making

CALIFORNIA BAY-DELTA AUTHORITY

Delta Improvements Program

- **Water Supply**
- **Water Quality**
- **Ecosystem Restoration**
- **Science**



Key Linkages

- Permanent Operable Barriers
- Water Quality Standards
- Old River and Rock Slough water quality Improvements
- Environmental Protection Measures
- Environmental Water Account

CALIFORNIA BAY-DELTA AUTHORITY

Delta Improvements Package Schedule

- Public Workshop-Sacramento ….May 27th
- Public Workshop-Walnut Grove...May 27th
- Review with Stakeholders/BDPAC Subcommittees……..May/June
- CBDA adopt Resolution……June 9-10th

CALIFORNIA BAY-DELTA AUTHORITY

8500 cfs
Operation & Linkages

- Interim Implementation
  - Prior to Permanent Operable Barriers
- Full Implementation
  - Permanent Operable Barriers constructed and operating

Both levels of operation will not be undertaken until environmental review is completed and all required permits are obtained

CALIFORNIA BAY-DELTA AUTHORITY

8500 cfs Operation & Linkages

- Conditions for Interim Implementation
  - Sufficient water levels for south Delta agricultural diverters
  - No significant degradation to Delta water quality (ag, M&I)
  - No significant negative impact to fish protection, including a functional EWA

Temporary Barriers Project would continue during this period

CALIFORNIA BAY-DELTA AUTHORITY

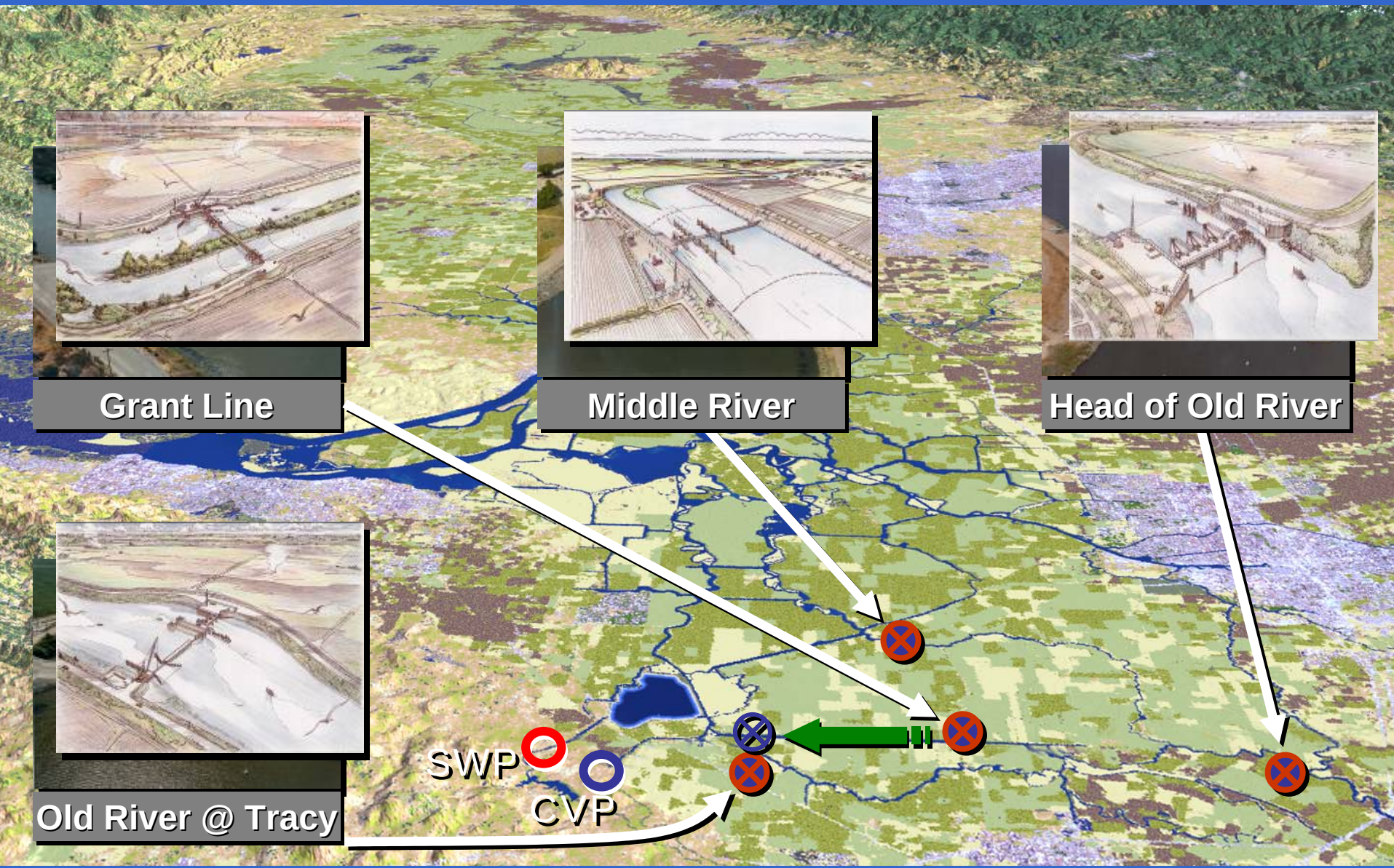
8500 cfs Operation & Linkages

- Conditions for Full Implementation
  - Permanent Operable Barriers constructed and operating to improve water quality and water levels, and provide fish protection
  - San Joaquin River Salinity Management Plan developed and commence implementation
  - Veale and Byron tracts components of the Old River and Rock Slough water quality projects to improve water quality near the intake of Contra Costa WD canal constructed and operating
  - Biological Opinions and measures to help restore covered species are in place
  - Long-term EWA to provide water supply reliability and fish protection developed and implemented

CALIFORNIA BAY-DELTA AUTHORITY

South Delta Improvements

South Delta Improvements



Water Quality Improvements: Salinity in the San Joaquin River

- **Commit to an aggressive integrated salinity management program**
  - **Coordinated actions by the parties and TMDL Process by RWQCB**
  - **Agricultural drainage management**
  - **Real Time salinity monitoring and management**
  - **Salt Load management and reduction**
  - **Recirculation**
  - **Water Transfers**

CALIFORNIA BAY-DELTA AUTHORITY

Recirculation Concept

CVP to San Joaquin River

AUTHORITY

Upstream Salt Load Management

San Joaquin River

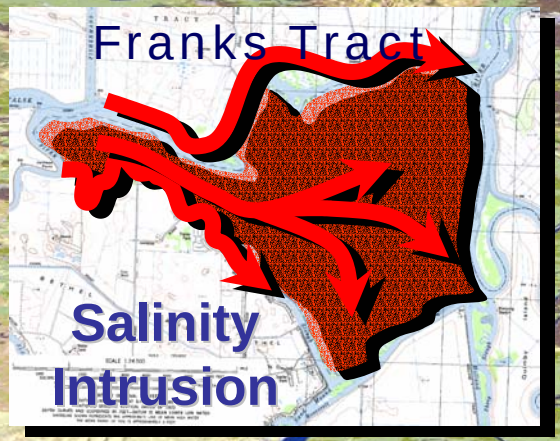
AUTHORITY

Water Quality Improvements: Drinking Water and Ecosystem

- **Continuous improvement in water quality**
- **Reroute Agricultural Drains – Veale and Byron Tracts**
- **Encase the CCWD canal in stages**
- **Franks Tract study and actions**
- **Consider moving CCWD M&I Intake**
- **San Joaquin River Dissolved Oxygen study and actions**

CALIFORNIA BAY-DELTA AUTHORITY

Water Quality Improvements

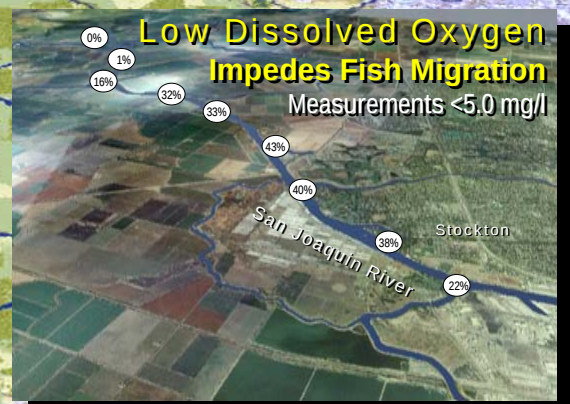


Sacramento

Franks Tract

Stockton DO

Veale & Byron Tract
drain relocations



DELTA IMPROVEMENTS PACKAGE IMPLEMENTATION PLAN REGARDING CALFED BAY-DELTA PROGRAM ACTIVITIES IN THE DELTA

I. Introduction

Actions to increase water supply reliability, improve water quality, protect important fish species, and maintain the integrity of the levee system in the Delta have frequently been at odds with each other. The purpose of this Delta Improvements Package Implementation Plan is to clarify the roles, responsibilities, and commitments of the state and federal in the implementation of programs, projects, evaluations, and other undertakings focused on the Delta region that advance the CALFED Bay-Delta Program goals in the areas of water supply reliability, water quality, ecosystem restoration, Delta levee integrity, and science.

The state and federal agencies are coordinating their assumptions and schedules to move forward with a set of activities focused on the Delta that are consistent with the CALFED Program's principle of balanced implementation. Coordination of these key activities will help the state and federal agencies implement the CALFED Record of Decision (ROD) in a balanced manner and avoid the conflict and gridlock that the CALFED Program was created to address.

Many of the actions described below are also described in the CALFED Bay-Delta Program Multi-Year Program Plans, and are outlined here to identify the linkages among key commitments made by the state and federal agencies. As part of the annual process to review and update the Multi-Year Program Plans and through the development of the California Bay-Delta Authority's 10-year Finance Plan, the status of actions and linkages in this Delta Improvements Package Implementation Plan will also be evaluated and updated.

The schedules for many of the proposed actions and commitments listed below are described in Appendix A.

II. Water Supply Actions and Commitments

The state and federal agencies intend for the proposed actions and commitments described below to improve water supply reliability from the Delta while protecting water quality and fishery resources.

A. State Water Project/Central Valley Project Integration Plan

DWR and USBR will continue to coordinate SWP/CVP operations, and propose to: (1) convey up to 50,000 acre feet per year of Level 2 CVP refuge water at the SWP Banks pumping plant; (2) use up to 37,500 acre feet per year of CVP water to reduce SWP in-basin obligation for Bay-Delta water quality and flow requirements; and (3) enable earlier, higher water allocations to CVP water users by developing and implementing a plan (which may consist of source-shifting strategies) to maintain the minimum storage in the State share of San Luis Reservoir. DWR and USBR are also proposing to increase the amounts of 50,000 acre feet and 37,500 acre feet to up to 100,000 acre feet per year and up to 75,000 acre feet per year, respectively, when full implementation of the SWP Banks pumping plant increase to 8,500 cfs permitted capability is achieved, or earlier if agreed to by DWR and USBR. In order to facilitate SWP/CVP integration, DWR and

USBR will develop and obtain SWRCB approvals of any needed water level, water quality, and fisheries response plans set forth in the SWRCB Water Right Decision 1641. These proposals will be evaluated through the Operations Criteria and Plan (OCAP) early consultation process, and will also go through applicable project-specific environmental and regulatory review processes before implementation.

B. State Water Project/Central Valley Project Intertie

USBR and DWR will evaluate, and USBR proposes to construct, an Intertie between the Delta-Mendota Canal and California Aqueduct, with an initial capacity of 400 cfs toward the California Aqueduct and a reverse flow capability of 900 cfs toward the Delta-Mendota Canal, to allow for greater operation and maintenance flexibility for both the CVP and SWP, and enable the CVP to recover conveyance capacity. Subsequent to the construction of the Intertie, USBR and DWR propose to further evaluate the potential for increasing the capacity of the Intertie to 900 cfs.

C. San Luis Reservoir Low Point Improvement Project

Alternatives are being evaluated to increase the operational flexibility of storage in San Luis Reservoir and ensure a high quality, reliable water supply for San Felipe Division contractors. A joint EIR/EIS will be prepared by the Santa Clara Valley Water District and USBR. USBR is conducting an Appraisal Study, which is the first step in obtaining feasibility study authority.

D. South Delta Improvements Project/Increase SWP Pumping to 8,500 cfs

As described in the CALFED ROD, DWR and USBR are proposing to increase the permitted pumping rates allowed at the SWP Banks pumping plant as part of the South Delta Improvements Project (SDIP).

In accordance with the CALFED ROD, implementation of increased permitted pumping is conditional upon avoiding adverse impacts to fishery protection, and in-Delta water supply reliability. In addition to the CALFED ROD commitments, DWR and USBR agree implementation of increased permitted pumping at the SWP Banks pumping plant is also conditioned on:

1. DWR and USBR constructing and operating permanent operable barriers in the South Delta to improve water quality, water level conditions, and provide fishery protection.

2. DWR and USBR, in cooperation with other CALFED agencies and local interests, developing and implementing a comprehensive San Joaquin River Salinity Management Plan (Plan) to enable reliable compliance with all existing Delta water quality salinity objectives (electrical conductivity and chloride) for which the state and federal water projects have responsibility, in accordance with SWRCB Water Right Decision 1641. This Plan will be completed by December 2004.

3. Construction of the Veale and Byron Tracts aspects of the Old River and Rock Slough water quality improvement projects to protect and improve water quality conditions near the Contra Costa Canal.

4. USFWS, NOAA Fisheries, and DFG developing and implementing environmental protection measures, including project-specific and updated programmatic federal biological opinions and state NCCP authorizations to comply with federal ESA and state NCCPA requirements, that continue to protect and recover covered species to an equivalent level of protection as provided for in the CALFED ROD. The assets needed to provide this level of protection will be adjusted periodically based on new science and other information.

5. DWR, USBR, USFWS, NOAA Fisheries, and DFG developing and implementing a long-term Environmental Water Account with appropriate water user and public funding to protect, recover, and restore at risk native fish species that rely on the Delta while providing water supply reliability commitments to the SWP and CVP exporters.

DWR and USBR will continue to comply with existing SWP and CVP water rights conditions, as described in SWRCB Water Right Decision 1641.

DWR and USBR expect the development of environmental documentation, obtaining permits, and construction of the permanent operable barriers will take until late 2007. In the interim there may be strategic opportunities during high flow months to increase allowable pumping capability at the SWP Banks pumping plant beyond existing operating rules. DWR will work with USBR, DFG, USFWS, NOAA Fisheries, US Army Corps of Engineers, SWRCB, and the Central Valley Regional Water Quality Control Board to identify the conditions, including the ones set forth above, that would allow for such interim operation as part of the SDIP permitting process.

III. Water Quality Actions and Commitments

The state and federal agencies reaffirm their commitment in the CALFED ROD to continuously improving Delta water quality for all uses, including drinking water, environmental, and agricultural uses. The state and federal agencies intend that actions listed below will collectively contribute to meeting this commitment, and commit to the process described in Section VI.H. to assess water quality impacts and ensure their actions collectively contribute to continuous improvement.

A. South Delta Improvements Project/Permanent Operable Barriers: DWR and USBR propose to dredge Delta channels and construct permanent operable barriers to ensure water of adequate quantity and quality to agricultural diverters within the South Delta. DWR, USBR, USFWS, NOAA Fisheries, and DFG will develop operating parameters for these permanent operable barriers as part of the SDIP EIS/EIR. The

permanent operable barriers will be constructed and operable prior to DWR fully implementing the proposal to expand SWP pumping to 8,500 cfs.

B. San Joaquin River Salinity Management Plan: DWR and USBR, in cooperation with other CALFED agencies and local interests, will develop and implement a comprehensive San Joaquin River Salinity Management Plan (Plan) to maintain compliance with all existing Delta water quality salinity objectives for which the state and federal water projects have responsibility, as required by SWRCB Water Right Decision 1641. The Plan will be developed by December 2004, and may include the following salinity control and flow-related actions:

- A coordinated agricultural and managed wetlands drainage strategy for the San Joaquin River.
- Salt load management and reduction activities.
- Recirculation of Delta exports using excess conveyance capacity for subsequent release into the San Joaquin River for purposes of reducing salinity concentrations.
- Voluntary water transfers and exchanges to improve water quality.
- Real-time water quality monitoring and forecasting.
- Real-time coordination of east side tributary operations.
- Introduction of potential high quality wastewater treatment plant flows.
- Westside groundwater management.

This Plan will be coordinated with and provide input to the SWRCB and Central Valley Regional Water Quality Control Board regulatory processes and programs with the intent of ensuring consistency.

USBR, under federal Court Order, is currently preparing a report on Drainage Feature Reevaluation for the San Luis Unit of the CVP. Aspects of the Plan described above may or may not be part of the final drainage plan for the San Luis Unit.

C. Vernalis Flow Objectives: USBR, in cooperation with DWR, will submit a plan by November 15, 2004 describing how USBR intends to meet the Vernalis flow objectives in 2005. This plan will include a thorough analysis of options for meeting the Vernalis flow objectives, including alternatives to releases from New Melones Reservoir. In addition, USBR and DWR will identify the long-term ability to meet the existing flow objectives contained in SWRCB Water Right Decision 1641. USBR will provide this information to the SWRCB in any future urgency change petitions related to the Vernalis flow objectives, and as part of the SWRCB's periodic review of the 1995 Bay-Delta Water Quality Control Plan.

D. San Joaquin River Dissolved Oxygen: To help improve water quality beyond their water project obligations, DWR and USBR, in coordination with USFWS, NOAA Fisheries, DFG, CBDA, other CALFED agencies, and local interests will develop and implement a comprehensive strategy to improve dissolved oxygen conditions in the Deep Water Ship Channel near Stockton. This strategy will be coordinated with and

provide input to the SWRCB and Central Valley Regional Water Quality Control Board regulatory processes with the intent of ensuring consistency among these programs.

E. Old River and Rock Slough Water Quality Improvement Projects: The state and federal agencies will work with Contra Costa Water District to relocate agricultural drains in Veale and Byron Tracts. In accordance with the CALFED ROD, these projects will be completed prior to the operation of the proposed permanent, operable barriers in the South Delta. In addition and in support of the CALFED Program objective of continuous improvement in Delta drinking water quality, the state and federal agencies will work with CCWD to reduce seepage into the Contra Costa Canal.

F. Franks Tract: Through studies, pilot projects, and other actions, the state and federal agencies will evaluate and implement, if appropriate and authorized, a strategy to significantly reduce salinity levels in the South Delta and at the CCWD and SWP/CVP export facilities and improve water supply reliability by reconfiguring levees and/or Delta circulation patterns around Franks Tract while accommodating recreational interests.

G. Delta Cross Channel Program: USBR and the state and federal agencies will evaluate Delta Cross Channel gate operational strategies to improve Central and South Delta water quality while improving fish passage through the Delta.

H. Relocation of M&I Intake: If the water quality improvements from the above measures do not provide acceptable continuous improvements in Delta water quality, the state and federal agencies will evaluate, and if appropriate, work with the Contra Costa Water District to relocate their intake to the lower part of Victoria canal, with appropriate environmental review and, if authorized and appropriated, cost-sharing.

I. Through-Delta Facility: DWR and the state and federal agencies will complete the feasibility studies on a 4,000 cfs diversion facility in the north Delta to assess its potential benefits and impacts on water quality, water supply, and environmental conditions in the Delta.

IV. Environmental Protection Actions and Commitments

The state and federal agencies recognize the need to continue to provide the protections for covered species that were established in the CALFED ROD, and believe that the actions below will meet this commitment for those covered species that are dependent in part or entirely on the Delta ecosystem.

A. OCAP ESA Consultation: DWR and USBR have prepared a Biological Assessment for the OCAP. Based on this document, USFWS and NOAA Fisheries will prepare coordinated Biological Opinions, including Preliminary Biological Opinions on SDIP. This integrated package will allow USFWS and NOAA Fisheries to

comprehensively analyze the effects of proposed water project operations to federally listed species.

B. SDIP ESA Consultation: Consistent with the CALFED ROD Conservation Agreement Regarding Multi-species Conservation Strategy, DWR and USBR are preparing an Action Specific Implementation Plan (ASIP) for Multi-species Conservation Strategy covered species potentially affected by the SDIP. USFWS and NOAA Fisheries will evaluate the SDIP Preliminary Biological Opinions and the ASIP to determine if re-initiation of consultation for SDIP is appropriate. DFG will evaluate the ASIP for NCCP authorization.

C. Update of CALFED ROD Programmatic Regulatory Commitments and Programmatic Biological Opinions: USFWS, NOAA Fisheries, and DFG will evaluate and may update the CALFED ROD programmatic regulatory commitments. USFWS, NOAA Fisheries, and DFG authorized programmatic compliance under FESA, CESA, and the NCCPA by establishing and implementing the Stage 1 milestones for restoration and species recovery, as detailed in the biological opinions and the MSCS Conservation Agreement. The CALFED ROD requires USFWS, NOAA Fisheries, and DFG to review these regulatory commitments provided to DWR and USBR by September 30, 2004, based in part on progress in achieving the milestones and the efficacy of the EWA, and to issue supplemental biological opinions and NCCP determinations which may retain the regulatory commitments to DWR and USBR described in the CALFED ROD. In part, these regulatory commitments are provided by the operation of the EWA and funding for the ERP at levels sufficient to provide for adequate protection and recovery of covered species, as described in the CALFED ROD.

D. Environmental Water Account: DWR, USBR, USFWS, NOAA Fisheries, and DFG will determine whether to continue the short-term Environmental Water Account through Stage 1. If a decision is made to continue an EWA beyond Stage 1, DWR, USBR, USFWS, NOAA Fisheries, and DFG will develop and implement a long-term Environmental Water Account based on criteria developed by USFWS, NOAA Fisheries, and DFG to protect and restore at risk native fish species that rely on the Delta while providing water supply reliability commitments to the SWP and CVP exporters with appropriate water user and public funding.

E. Delta Regional Ecosystem Restoration Implementation Plan (DRERIP): The DRERIP is the first of several regional plans intended to refine the existing planning foundation guiding the long-term implementation of the CALFED Ecosystem Restoration Program element. The DRERIP will update the ERP's planning foundation specific to the Delta, refine existing Delta-specific restoration actions and guidance for Delta-specific EPR tracking, performance evaluation, and adaptive management feedback. DFG, USFWS, and NOAA Fisheries, in collaboration with other CALFED agencies, will continue to develop this regional restoration plan for the Delta.

V. Delta Levees Actions and Commitments

The state and federal agencies recognize the many benefits provided by the approximately 1,100 miles of Delta levees, including protection for 520,000 acres of farmland, the Mokelumne Aqueduct that crosses the Delta to serve water to the East Bay, three state highways, a railroad, natural gas and electric transmission lines, and thousands of acres of habitat. These levees also protect water quality for Delta and export water users. The recent levee failure on Upper and Lower Jones Tract illustrates the importance of the existing Delta levee system, and emphasizes the significance of including the Delta Levee Program in the CALFED ROD.

DWR, DFG, and the US Army Corps of Engineers, in cooperation with other state and federal agencies, will implement the CALFED Levee System Integrity Program Plan as described in the Multi-Year Program Plan and the California Bay-Delta Authority's 10-year Finance Plan to provide long-term protection for the multiple Delta resources described above by maintaining and improving the integrity of the extensive Delta levees system.

VI. Science Actions and Commitments

The state and federal agencies will continue to conduct workshops, studies, independent reviews, and other activities to evaluate the relationship between SWP/CVP operations, water quality, and biological resources, and to incorporate the best available information into their planning and regulatory activities.

A. CBDA Independent Science Board: The CBDA Independent Science Board (ISB) will continue to provide input to the CBDA on implementation of this Delta Improvements Package Implementation Plan regarding the long-term risks and challenges associated with providing water supply reliability, improving water quality, protecting key species by restoring the Delta ecosystem, and maintaining the integrity of the Delta levee system.

B. EWA Independent Reviews: The CBDA Science Program, in cooperation with DWR, USBR, DFG, USFWS, and NOAA Fisheries-will undertake a comprehensive review of the first four years of the Environmental Water Account**,** in preparation for the annual EWA Review Panel analysis of water project operations and its impact on key species. The EWA Review Panel will continue, as necessary, to conduct independent annual reviews, and a comprehensive assessment every four years, and the CALFED agencies will consider the recommendations from the EWA Review Panel in their annual operations planning.

C. Focused Study on South Delta Hydrodynamics, Water Quality, and Fish: DWR, USBR, USGS, DFG, and USFWS will investigate fish movement, distribution, entrainment, and water quality in the South Delta to improve understanding of the effects of South Delta export and barrier operations and flows. This information, in combination with information from the Vernalis Adaptive Management Plan experiments and other studies, will be used to evaluate water project operation and fishery management actions.

D. Focused Study on Delta Smelt and Fish Facilities: DFG will complete studies to evaluate Delta smelt survival at the South Delta export and fish salvage facilities.

E. Science Program PSP: The CBDA Science Program will undertake a Proposal Solicitation Process to evaluate and fund studies to address the gaps in information about the relationship between water management activities and biological resources.

F. SWRCB Periodic Review: The CBDA Science Program will work with the state and federal agencies to provide key summaries and analyses of research on Delta water operations, water quality, and biological resources to the SWRCB as part of its periodic review of Delta water quality objectives. These summaries and analyses will include but are not limited to: (1) salinity and flow objectives in the South Delta; (2) the 2.64 mmhos/cm EC (X2) objective; and (3) the Vernalis Adaptive Management Program.

G. South Delta Fish Facilities: USBR and DWR will continue to evaluate potential improvements to fish facilities in the South Delta to ensure operation as originally intended to accommodate changing environmental conditions and proposed operations. In addition, recommendations on alternative facilities, combined operations, and intake locations will determine how fish facilities should be implemented with SWP operations in the future.

H. Performance Evaluation and Monitoring Program:
USBR, DWR, USFWS, NOAA Fisheries, DFG, and USEPA will work with the Interagency Ecological Program (IEP), US Army Corps of Engineers, SWRCB, and Central Valley Regional Water Quality Control Board to design and implement a Performance Evaluation and Monitoring Program. This program will evaluate the water quality and biological resource effects of the SWP, CVP, and the Delta activities described in this MOU. This program will be designed to fully evaluate compliance with existing regulatory requirements (including the MSCS and the SWRCB Water Right Decision 1641) and progress towards achievement of CALFED Program goals, including continuous improvement in Delta water quality for all uses, and restoration and recovery targets for endangered species.

This program will include, at a minimum, performance measures, conceptual models, adaptive management strategies, data handling and storage protocols, expected products and outcomes, regular reporting, and an independent review of existing monitoring programs. The proposed program will be submitted to the CBDA Science Program for external review and to the CBDA Independent Science Board for a recommendation on the proposed program to CBDA.

The proposed program will include an annual technical report by the appropriate agencies, in a form acceptable to, and submitted to, the CBDA Lead Scientist, that describes significant advances in scientific understanding of the system, status and trends of water quality and biological resources, causes for any significant changes in water quality or biological resources, and recommendations for further study.

Significant findings from this annual technical report will be summarized by the CBDA Science Program, in cooperation with the appropriate agencies, and provided to the CBDA. This annual summary of significant findings to the CBDA will identify any failure to meet existing water quality objectives, achieve continuous improvement in Delta water quality, and restoration and recovery targets for endangered species, and any necessary corrective actions as needed.

VII. Appendix A

Appendix A: Summary of Schedules

SUMMARY OF SCHEDULES

WATER SUPPLY ACTIONS AND SCHEDULES

SWP/CVP Integration Plan

Schedule:

- Complete SWP/CVP Operations Criteria and Plan Biological Opinion and early consultation on intermediate actions to improve CVP/SWP operation coordination by Summer 2004
- Completion of appropriate Response Plans required by D-1641 for use of Joint Point of Diversion by August 2004
- Complete NEPA/CEQA analyses and public review of interim SWP/CVP operation actions by early 2005
- Initiate formal consultation or request confirmation of preliminary Biological Opinion on interim SWP/CVP operation actions by early 2005
- Implement intermediate SWP/CVP operation actions during 2005

SWP/CVP Intertie

Schedule:

- Complete environmental documents by the Summer of 2004
- Initiate construction of the 400 cfs intertie by late 2004
- Operation of the 400 cfs conveyance capacity by late 2005
- Obtain federal construction authorization to increase intertie conveyance capacity to 900 cfs by November 2006

San Luis Reservoir Low Point Improvement Project

Schedule:

- Complete Appraisal Study by September 2004
- Complete Draft EIR/EIS by May 2005
- Obtain funding and authorization for construction in June 2006

South Delta Improvements Project/Increase SWP Pumping to 8,500 cfs

Schedule:

- Final SDIP EIS/EIR and Record of Decision by Mid-2005
- Transitional implementation of 8500 cfs, dredging/diversion improvements, 2005-2007
- Construct permanent operable barriers by December 2007
- Fully operate under 8,500 cfs by January 1, 2008

WATER QUALITY ACTIONS AND SCHEDULES

South Delta Improvements Project/Permanent Operable Barriers

Schedule:

- The SDIP Final EIS/R and Record of Decision by mid-2005
- Begin actions in 2005

San Joaquin River Salinity Management Plan

- **Coordinated Drainage Strategy**

  Schedule: Ongoing

- **Salt Load Management and Reduction**

  Schedule:
  - The San Joaquin River Salinity Management Group to begin study of refuge salinity management by summer 2004

- **Recirculation**

  Schedule:
  - Ongoing
  - Initiate studies for specific recirculation scenarios by fall 2004

- **Voluntary Water Transfers and Exchanges**

  Schedule: Ongoing

- **Real-time Monitoring**

  Schedule: Ongoing

- **Coordination of East Side Tributary Operations**

  Schedule:
  - Initial draft of potential actions for coordination by October 2004

- **Introduction of Potential High Quality Wastewater Treatment Plant Flows**

  Schedule:
  - Develop draft options by March 2005

- **Westside Groundwater Management**

  Schedule: Ongoing

Vernalis Flow Objectives

Schedule: Ongoing

San Joaquin River Dissolved Oxygen

Schedule:

- Complete the RWQCB Phased TMDL and Basin Plan Amendment by December 2004
- Complete monitoring and modeling studies by June 2007
- Design, construct and operate a demonstration aeration system, fall 2005-2008
- Evaluate other control projects and mitigation strategies, April 2004- December 2008
- Complete Final TMDL/Basin Plan Amendment for long-term control by 2009

Old River and Rock Slough Water Quality Improvement Projects

Schedule:

- Complete construction of Veale and Byron tracts drainage improvements by April 2005
- Complete construction of first phase Canal lining project by September 2006

Franks Tract

Schedule:

- Complete feasibility studies, assess fisheries and recreational impacts and develop pilot projects by January 2006
- Construct and monitor pilot projects, January 2006 - January 2008

Delta Cross Channel Program

Schedule:

- Complete evaluations and make recommendations on reoperation by November 2005
- Implement reoperation recommendations by January 2006

Relocation of M&I Intake

Schedule:

- Complete evaluation of water quality improvements (date to be developed)

Through-Delta Facility

Schedule:

- Complete evaluations, determine TDF technical viability, and recommend projects for implementation by November 2005
- Seek funding and initiate EIR/EIS for project implementation by January 2006

ENVIRONMENTAL PROTECTION ACTIONS AND SCHEDULES

OCAP ESA Consultation

Schedule:

- OCAP Biological Opinion issued by summer 2004

SDIP ESA Consultation

Schedule:

- SDIP Biological Opinion issued by January 15, 2005

Update of CALFED ROD Programmatic Regulatory Commitments and Programmatic Biological Opinions

Schedule:

- Complete assessment of the efficacy of the EWA and progress toward achieving the milestones~~,~~ by August 2004
- Update Programmatic Regulatory Commitments by September 30, 2004
- Update Programmatic Biological Opinions by September 30, 2004

Environmental Water Account (EWA)

Schedule:

- Decision on continuing short-term EWA by September 30, 2004
- Draft EIS/EIR on long-term EWA by June 2005
- Final EIS/EIR on long-term EWA by December 2005

Delta Regional Ecosystem Restoration Implementation Plan (DRERIP)

Schedule:

- Complete development and peer review of species life history and ecosystem element conceptual models by December 2004
- Evaluate Delta ERP Actions and approve priority setting process by May 2005
- Complete final DRERIP in December 2005

DELTA LEVEES ACTIONS AND SCHEDULES

Schedule:

- Implement the Levee System Integrity Multi-Year Program Plan (Years 5-8)

SCIENCE ACTIONS AND SCHEDULES

Independent Science Board

Schedule: Ongoing

Environmental Water Account Independent Reviews

Schedule:

- EWA Science Panel review in November 2004

Focused Study on South Delta Hydrodynamics, Water Quality, and Fish

Schedule:

- Conduct pilot investigations on South Delta hydrodynamics, fisheries, and water quality between May 2004 and July 2005
- Conduct full scientific study on SWP/CVP operations based on pilot work and peer review between March 2005 and July 2007
- Make operations recommendations by July 2008

Focused Study on Delta Smelt and Fish Facilities

Schedule:

- Evaluate fish survival in the existing CHTR process between April 2004 and June 2007
- Recommend implementing CHTR improvements for Delta smelt by July 2008

Science Program PSP

Schedule:

- Proposal Solicitation Package will be available October 2004

SWRCB Periodic Review

Schedule:

- Periodic review proposed to start in fall of 2004

South Delta Fish Facilities

Schedule:

- Maintain and improve existing fish facilities. Ongoing.
- Conduct alternative facility configurations and operational studies, July 2004 to July 2006
- Recommendation on new fish facility alternatives (with SDIP 10,300 cfs) by July 2006

Performance Evaluation and Monitoring Program

Schedule:

- Final Conceptual Plan and draft funding needs by October 2004
- Final Implementation Plan for Comprehensive Monitoring Plan by July-2005
- Program implementation by January 2006

CALIFORNIA BAY-DELTA AUTHORITY

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Agenda Item: 10-3
Meeting Dates: June 9 and 10, 2004

CALIFORNIA BAY-DELTA AUTHORITY
INDEPENDENT SCIENCE BOARD

Summary: This report provides an update on recent activities of the California Bay-Delta Authority's Independent Science Board (ISB).

Recommended Action: Informational only. No action to be taken.

Summary of Recent ISB Activities

The Authority's ISB held its third meeting on April 22-23, 2004. Specific items discussed at the meeting included:

- Conflict of interest guidelines
- Delta Improvements Package (DIP)
- Environmental Water Account/Ecosystem Restoration Program (EWA/ERP) Integration
- Levee Integrity
- Expanding ISB membership
- Water Management Science Board

The ISB received a substantial briefing on the Delta Improvements Package (DIP) from Dr. Denise Reed, Tim Ramirez, and Patrick Wright, and has developed some initial observations and recommendations regarding the DIP (see Attachments 1 and 2). The ISB intends to continue discussing science-related issues associated with the DIP and will be making additional recommendations to the Authority in the future. The ISB also is in the process of developing materials regarding EWA/ERP integration and the status of knowledge on the integrity of levees and consequences of their failure for public safety, shallow water and terrestrial habitats, water circulation, and water quality in the Delta.

Advice regarding additional disciplinary skills to be added to the ISB and suggestions about the composition and focus of the Water Management Science Board have been provided to the Science Program and the Water Management Program.

Future ISB meetings are scheduled for:

- September 21-22, 2004
- November 11-12, 2004

List of Attachments

Attachment 1 – Delta Improvements Package Transmittal Memo
Attachment 2 – Delta Improvements Package ISB Memo

Contact

Kim Taylor Phone: (916) 445-0464
Deputy Director of Science

Agenda Item: 10-3
Meeting Dates: June 9 and 10, 2004

Attachment 1

TO: Gary Hunt, Chair California Bay-Delta Authority

FROM: Dr. Tom Dunne, Chair Independent Science Board

DATE: May 19, 2004

RE: Independent Science Board Observations and Recommendations Concerning Delta Improvements Package (Agenda Item # 9-4)

The Independent Science Board (ISB) has been briefed on the Delta Improvements Package and recognizes the importance of this issue for the whole CALFED Bay-Delta Program. We have formulated the attached observations and recommendations for consideration by the California Bay-Delta Authority (Authority). Dr. Denise Reed, ISB Vice Chair, who has worked extensively on the review of the package, will be available to present these recommendations. We will continue our discussions at future ISB meetings and look forward to working with the Authority as the Delta Improvements Package moves forward.

Observations and Recommendations Concerning the Delta Improvements Package
Prepared by the Independent Science Board
of the California Bay-Delta Authority
May 19, 2004

Introduction

The purpose of this memo is to convey initial thoughts of the Independent Science Board (ISB) regarding the development and future implementation of the Delta Improvements Package (DIP). The memo also identifies areas where the ISB could provide input to the California Bay-Delta Authority (Authority) in the coming months regarding elements of the DIP, including the 8,500 cfs pumping capability and the South Delta Barriers. At this initial stage, our observations and recommendations do not address the specifics of the proposed changes. Rather, our comments address issues we believe are of general importance for the Authority to consider as the DIP develops in the future. The ISB expects to receive regular briefings regarding the DIP, and will report further observations and recommendations to the Authority as they develop in the future.

The comments provided herein are based on recent briefings and discussions, our knowledge of Authority activities from our service within the program (e.g., Environmental Water Account (EWA), Ecosystem Restoration Program (ERP)), and our experience with natural system dynamics and large-scale water management within California and in other regions of the country such as the Appalachicola-Chattahoochee-Flint system in GA, the Colorado River, and the Mississippi River. We are not experts on the specific proposed changes associated with the DIP, but we have experience that can assist the Authority in ensuring the highest quality of science is used in the DIP.

Observations

<u>Interconnections within the Program</u>
There is considerable overlap between the DIP and other components of the CALFED Program, specifically the EWA and the ERP. It is critical that the DIP planning documents clearly state and address the relationships between DIP activities and planned EWA and ERP activities. For example:

- How do DIP activities relate to ERP projects that are also designed to improve water quality and fish habitat in the Delta?
- Are there ways to coordinate EWA water use with DIP so as to better manage and protect endangered species and provide opportunities to test and evaluate DIP proposals and activities?
- How can information learned from past and anticipated experiences with EWA and ERP be used to ensure that the present and future expected operational benefits of the DIP are realized?

Interconnections beyond the Program

The planning effort for DIP provides an excellent opportunity for the CBDA to consider how major changes in water project operations could affect the functioning of the entire ecosystem. *The ISB is concerned that the DIP planning is currently focused too narrowly on the local near-term effects, rather than the long-term broader ecosystem implications. It is essential to view the changes associated with the DIP in the context of changes in upstream tributaries, the Sacramento River, and the downstream bay environment.*

An even broader perspective will eventually be needed that views changes like those with the DIP in the context of projected changes in human population and climate. For example, during the 20th Century, the temperature in the western United States increased by 2 to 5ºF. This temperature increase has had a major effect on snow pack and the timing of snow-melt runoff. Various models suggest that the temperature in California could warm an additional 5ºF in the present century. Such increasing temperatures may have serious implications for natural supply rate, storage, and transport of water throughout California.

Our experience working in other systems indicates that a broad view frequently leads to alternative interpretations of the effects of individual actions. Broad scale implications of individual actions are often not apparent at the site-specific level of planning.

Questions for Further ISB Consideration

The ISB has identified several overarching questions that the ISB intends to pursue during its forthcoming meetings:

1. What is the Program-wide vision for the Delta? Do current references in the ROD and planning documents reflect current knowledge of how the Delta functions affect water quality, food for valued fish species, etc.; or is updating and revision in order? How do changes associated with the DIP relate to that vision?

2. What and how can CBDA learn from operational changes, such as changed pumping rates and barrier operation? Can changes that have been made and that are planned be used to learn more about how the Delta functions?

3. Are there any irreversible or serious implications of the DIP for other Program elements or other aspects of the ecosystem?

Recommendations

1. Monitoring

Existing monitoring programs should be assessed, reinforced as necessary, and new approaches developed to provide the information necessary for a full evaluation of the effects of the DIP on local and system-wide attributes.

The ISB recognizes the importance of long-term data sets such as those developed under the Interagency Ecological Program. It is a false economy to scale back such efforts when major operational changes are being considered. Monitoring and interpretation of monitoring data are crucial to evaluating DIP in the context of spatial and temporal variability, and to assessing ongoing risks to water quality and ecosystem goods and services.

2. Modeling

Continue, and where appropriate initiate, the development and coordination of a series of nested and interconnected local and system-wide models to provide the Authority with forecasts of the potential benefits and risks of the DIP to ecological function, water quality, and water supply.

It is important to consider the DIP with respect to the entire ecosystem and in the context of long-term changes such as climate change and population growth. The complex linkages among water supply, conveyance, and ecosystem health require a modeling effort beyond that undertaken to support any individual program element; one which is able to examine the cumulative effects of different delta configurations, DIP operating principles, and climate regimes.

3. Sound Science Practices

Develop guidelines for incorporation of current scientific knowledge and thorough scientific procedures into all technical documents supporting Authority decisions.

The ISB believes it is important that all technical documents informing the Authority be based on sound science (e.g., clear statement of hypotheses, thorough data analyses, assimilation of up-to-date understanding of natural processes, acknowledgment of key assumptions, identification of uncertainties and data limitations) and on adaptive management principles. Mechanisms should be put in place (e.g., external peer review) to ensure that all technical documentation supporting Authority decisions adheres to these guidelines.

Reference to three articles from companion book:

Hollibaugh, J.T., editor(ed.). 1996, *San Francisco Bay The Ecosystem: – Further Investigation into the Natural History of San Francisco Bay and Delta with Reference to Influence of Man*. San Francisco: Pacific Division AAAS.1994. (Not available electronically.)

a. Arthur, Ball, and Baughman. *Summary of Federal and State Water Project Environmental Impacts on SF Bay-Delta Estuary, California*. Pages 445-496.
b. Brown,, Green, Coulston, and Barrow. *An Evaluation of the Effectiveness of Fish Salvage Operations at the Intake of the California Aqueduct. 1979–1993*. Pages 497-518.
c. Bennett and Moyle. *Where Have All the Fishes Gone? Interactive Factors Producing Fish Declines in the Sacramento-San Joaquin Estuary*. Pages 519-542.

M E M O R A N D U M

From: Tom Dunne, Chair ISB

To: Jack Keller, Chair WMSB

Subject: Water Supply

Date: January 26, 2004

During the November 11-12, 2004 meeting of the Independent Science Board (ISB), the Delta Improvements Package (DIP) was discussed. DWR and the Bureau of Reclamation are developing a draft plan to increase the capacity for pumping of water from the south Delta (*8500 plan*). The working hypothesis is that the increased flexibility in pumping that would be allowed by increasing pumping capacity will simultaneously increase water supply reliability and allow for maintenance and improvement of ecosystems and water quality. The ISB raised several questions related to this issue including:

- What are the current diversions and the potential trends in diversions under the new regime?
- What would be the characteristics of the hydrographs at various monitoring points under different weather years under the proposed new pumping regime?
- What potential exists for water conservation to play a role in reducing pumping demand?
- What are and what would be the effects of pumping on habitat conditions throughout the system?

At the February 22-23 ISB meeting, it is expected that the ISB will request the Water Management Science Board (WMSB) to consider how or if the CALFED programs are addressing assumptions and current methods of projecting water yield, supply and pumping and how the changes in flow to be expected from the new pumping regime are likely to affect aquatic habitat throughout the system. This might be a first step in the Boards working together to provide guidance on such issues.

Placeholder for Report from EWA/ERP Subcommittee

Subsidence, Sea Level Rise, Seismicity in the Sacramento-San Joaquin Delta: Report to the Levee Integrity Subcommittee of the California Bay-Delta Authority Independent Science Board

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Executive Summary

Based on the 2000 Record of Decision, an explicit goal of the California Bay-Delta Program is to stabilize and maintain the current configuration of channels and islands in the Delta. This effort is based on the conclusion that hydraulic integrity of the Delta is necessary for meeting water supply, water quality and ecosystem restoration objectives. Landscape level simulations of historic and projected subsidence of Delta islands indicate that the Delta landscape, including both channels and islands, is undergoing considerable change. These simulations indicate that it will become increasingly difficult and expensive to maintain the Delta levee system. Additionally, change in Delta landscape is not confined to gradual shifts. Major floods and earthquakes are capable of creating rapid changes in the Delta, with significant impacts to all CALFED Bay-Delta programs.

Anthropogenic accommodation space, or that space in the Delta that lies below sea level and is filled neither with sediment nor water, serves as a useful measure of the regional consequences of Delta subsidence and sea level rise. Microbial oxidation and compaction of organic-rich soils due to farming activity is the primary cause of Delta subsidence. During the period 1900-2000, subsidence created approximately 2.5 billion cubic meters of anthropogenic accommodation space in the Delta. From 2000-2050, subsidence rates will slow due to depletion of organic material and better land use practices. However, by 2050 the Delta will contain more than 3 billion cubic meters of anthropogenic accommodation space due to continued subsidence and sea level rise. An Accommodation Space Index, which relates subaqueous accommodation space to anthropogenic accommodation space, provides an indicator of past and projected Delta conditions. While subsidence and sea level rise create increasing anthropogenic accommodation space in the Delta, they also lead to a regional increase in the forces that cause levee failure. Although these forces take many forms, a Levee Force Index can be calculated that is a proxy for the cumulative forces acting on levees. The Levee Force Index increases significantly over the next 50 years reflecting regional increases in the potential for island flooding. Based on continuing increases in the Levee Force Index and the Accommodation Space Index, and limited support for Delta levee upgrades, there will be a tendency for increases in and impacts of island flooding, with escalating costs for repairs and increasing threat to CALFED program elements. Additionally, there is a two-in-three chance that 100-year recurrence interval floods or earthquakes will cause catastrophic flooding and significant change in the Delta by 2050. Currently, the California Bay-Delta Authority has no overarching policy that addresses the consequences of, and potential responses to, gradual or abrupt landscape change in the Delta.

Introduction

The hydraulic integrity of the Sacramento-San Joaquin Delta is maintained by more than 1700 km of levees, most of which are privately owned and maintained (DWR, 1995). Microbial oxidation and consolidation of organic-rich soils on Delta islands is causing widespread subsidence (Fig. 1), with island elevations in the western and central Delta locally more than 8 m below mean sea level (Ingebritsen, et al., 2000). Island subsidence has reduced the stability of Delta levees, increasing the risk of failure. Embankment and foundation materials for most Delta levees are substandard, adding the risk of failure during seismic events (Torres et al., 2000). It is generally acknowledged that the current channel network of the Delta and the hydraulic disconnection between islands and surrounding channels is necessary for maintaining water quality standards at the pumping plants that support the Central Valley Project, State Water Project and Contra Costa Water District (NHI, 1998; CALFED, 2000). CALFED (2000) and DWR (2002) have noted that failure of the levees and the flooding of subsided islands, particularly during the spring and summer months, has the potential to significantly degrade Delta water quality by 1) drawing brackish water into the Delta during rapid flooding of Delta islands and 2) changing the dynamics of the tidal prism in the western Delta. Additionally, the CALFED Ecosystem Restoration Program (CALFED, 2004) has concluded that subsided islands and deeply flooded islands provide poor quality habitat for native aquatic plant and animal communities, and are generally viewed as undesirable.

With the exception of recognizing the impacts of population growth and increases in water demand, federal and state programs that seek to improve water quality, water supply reliability and ecosystem health in the Delta are predicated upon fixed current conditions in the levee and channel network. We found no comprehensive plan or policy that addresses response to gradual or abrupt changes in hydrologic, geomorphic, geotechnical and cultural factors that influence levee integrity. In this report to the Independent Science Board, we present low-resolution simulations of potential changes in Delta levee integrity through 2050. These simulations assume business-as-usual approaches to management of the Delta, principally for agriculture. Continued island subsidence, coupled with eustatic rise in sea level, will threaten levee stability significantly by 2050, leading to increased potential for island flooding. Additionally, it is likely that a seismic event or regional flood will impact the levee network of the Delta. Landscape change, whether gradual or abrupt, will affect CALFED programs in the Bay-Delta and the watershed, and should be considered by the ISB.

Background

Historic Accommodation Space. Sediment core analyses indicate that the Sacramento-San Joaquin Delta has been a tidal freshwater marsh, with a network of channels, sloughs and islands, for more than 6000 years (Shlemon and Begg, 1975; Atwater, 1982). The persistence of intertidal conditions reflects a dynamic equilibrium between processes that regulated the influx of sediment into the Delta, the production of organic sediment within the Delta, and the export of sediment to the San Francisco Bay. A preserved stratigraphic record of intertidal conditions indicates that regional tectonic subsidence and sea level rise were sufficient to allow net accumulation of sediment in the Delta during that time (Atwater et al., 1979; Orr et al., 2003). This reflects the long-term

formation of *accommodation space*, or space that is available for the accumulation and preservation of deposited sediment. The concept of accommodation space is well-

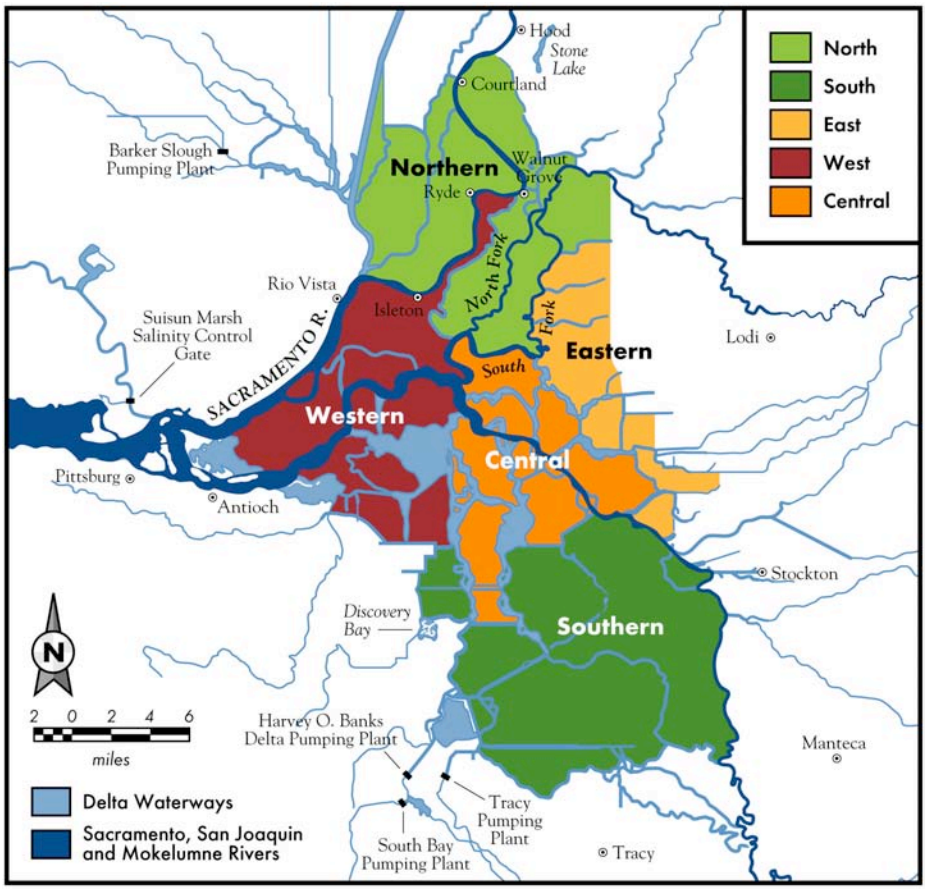

Figure 1. Generalized map of subsided portion of the Sacramento-San Joaquin Delta indicating regions discussed in text.

established within the geologic literature and forms the underpinnings of modern concepts of depositional sequence stratigraphy (Emery and Meyers, 1996).

In estuarine settings like the Sacramento-San Joaquin Delta, the formation and destruction of accommodation space controls the distribution and character of sediment deposition and related environmental conditions at large scales. For any given interval of time, accommodation space is created by eustatic (global) sea level rise and subsidence of the bed, typically associated with sediment compaction and tectonic subsidence of the crust. The eustatic rise (or fall) of sea level and the rate of subsidence control the rate at which accommodation space is either created or, in the case of falling sea level or crustal uplift, lost. In intertidal systems, accommodation space is filled with water and sediment. Where rates of organic and inorganic sediment deposition keep pace with accommodation space formation, intertidal conditions persist; where rates of accommodation space formation exceed sediment deposition, there is a landward shift in sedimentary environments (known as transgression) and subtidal conditions expand. In

deltaic or estuarine settings, sediment will tend to move through or bypass areas of low available accommodation space (supratidal or high intertidal) and accumulate in areas with higher accommodation space (low intertidal or subtidal). This process, which is governed in part by tidal energy and wind waves, regulates the movement of sediment through estuarine depositional systems and is responsible for large-scale lateral shifts in sedimentary environments (Pethick and Crook, 2000; Reed, 2002a,b).

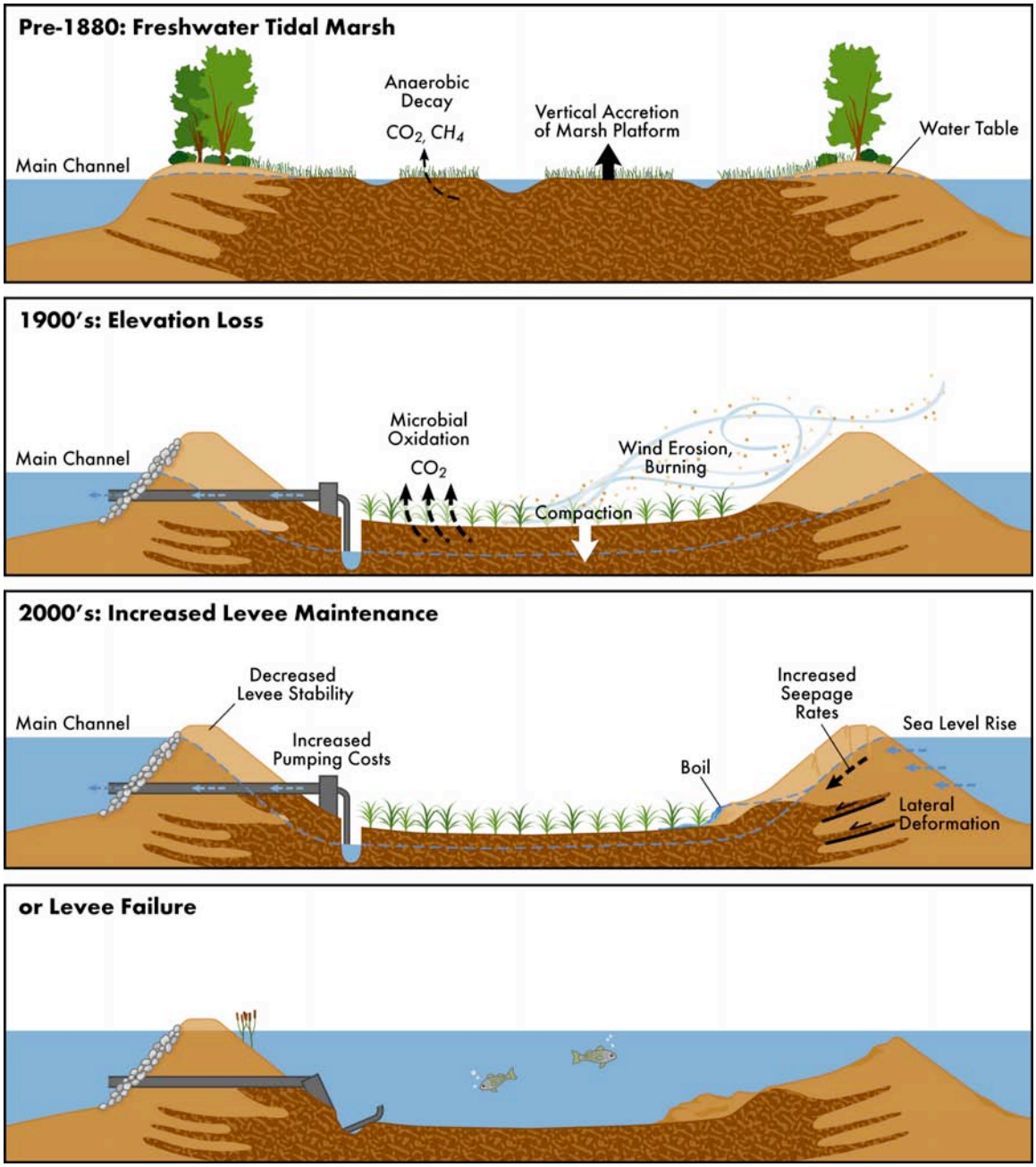

Figure 2. Conceptual diagram illustrating evolution of Delta islands due to levee construction and island subsidence. Modified from Ingebritsen et al., (2000).

Anthropogenic Accommodation Space. Prior to the conversion of the Delta to farms, the creation of accommodation space was balanced by sedimentation, maintaining persistent tidal marsh conditions. Sedimentation on marsh platforms consisted of sub-equal mixes of inorganic material, derived from the watershed, and locally-derived organic material from highly-productive tule marshes. Beginning in the late 1800's, there were substantial changes in the balance between the creation of accommodation space and sedimentation patterns. In the 1880's the Delta was impacted by a wave of hydraulic mining sediment (Gilbert, 1917). Since accommodation space was limited within the Delta, the bulk of this material by-passed the region, eventually accumulating in San Pablo Bay and other portions of the San Francisco Bay (Jaffe et al., 1998). During and immediately following the arrival of the hydraulic mining sediment, widespread reclamation of Delta tule marsh islands began. By 1930, virtually all of the marshes of the Delta had been reclaimed (Thompson, 1957). This involved construction of more than 1700 km (1100 mi) of levees and stabilization of the channel network in the configuration much like that seen today.

Farming of the Delta islands required the construction of extensive drainage ditches to lower water tables below crop root zones. The draining of tule marsh soils initiated a sustained period of land subsidence that continues today (Prokopovitch, 1985; DWR, 1995; Ingebritson et al., 2000). Subsidence of Delta histosols is related to their organic content and farming practices (Fig. 2). Draining of organic-rich soils leads to compaction and microbial oxidation of organic matter. Deverel et al. (1998) and Deverel and Rojstaczer (1996) demonstrated that gaseous CO_2 flux associated with microbial oxidation accounts for approximately 75% of current elevation losses, while the remaining 25% is associated with consolidation due to dewatering of the soils and compaction of saturated, underlying soils. Prior to 1950, poor land use practices, including burning of peat soils and wind erosion, exacerbated soil losses due to microbial oxidation (summary in Deverel, 1998). Today, the Delta is a mosaic of levee-encased subsided islands with elevations locally reaching more than 8 m (26 ft) below mean sea level.

The subsidence of the Delta islands created a new form of accommodation space. This *anthropogenic accommodation space* is distinguished by the fact that it is filled with neither sediment nor water, yet lies below mean sea level. The current levee system imperfectly isolates this space from processes that seek to fill it throughout the Delta. We suggest here that the amount of anthropogenic accommodation space is a 3-dimensional, landscape-scale measure of potential consequence of subsidence within the Delta. When levee breaches occur on deeply-subsided islands, rapid filling draws brackish water into the Delta, temporarily degrading water quality over a large region (DWR, 2002). Known colloquially as the "Big Gulp", the water quality impact of island filling is principally a function of the magnitude and location of anthropogenic accommodation space. In addition, flooding of islands directly affects tidal prism dynamics within the Delta (DWR, 2002), with the potential for long-term degradation of water quality. The magnitude of the impact depends upon the location of flooded islands, the volume of water within the island, and the geometry of breach openings.

Levee Instability. While regional increases in anthropogenic accommodation space in the Delta increase the consequence of island flooding, there is increase in the

concomitant force that acts to destabilize levees and introduce water and sediment into available accommodation space. At the local scale, the processes that cause levee failure are diverse and commonly exacerbated by island subsidence. The increase in head difference between the water surface of the Delta channels and the interior of the islands increases hydrostatic forces on levees and seepage rates through and beneath levees. Depending upon location and magnitude, subsidence increases levee foundation problems by reducing lateral support and shear resistance, promoting settling or deformation of underlying peat layers (Foote and Sisson, 1992; Enright, 2004). This leads to lateral spreading, slumping and cracking of levees, which increases the likelihood of their failure due to seepage erosion or overtopping.

The susceptibility of levees in the Delta to the processes that cause failure is highly variable and, to date, poorly-documented (Torres et al., 2000; CALFED, 2004). This makes it difficult to precisely address the level of risk associated with island subsidence at the landscape scale. However, generalizing over the regional scale, the forces that are acting on Delta levees derive, in some form, from the differences in elevation between the water surface of the channels and the interior of the subsided island. For this reason, hydrostatic force for any length of levee can be used as a proxy for the potential to destabilize that levee. In order to apply this as a landscape-scale measure that can capture regional differences at various scales, hydrostatic force needs to be summed over the length of levees. The potential for levee failure on an island, or group of islands, is therefore a function of the magnitude of subsidence and the length of levee that the hydrostatic forces are acting on. Although not precisely recording the processes that cause levee failures at the local scale, we suggest that *cumulative hydrostatic force* provides a useful landscape-scale measure of levee failure potential in the Delta.

Accommodation Space and Levee Force Indices

In order to evaluate historic, current and projected landscape changes in the Delta, we developed two indices: the Accommodation Space Index, an index that captures the consequence of island subsidence and flooding, and the Levee Force Index, an index that is a proxy for the potential for levee failure and island flooding.

For any given time the Accommodation Space Index (ASI) is calculated as:

$$ASI = (A_s + A_a)/(A_s) \quad (1)$$

where A_s = subaqueous accommodation space, or the volume of the Delta that is filled with water and lies below mean sea level, and A_a = anthropogenic accommodation space, or the subaerial volume of the Delta that lies below mean sea level. Up until the late 1800's, all accommodation space that was generated by sea level rise or regional subsidence in the Delta was filled with water and sediment. Thus, the ASI in the late 1800's, prior to the construction of high levees and the initiation of widespread subsidence, was approximately 1. As discussed below, by the early 1900's island subsidence created rapid increases in anthropogenic accommodation space, dramatically increasing the ASI. This rate of increase in the ASI has been slowed somewhat by the abandonment of some islands within the Delta, such as Franks Tract and Mildred Island, since these flooded islands are counted as subaqueous accommodation space.

The Levee Force Index (LFI), a concept and method suggested by Jack Keller of the CALFED Independent Science Board, records the cumulative hydrostatic force acting on the levees of the Delta, indexed to an estimated force in 1900, immediately prior to widespread subsidence of the Delta. To simplify the calculation of this index, each levee is considered as a wall, with the difference between the average elevation of water in the channel and the average elevation of the adjacent island as the control on the magnitude of hydrostatic force. Based on this simplification, the cumulative hydrostatic force (CF) for an island is represented by

$$CF = P \times A \times L \quad (2)$$

Where P is average hydrostatic pressure on the island levee, A is area of the unit length of levee (1 m x H), and L is levee length of the island. Since

$$P = .5\rho g H \quad (3)$$

where ρ is the density of water, g is gravitational acceleration and H is the difference between the average channel water surface elevation and the average elevation of the island, then

$$CF = .5\rho g H^2 L. \quad (4)$$

The cumulative hydrostatic force acting on an island's levee is therefore a function of the square of the depth of subsidence in the island. In contrast to arithmetic increases in accommodation space, hydrostatic forces due to subsidence increase with the square of subsidence depth.

Cumulative hydrostatic force, as defined here, captures two general processes that influence the regional stability of levees. Islands that are deeply subsided are more prone to levee failure due to greater force acting on the levees. Additionally, when coupled with deep subsidence, islands with relatively long levee lengths are more prone to levee failure because hydrostatic forces are acting over a greater levee surface, increasing the likelihood of exposing weaknesses in levee construction, maintenance and foundation.

Based on these calculations, the LFI for the Delta is

$$LFI = CF_t/CF_{1900} \quad (5)$$

where CF_t and CF_{1900} are the sum of the estimated cumulative hydrostatic force throughout the Delta at time t and 1900, respectively. The two islands that are filled, Mildred Island and Franks Tract, are not counted in these totals since their cumulative force is effectively zero. In addition, islands with mean elevations at or above MSL are not included in this calculation since their LFI = 0.

Methods

For the purposes of this report, we utilized a simplified approach for reconstructing historic and projected changes in the ASI and LFI. An elevation model of

the Delta was constructed from the Shuttle Radar Topography Mission (SRTM) data obtained from the Global Land Cover Facility (USGS, 2004). This dataset was collected in February 2000 at approximately 1:100,000 scale, with reported +/-1 meter vertical resolution and 1 arc-second/30-meter horizontal resolution. Delta island maps were acquired from the Research Program in Environmental Planning and GIS (REGIS), at the University of California, Berkeley (http://www.regis.berkeley.edu/), which digitized the island-forming levees from the DWR Delta Atlas and USGS maps. Zonal statistics for each island were then used to calculate mean island elevations in the year 2000. Based on area/elevation relationships, the average elevation and accommodation space was estimated for each island in year 2000.

It is important to note that the resolution of the SRTM data within the Delta has not been established. On-going efforts at the Global Land Cover Facility are testing the resolution, with assessments anticipated to be released in Fall, 2004. We conducted a first-order assessment of the SRTM data through comparison with multiple data sources. Recent, unpublished surveys have been performed on Bacon Island by private consultants (personal communication, Delta Wetlands, December 2004). These surveys re-established historic transects across the island and were used to calculate average elevation losses due to subsidence. Based on these surveys, conducted in the summer of 2000, the average elevation of the island was estimated to be -5.06 m; calculated mean elevation based on SRTM data is -4.82 m. Given the different methods used to estimate average elevation (transect vs zonal statistics) these results are surprisingly comparable. In addition, we compared SRTM data with LIDAR surveys supplied to us by DWR. These surveys covered Jones Tract and McDonald Tract in the South Delta (flown in April, 2004) and Staten Island and McCormick-Williamson Tract in the North Delta (flown in February/March, 2002). For all datasets we used zonal statistics to calculate average island elevation. The mean difference in average elevation between LIDAR and SRTM data is +.24 m, with a maximum difference of +.49 m on Staten Island and a minimum difference of -.10 m on Jones Tract. This cursory analysis of SRTM data indicates that areal averaging of elevations on islands provides a reasonable method for estimating accommodation space and total subsidence.

To derive the time-averaged subsidence, we made the assumption that the average elevation of the interior of Delta islands prior to reclamation was approximately current mean sea level (MSL). This is based on the distribution of topographic features, including tidal channels and tule marsh, which make up the marsh platform, and the limited change in sea level over the past century. Based on this information, we calculated an average annual subsidence rate for each island for the period 1900-2000. Because detailed information about individual islands is relatively sparse, the year 1900 was chosen as an average year for the initiation of subsidence throughout the Delta, recognizing that subsidence may have begun as early as 1880 on some islands (e.g. Jersey Island) and as late as 1930 on some smaller islands (Thompson, 1957).

Rojstaczer and Deverel (1995), Deverel and Rojstaczer (1996), Deverel et al. (1998) and Deverel (1998) conducted detailed studies of the rates of subsidence on several Delta islands. Based on field experiments and analysis of historic survey data, they suggest that rates of subsidence have been declining since the 1950's due to improvements in land use practices and decreasing organic content of island soils. For this reason, projecting average 1900-2000 subsidence rates into the future will result in

significant overestimation of future subsidence. To address this issue, we reanalyzed elevational data summarized by Deverel et al. (1998) for Mildred Island, Bacon Island and Lower Jones Tract. Survey transects on these islands were reoccupied 18 times between 1925 and 1981, with average island depth estimated for each survey (Fig. 3). Linear regression analysis was used to establish average subsidence rates for each island during the survey period 1925-1981. To estimate the decline in subsidence rates associated with better land use practices, we regressed post-1950 island elevations separately (Fig. 3). The post-1950 subsidence rates range from 20 to 40% less than the averaged rate of subsidence for the period 1925-1981. In order to simulate subsidence of Delta islands from 2000-2050, we applied the more conservative rate of 40% reduction in subsidence rates to the calculated 1900-2000 subsidence rates based on the SRTM data.

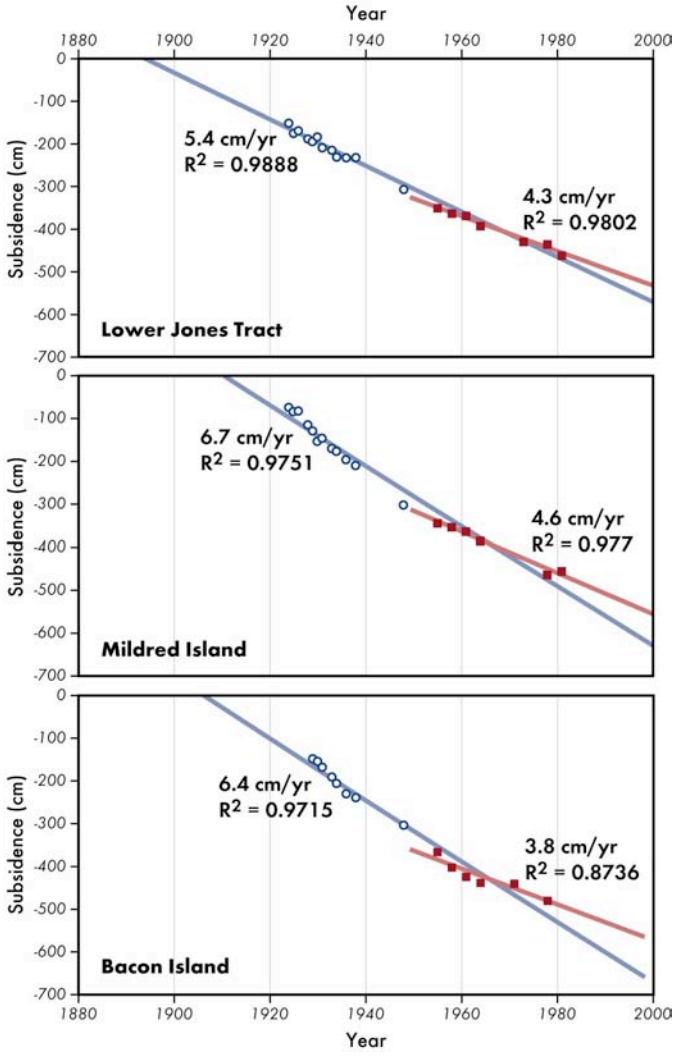

Figure 3. Linear regression of elevation data from three Delta islands to assess changes in rates of subsidence. See text for discussion. Data from Deverel (1998; pers. comm., 2004).

Future subsidence in the Delta is constrained by the thickness of organic-rich sediments, deposited since the mid-Holocene. Using 500 m grid point data provided by

DWR, spline interpolation was used to derive a surface representing the base of the organic-rich sediments. Subsequently, we were able to use this surface in conjunction with subsiding land surface elevations to calculate depth to the base of the peat layer through time. Average interior island subsidence and anthropogenic accommodation space were simulated in annual time steps. Annual subsidence at 40% less than the 1900-2000 average for each island was held constant for each time step until depth of subsidence equaled the depth of organic-rich soils, at which point subsidence ceased for the remaining time steps.

Subaqueous accommodation space and average channel depth were calculated from bathymetry maps supplied by the California Department of Fish and Game (CDFG, 1998), using ArcGIS 3D Analyst. With the exception of space added by flooding of Franks Tract and Mildred Island, subaqueous accommodation space was assumed to be constant since the late 1800's. This volume may overestimate the subaqueous accommodation space during the late 1800's and early 1900's, since channel dredging and re-alignment may have increased the total channel volume. With local exceptions, channel depth is typically greater than the elevation difference between the water surface and the average elevation of the subsided island.

Since accommodation space and difference in elevation between the channel and the island is a function of subsidence and sea level change, we adjusted our simulations for rise in sea level over the period 2001-2050. Eustatic sea level rise in the latter parts of the 20th century and the present is being driven by a combination of thermal expansion of the oceans due to global warming and increases in ocean mass associated with melting of continental ice. A recent discussion by Miller and Douglas (2004) notes significant disparity between current estimates of sea level rise. Most estimates range from 1.5-2.0 mm/yr, based on analysis of historic gage and dynamic ocean height data, to approximately 2.5 mm/yr based on satellite altimetric estimates from the 1990s. We used an average of the range of reported sea level rise values of 2 mm/yr for this study. Modeling efforts summarized by the IPCC (2001) indicate variable rates of projected sea level rise, ranging from as little as 1 mm/year to as much as 5.1 mm/yr by 2050. For the purposes of this simulation, we assumed a conservative linear increase in sea level rise from 2mm/yr in 2001 to 3 mm/yr in 2050. This reflects an approximate average of six different global climate models (IPCC, 2001) and may underestimate total sea level rise.

The results of this modeling effort are summarized in the maps shown in Figure 4, depicting the current elevations within the Delta and simulated elevations in 2050. The 2050 map elevations reflect a systematic lowering of relative inner island elevations by an average rate of subsidence and an increase in sea level.

This simplified approach to estimation of the ASI and LFI makes multiple assumptions that should be taken into account in interpreting the results of this study. First, projections to 2050 assume business-as-usual approaches to management of the Delta. That is, Delta islands will continue to be farmed using current best management practices and levees will continue to be maintained in their current configuration.

Second, this approach does not accurately model anticipated asymptotic declines in rates of subsidence that should occur as the inorganic fraction of some island soils increases over time. For that reason, the estimates of accommodation space given here should be viewed as conservative maxima. However, it is important to note that if farming continues to be the dominant land use in the Delta, subsidence will continue and

accommodation space will increase. There is no known or anticipated technologically feasible method to eliminate or reverse subsidence in land that is being farmed. As the regression analyses of subsidence data from Bacon, Mildred and Jones Tract show, improved land use practices have only slowed subsidence rates by 40% or less (Fig. 3). Additionally, the impact of increased concentration of inorganic content of the soils appears to only impact subsidence once the organic-matter content of the soils is less than 20% (Deverel, 1998). In many central and western Delta islands the organic matter content of the soils is unlikely to reach concentrations below 20% during the next 50 years.

Finally, it is important to note that the methods used here cannot resolve local-scale complexities of historic or projected subsidence in the Delta. Detailed studies by Rojstaczer et al. (1991) and Deverel and Rojstaczer (1996), showed order-of-magnitude variation in subsidence within individual islands. Areas near the margins of the islands tend to be organic-poor, recording the influence of natural levee deposition prior to reclamation. Conversely, the center of the islands, which were covered by marsh plain and were most isolated from channel influences, tend to be most organic rich. Differential rates of subsidence occur on every island, with generally less subsidence near the margins and higher subsidence near the center. Acknowledging the limits of resolution of SRTM data described above, the approach taken here averages subsidence for the entire island and should not be used to interpret processes within a specific island. This approach may also overstate the cumulative levee force on some islands since the LFI is based on the average elevation, rather than elevations immediately adjacent to the levee.

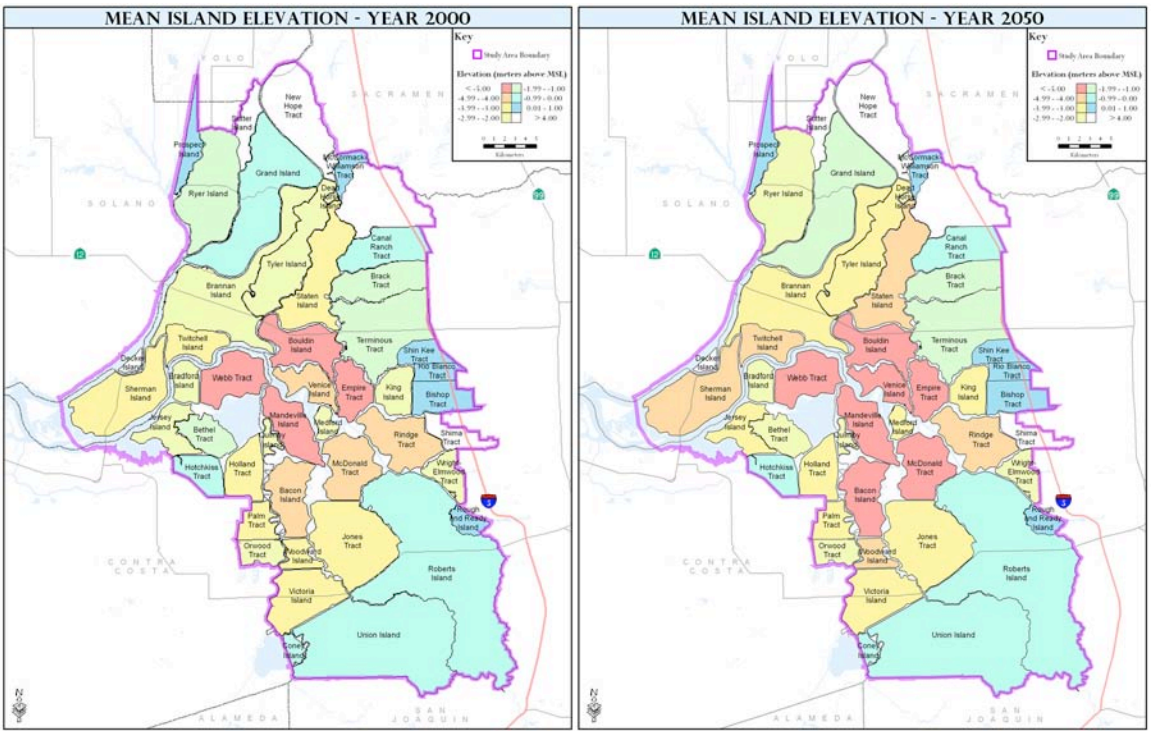

Figure 4. Calculated average island elevations for 2000 and simulated elevations for 2050. Methods described in text.

Results

Wherever there are organic-rich soils in the Delta that have been farmed, there has been significant subsidence and the formation of anthropogenic accommodation space. The magnitude of anthropogenic accommodation space generation varies in space and time (Fig. 5a). As noted above, rates of subsidence are a function of organic content of the soils and land use practices. The organic-rich soils of the Central and Western Delta, for example, exhibit the highest historic average rates of subsidence, 3.2 and 4.8 cm/yr respectively. More than half the total 2.5 billion cubic meters of anthropogenic accommodation space formed during the past century occurs in the Central and West Delta. Simulations of future accommodation space generation also reflect the distribution and thickness of organic-rich soils. In the East and South Delta, historic subsidence has reduced or eliminated the organic-rich soils. In these areas, anthropogenic accommodation space formation will be dominated by the effects of eustatic sea level rise, rather than continued subsidence. In contrast, the Central and West Delta, which contains thick organic-rich soils, will continue to subside. Although the North Delta retains the thickest organic-rich soils of the Delta, the lower subsidence rate reflects the lower total organic content.

Similar to changes in anthropogenic accommodation space, historic and future cumulative levee force varies substantially in the Delta (Fig. 5b). The lowest cumulative levee forces are in the East Delta, where relatively high island elevations and correspondingly smaller levees predominate. The Central Delta dominates cumulative levee force, approximately equaling all other regions of the Delta combined. The disproportionate cumulative levee force of the Central Delta is a function of both the high regional rates of subsidence and the large levee lengths relative to total island area. Unlike anthropogenic accommodation space, future cumulative levee force in the Central, West and North Delta increases substantially in the period 2000-2050.

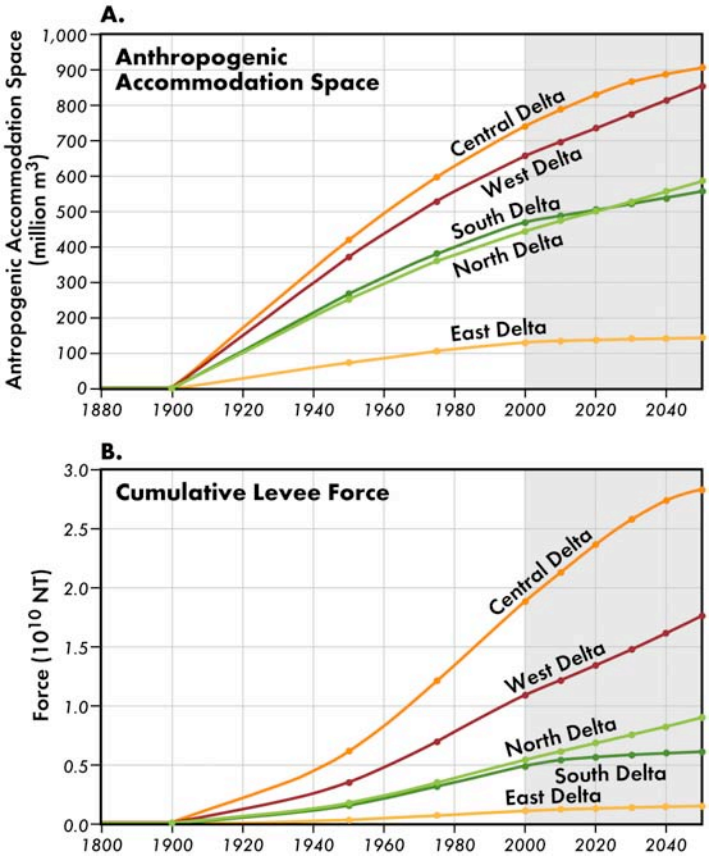

Figure 5. Calculated and simulated Anthropogenic Accommodation Space and Cumulative Hydrostatic Force for regions of the Delta shown in Figure 1. In order to establish anthropogenic accommodation space and cumulative levee force for the 1950 and 1975 data points we adjusted individual island subsidence rates for the periods 1900-1950 and 1951-1975 based on an average of relative rate changes noted on Lower Jones Tract and Mildred and Bacon Islands, as shown in Figure 3.

The ASI and the LFI for the Delta are depicted in Figure 6. These indices provide a landscape-scale proxy for current and future consequence of levee failure in the Delta (ASI) and the relative risk of island flooding (LFI). As noted above, these indices are dominated by the impacts of Central and West Delta subsidence and, in the case of the LFI, relative levee lengths. Both indices show substantial increases in the future, due to continued subsidence and sea level rise.

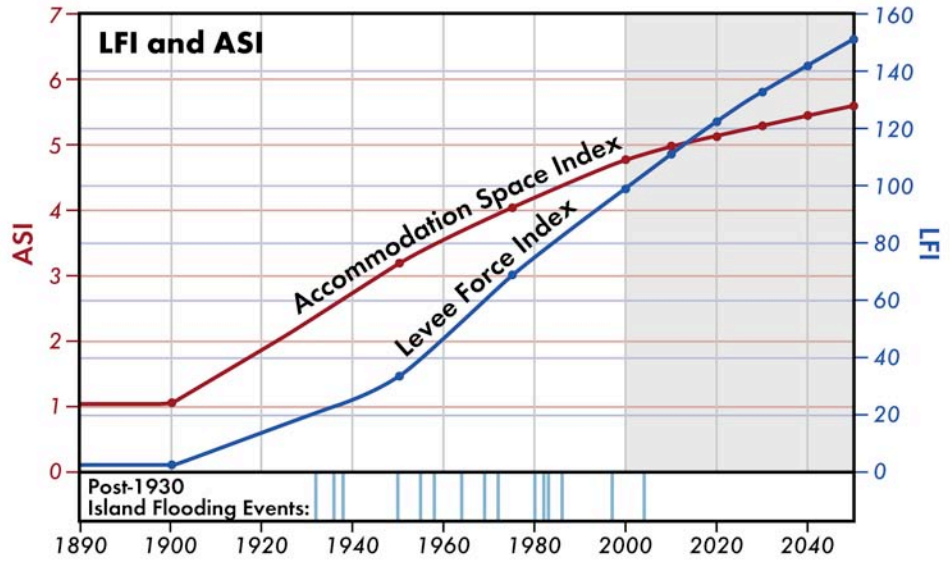

Figure 6. Accommodation Space Index (ASI) and Levee Force Index (LFI) for the subsided portion of the Delta. See text for discussion.

Landscape Change in Context

During the past 100 years, farming activity in the Delta has resulted in the loss of approximately 2.5 billion cubic meters of soil—an average of 25 million cubic meters per year. The amount of anthropogenic accommodation space generated from subsidence and sea level rise is projected to increase to more than three billion cubic meters in 2050, an annual average of approximately 10 million cubic meters/year. Sea level rise accounts for approximately 30% of the increase in the anthropogenic accommodation space during this period.

It is important to place the amount of anthropogenic accommodation space into historic perspective. The volume of organic-rich sediment that accumulated within the Delta during the mid- to late Holocene can be approximated by summing the volume of anthropogenic accommodation space and the volume of organic-rich soils that underlie the islands. This underestimates the total volume because it does not account for material that underlies the current channel network. Based on this approach, we estimate that approximately 5.1 billion cubic meters of tidal marsh sediment filled accommodation space within the Delta during the past 6000 years. This represents an average annual rate of accumulation of approximately 850,000 cubic meters. During the past 100 years, oxidation, compaction, erosion and burning have reduced the volume of accumulated sediment by almost one half—an annual rate of loss almost 30 times the rate of historic accretion. Over the next 50 years rates of anthropogenic accommodation space generation will decline, but will remain more than an order of magnitude greater than historic rates of accretion, substantially increasing the forces acting on the Delta levee systems.

In his seminal study of the impacts of 19th century hydraulic mining on the Bay-Delta watershed, G.K. Gilbert (1915) estimated that mining introduced 1.2 billion cubic meters of sediment into the Sacramento River system. As noted above, when the hydraulic mining sediment waves entered the Delta in the late 1800's, there was little accommodation space and the material by-passed the Delta. The volume of sediment

created by hydraulic mining, considered one of the most destructive land use practices in the history of the Bay-Delta watershed (Mount, 1995), is less than half of the volume of accommodation space created by subsidence to date, and approximately one third of the projected total volume in 2050.

Alternatively, levee and dam construction throughout the Bay-Delta watershed limits the current sediment inputs into the Delta. Wright and Schoellhamer (2004) estimate that approximately 6.6 million metric tons of sediment enter the Delta annually, with 2.2 million metric tons leaving the Delta and 4.4 metric tons deposited within the Delta. Assuming a bulk density of 850 kg/m^3, annual deposition in the Delta is approximately 1.7 million cubic meters. This volume is less than 7% of the rate of historic anthropogenic accommodation space generation and only 17% of future rates. If sea level remained unchanged, subsidence in the Delta were stopped, and current rates of inorganic deposition in the Delta were maintained, it would take 1470 years to restore elevations to mean sea level. However, projected annual accommodation space created by sea level rise alone is roughly twice the amount that could be filled by inorganic sedimentation.

The goal of these comparisons is to illustrate that subsidence and associated anthropogenic accommodation space generation is the dominant landscape-forming process in the Delta during the past 100 years and will remain so for the indefinite future. All CALFED programs that relate to the Delta are being affected in some manner by this process, yet, with the exception of the Levee Integrity Program (CALFED, 2004), none appear to fully recognize the potential impacts and implications.

Punctuated Landscape Change

The above discussion illustrates that the landscapes of the Delta are dynamic, with change occurring incrementally. However, change in the Delta is not limited to gradual shifts. Punctuated, or sudden landscape change has a high probability of occurring within the Delta during the period simulated here, posing a considerable policy challenge for the CBDA and its member agencies. Punctuated change can be derived from two sources: seismicity and extreme flood events.

The levees of the Delta are at significant risk of failure due to seismicity. This stems from poor foundation soils prone to settling or liquefaction, or poor-quality engineering and construction materials (DWR, 1995). Although there have been no significant quakes in or closely adjacent to the Delta since high levees were originally constructed, there are at least five major faults within the vicinity of the Delta capable of generating peak ground acceleration values that would likely lead to levee failures. A preliminary analysis of the risk of levee failure due to seismicity was prepared for the CALFED Levee System Integrity Program (Torres et al., 2000). Based on standard methods and local expertise, Torres et al. (2000) estimated the magnitude and recurrence intervals of peak ground accelerations throughout the Delta. Two competing fault models were evaluated for this study, producing a wide range of potential accelerations. Then, based on local knowledge and limited geotechnical information, Damage Potential Zones were established for the Delta (Fig 7). The zones of highest risk lie in the Central and Western Delta where tall levees are constructed on unstable soils that are at high risk of settling or liquefaction during an earthquake. This also coincides with areas of the

Delta that have the highest cumulative hydrostatic force and anthropogenic accommodation space.

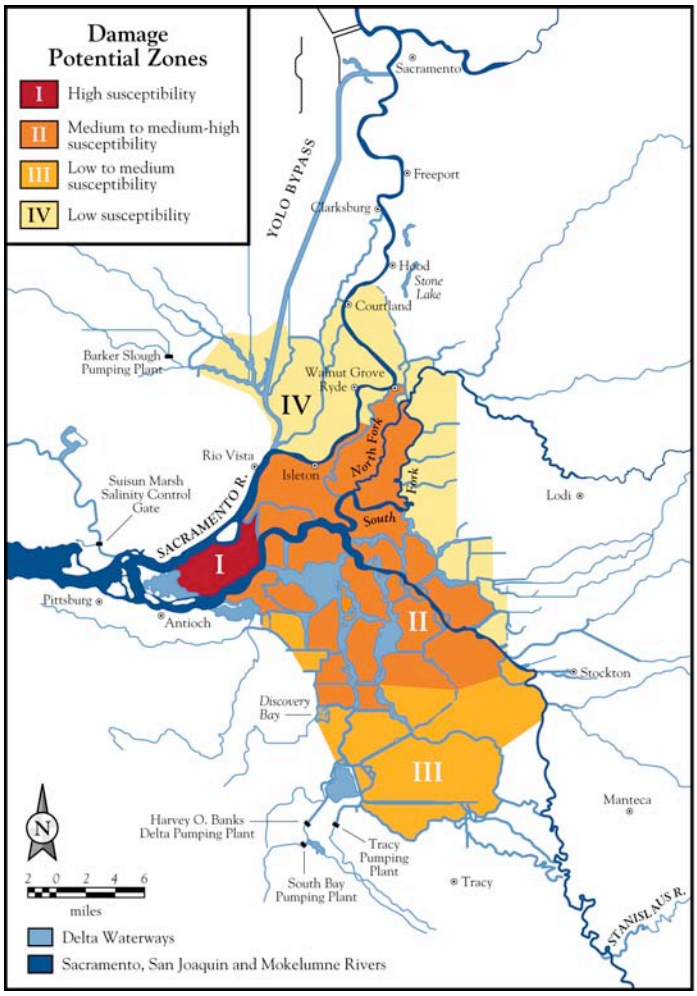

Figure 7. Zones of varying potential damage due to seismically-induced liquefaction and levee collapse. Modified from Torrens et al. (2000).

The Torres et al. (2000) study estimated recurrence intervals for ground accelerations and the number of potential levee failures in each Damage Potential Zone. It is useful to examine their estimates of the number of failures that might occur during a 100-year event, or an event with a .01 probability of being equaled or exceeded in any given year (Fig. 8). As in any probabilistic analysis of this sort, the range of potential responses to this kind of earthquake are broad and difficult to predict with precision. Based on their estimates, it is a roughly 50-50 chance that 5 to 20 levee segments (equal to one standard deviation around a mean of seven) will fail during a 100-year event in the Delta. This does not imply that 5-20 islands will flood, but just that 5-20 levee segments will fail. The loss of 5-20 levee segments in the Delta constitutes considerable and abrupt landscape change, since island flooding is likely to be widespread and, as discussed below, persistent for a long period of time.

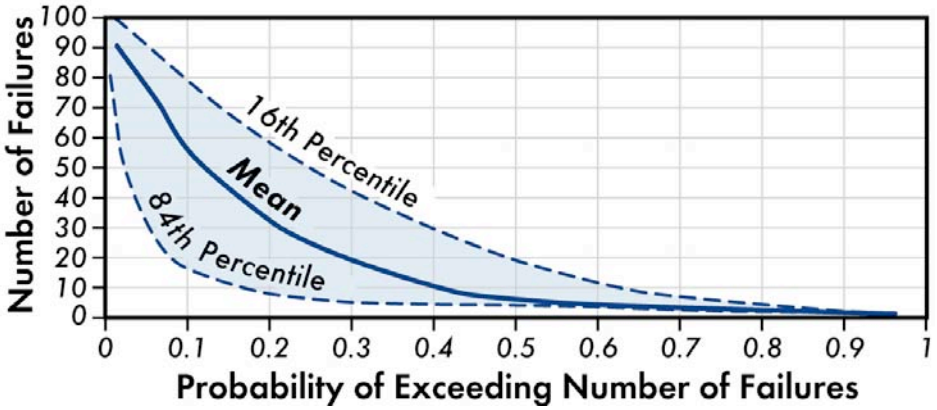

Figure 8. Probabilities of number of levee failures expected in 100-year recurrence interval event impacting Delta. Modified from Torrens (2000).

The high likelihood of abrupt change during seismic events is compounded by the potential for change during and immediately following major winter runoff events. Following the 1986 flood event, the State legislature developed target elevations and cross sections for levees throughout the Delta. Under SB 34, the State established the Subventions Program to support maintenance and levee upgrades. Under this program, the elevation of the levee crowns were to be upgraded to one foot above the US Army Corps of Engineers' estimated 100-year flood stage (DWR, 1995). Although this target elevation is tied to the 100-year flood stage, it does not imply that there is 100-year flood protection for Delta levees. There is insufficient freeboard or levee cross section to withstand sustained flows of this stage. The National Flood Insurance Program maps of the Delta reflect this, indicating that all the major islands have less than 100-year flood protection. It is reasonable to assume, therefore, that a flood of 100-year recurrence interval will produce substantial, widespread and, as discussed below, possibly permanent flooding of islands in the Delta comparable to that associated with seismic events.

The risk of abrupt change in the Delta during the 50-year simulation period can be evaluated probabilistically using standard methods (review in Mount, 1995). In any year, the probability that a flood with a 100-year recurrence interval will occur is .01. However, the probability that such a 100-year event will occur sometime in the next 50 years is .40, or a two-in-five chance. Since either a 100-year flood or 100-year seismic event can produce significant change in the Delta, it is more appropriate to estimate the probability that either event would occur in the 50-year time interval. When evaluated this way, the odds of either event occurring is .64: a roughly two-in-three chance. This discussion is meant to highlight the fact that punctuated landscape change in the Delta is not a remote, hypothetical possibility, but is highly likely during the simulated period of 50 years. This is especially pertinent to the risk of seismicity where continued accumulation of strain on local fault zones may increase the risk of an earthquake with time.

Discussion: Future Tendencies

The approach used here to assess historic and projected changes in the Delta does not offer the resolution necessary for island-by-island assessments or prediction of future levee failure. Thus, this report is not intended to be used as a planning tool. Rather, this approach offers a landscape-scale assessment of processes that are increasing the overall consequences of, and potential for island flooding in the Delta over the next 50 years. However, given the relative magnitude of increases in the ASI and LFI and the high probability of seismic or flood events that will result in levee failure, it is reasonable to assume that there will be an increasing tendency for island flooding events, with the consequences of any flooding event also increasing.

Local island flooding events are a relatively common occurrence in the Delta (Fig. 5). Since the 1930's there have been more than 15 such flooding events (DWR, 1995). Several state and federal programs, including the Subventions and Special Projects Programs (DWR) and the Base Level Protection and Special Improvements Programs (ACOE) have improved maintenance of many private levees within the Delta and have upgraded multiple at-risk levee segments. Although improvements have been made within the Delta and reduced the risk of flooding, the current level of risk is largely unknown. Levee programs are focused principally on maintaining current levels of protection, set in 1986, rather than assessing and planning for future conditions. The Levee System Integrity Program Plan (CALFED, 2000) notes that 885 km (550 mi) of levees will require upgrading to meet Federal PL84-99 standards at a cost of more than $1B in today's dollars. Recently signed federal legislation authorizing the CALFED Bay-Delta program includes $90M for levee projects in the Delta for the next five years. However, this represents less than 10% of the current backlog and is unlikely to address future needs. Levee upgrades to meet existing standards typically cost $1.0-1.7M/km ($1.5-2.5M/mile), with costs rising to near $3.4M/km ($5M/mile) where extensive reconstruction is required (DWR staff, 2004). Given the high costs and historic trends in funding, the Delta levee system, which is already well behind in maintenance, repairs and upgrades, will continue to fall behind under future, business-as-usual landscape change scenarios.

Although maintenance and upgrade of levees represents a significant, on-going cost in the Delta, island flooding events have the potential to dramatically impact local and government resources. The June 3, 2004 flooding of Jones Tract in the south Delta created substantial costs for repair, flood fighting, emergency services, and island pumping. According to DWR staff, costs to government alone for this break exceeded $44M. This does not account for crop losses, job losses, farm infrastructure repair or carriage water releases to maintain water quality. Estimates of total costs of the Jones Tract failure reported in the Sacramento Bee and Contra Costa Times approach $90M (quoted from California Office of Emergency Services sources): a figure equal to the total amount allocated for levees in the 2004 federal authorization of CALFED.

Limited funding for levee maintenance and upgrades, high costs of emergency levee repairs, and projected increasing instability of the Delta indicate that local island flooding will impact the Delta significantly during the next 50 years. Climate change and changes in runoff conditions (which are, for the most part, beyond the scope of this report) may exacerbate these conditions. There are multiple potential policy responses to this projected trend. However, to date, there has been no comprehensive assessment of

the effects of increased island flooding on CBDA programs. Rather, current policies appear to be predicated upon the unlikely prospect of maintaining fixed hydraulic conditions.

The impact of regional flooding associated with seismic events or large floods poses an additional challenge to CBDA programs. These events have the capability to significantly and permanently change conditions within the Delta over a very short period of time. To illustrate, currently there is one contractor, Dutra Corporation, with the equipment necessary for repairing levee breaks in the Delta. According to DWR staff, this contractor is capable of restoring two to three levee breaches in a single season. If regional island flooding occurs with numerous levee breaches, it is unlikely that levee integrity can be restored for many years, with protracted disruption of water supply conditions and loss of farm income. Moreover, if a seismic event leads to levee failures in the Delta, it is likely to be associated with significant damage to infrastructure in the San Francisco Bay Area, creating competition for resources necessary for restoring levee integrity.

To our knowledge, the CBDA and its member agencies have not articulated a policy regarding regional flooding in the Delta and the possibility of permanent, abrupt change. It is important to note, however, that the Delta Levee Integrity Program has initiated a comprehensive, multi-year study of the risks due to seismicity in the Delta (CALFED, 2003). This program, which is being run by DWR, is in its nascent stage, but will address some of the key issues raised here and provide more precision on estimates of risk.

Fact Finding Committee Recommendations

The results of the simulations conducted for this report indicate that microbial oxidation and compaction of organic-rich soils in the Delta have led to significant regional subsidence in the Delta. Although slowing substantially, subsidence is likely to continue into the indefinite future, particularly in the Central and West Delta. When coupled with rising sea level over the next 50 years, continued subsidence will magnify the instability of the Delta levee network, leading to increased potential for and consequence of island flooding. Additionally, there is significant likelihood of regional flooding in the Delta during the next 50 years due to earthquake-induced levee failures or sustained large floods. These events are likely to result in dramatic change in the Delta.

The implication of future Delta landscape change is, at present, largely unknown and speculative. Outside of initial efforts by the Levee Integrity program, there are no systematic assessments of risk to CALFED program elements. There have been efforts to assess methods of subsidence reversal in the Delta, but these have been stalled by on-going contract issues at DWR. In our view, there is no comprehensive scientific effort to address this issue and to provide the necessary information to inform policymakers.

Acknowledgments

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developed the concept for the Levee Force Index used in this report and guided the authors in its analysis. Janice Fong of the UC Davis Department of Geology prepared the illustrations. Drs Johnnie Moore, Denise Reed and Tom Dunne provided comment on the manuscript. All errors of omission or commission are, however, entirely our own. This work was supported by the CALFED Bay-Delta Authority Independent Science Board and the UC Davis Center for Integrated Watershed Science and Management.

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Review of the 2003-04
Environmental Water Account (EWA)
Submitted by the 2004 EWA Review Panel
Submitted: 1/17/05

Introduction

The fourth annual meeting to review the Environmental Water Account (EWA) convened on November 8-10, 2004 at the Bay-Delta Authority office in Sacramento, California. The EWA Technical Review Panel (Panel), as charged by CALFED's 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 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 Bay-Delta 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 salmon spawning estimates and the resulting effect on the estimation of the juvenile production index. In addition, the multi-agency, multidisciplinary 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 CBDA 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 into the Bay-Delta Authority's 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 Water Acquisition Program (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 EWA's 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 CALFED's 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 EWA's 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 EWA's 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 in the South. 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 CBDA proposal solicitation is directed at addressing a number of the issues raised by the Panel in previous reviews. Nonetheless, the Panel recommends that CBDA 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 CBDA 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.) CBDA 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 towards 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 CBDA 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.

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

(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 CBDA 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

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Appendix 1. EWA Review Panel 2004

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