

**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.	Denise Reed, Ph.D.
Tom Dunne, Ph.D.	Sam Luoma, Ph.D.	Kenny Rose, Ph.D.
David Freyberg, Ph.D.	John Melack, Ph.D.	Duncan Patton, Ph.D.
Bill Glaze, Ph.D.	Judy Meyer, Ph.D.	Bob Twiss, Ph.D.
Helen Ingram, Ph.D.	Jeff Mount, 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)
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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 of 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 operations⁵, 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 potential⁶.

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. 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 compliance⁸ 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 state¹⁰, 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 skills¹² 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 contamination¹⁶ 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 Melack²¹ 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 quality such as agricultural nitrogen in the estuary. The original CMARP steering committee contained state and federal staff and representatives from environmental agencies.

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.

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 priority for interagency cooperation on ocean science and technology"²⁸. This program will eventually

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.*

²⁸ <http://www.ocean.us/ioosdevplan.jsp>.

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

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

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.

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

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 effort³⁹ involving the California Water and Environmental Modeling Forum. The purpose of the modeling effort will be to advise the Authority on useful modeling applications^{40,41}. 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 models⁴⁴ or other appropriate resolution are needed

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

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.

⁴⁵ CALFED goals are vague, so hypotheses underlying the ROD and new scientific understanding will be used.

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 initiative⁴⁶ 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 public⁴⁷ 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

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

Other⁵⁰

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 Panel⁵¹, 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 concern⁵². 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: EWA⁵⁵, EWP⁵⁶, b2⁵⁷, and b3⁵⁸ (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 take⁶² 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.

Work Plan 2005

- 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.

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 ISB⁶⁹. A working group (Dunne and Glaze) will present a straw proposal⁷⁰ 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 Subcommittee⁷¹ 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 Modeling⁷²

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.