State of Science for the Bay-Delta System
Edition 1 (2007): The connections among components

System Function, Services, and Management

What is the State of Science for the Bay-Delta System?
An extensive effort to compile, synthesize and communicate the current scientific understanding of Bay-Delta ecosystem and provide relevant scientific context to inform resource management and decision making in the Delta. The first product of this effort, *State of Science for the Bay Delta System* (SOSBDS) will be completed in December 2007. The SOSBDS is expected to become an ongoing, iterative process, with periodic updates and new report editions. The first edition will focus on the key issues relevant to the upcoming CALFED Program Stage 2 decisions and the Delta Visioning process and attempt to incorporate the most current understanding of system function, description of ecosystem services, drivers or demands on these services, and the influence of management action on these services and the system as a whole. Future editions will aim to be responsive to management questions, and, will also include a more comprehensive assessment of ecosystem function and outcomes.

SOSBDS Process and Organizational Structure
A small editorial board will guide the development of the SOSBDS report. The Editorial Board (EB) will focus on providing timely feedback to report authors and preliminary review to support the accelerated pace and ensure quality and report cohesiveness. Members of the EB are the Lead Scientist Mike Healey; Independent Science Board member Dr. Richard Norgaard; Science Advisor Dr. Michael Dettinger; and the SOSBDS Managing Editor, Jana Machula. In addition to the guidance of the EB, report authors will work closely with Science Program technical staff that will serve as technical editors, guiding chapter content progress and ensuring scientifically and thematically relevant product. Technical editors and authors for each chapter are identified in the report outline below.

Writing the Report:
Science Program staff, with input from the ISB and the EB, has developed a general report outline that should provide initial content guidance for authors. The outline below should only serve as the starting off point, and it is expected that the specific content development and writing will actually occur through the collaborative process between the authors, chapter editors and the editorial board. For some chapters this process may be quite discrete, however, few chapters will require a more collaborative approach to achieve an integrated whole system perspective.

Peer Review:
In addition to the guidance and review provided by the EB, the individual report chapters and the report as a whole, will undergo independent peer review. Number of strategies are being considered, including individual chapter review in the style of scientific journal article review and organizing a review panel or panels. The

penultimate draft report will be presented to the ISB at the November 2007 meeting for final review.

Schedule Overview:

Content development and writing	***April – July***
Peer review	***August***
Revise report	***September – October***
Report to ISB for final review	***November***
Final revisions	***November – December***
Report released	***December 21, 2007***

See chapter outline below for schedule details for each chapter.

For any questions or additional information please contact the Managing Editor:
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Chapter 1 Description of System Setting and Water Management in the San Francisco Bay-Delta

The chapter will provide a description of the geographical and hydrographic attributes of the system and water management approaches used. This includes the water operations infrastructure and management features and strategies that provide drinking water, flood protection and conveyance mechanisms for water deliveries, and attempt to support ecosystem health and diversity. System setting description would include hydrographic characterization (precip. patterns, regional differences), changes to the physical setting due to human modification (mining, dams, levees), and description of present conditions and future stressor and how these stressors may affect water supply for all uses and current management strategies. RAISE THE ISSUES THAT WILL BE ADDRESSED IN SUBSEQUENT CHAPTERS. CHAPTER LENGTH: ~ 7 PAGES

Key questions that chapter would address are: *What defines California's 'Mediterranean' climate and how has this climate shaped local and regional watersheds? What are the predominant precipitation patterns in California? How will precipitation patterns change over time? Where are historical, current, and future needs for water throughout the State? Why were the State and Central Valley Projects built? How does the need for predictability in water supplies manifest itself through infrastructure in this climate? What is the purpose of water management in California? What are the key water management features? How is water delivery and infrastructure system operated to meet end user needs/support ecosystem services? What are the relevant drivers affecting water management? What are some potential resulting impacts to the system function or ecosystem services from water operations and management actions? What elements of the Water Resources Management system provide opportunities for alternative management manipulation?*

Some key topics this chapter would address are:

1. Unrestricted hydrologic geography circa 1840 and historic hydrographic characterization
    A. Precipitation patterns and natural hydrology (northern rainfall abundance, winter timing of snow and rain, spring runoff; flood events and patterns of dispersal and recharge)
    B. Environmental hydrology and key ecosystem linkages (important ecosystem cues from rainfall, runoff, or flood patterns; life stage integration with natural, variable, hydrograph using as examples spring run salmon, smelt, splittail, clams)
    C. Constituents and how Delta water quality gets like it is (an estuary where freshwater river flows mix with tidally moving sea water; focus on salinities, temperatures, sediments)
2. Human modifications
    A. Mining and watershed modifications 1850-1880
    B. Farming and basin modifications 1880-1950
    C. Description of State and Federal Water Projects, local diversions, storage facilities, levees and levee system, design demands (ca 1950), current demand, projected demand

   D. Development of "beneficial uses" concept and links to regulatory framework and basin plans (water quality regulations, ESA)
3. Future hydrologic characterization and impacts to beneficial use
   A. Drivers of Change" (critical certainties) and impacts to water use planning
   B. Environmental impacts beyond management control (floods, droughts, increased demand, disease, climate change-based habitat degradation)
4. Description of water supply infrastructure--ie reservoirs, delivery system (aqueducts, levees, gates, canals, pumps), State and Fed.Water Projects, etc
   A. System scale models used for managing water in California (ie CALVIN/CALSIM II)
   B. Water Management System constraints
      i. Climatic constraints and limitations
      i. Infrastructural constraints
      ii. Contractual obligations
      iii. Regulatory obligations
      iv. Operational criteria (X2, WR Decision 1641)
   C. Science-based management tools *(this topic will be addressed in more detail in Chapter 8)*
      i. Performance measures approach for managing water in California; use of conceptual models, indicators, and evaluation of management actions

Based on input from the Editorial Board, this chapter will be drafted in-house with outside editorial input. This chapter, along with chapter 2, will be used to provide initial content direction to authors for chapters 3-7.

Chapter Authors: Steve Culberson (lead)
Mark Roberson
Loren Botoroff
Technical Editor: Elizabeth Soderstrom

Chapter 2 Questions of Balance: Key Issues Surrounding Resource Management in the Bay-Delta

This chapter will present the key questions and raise the issues this report will address in subsequent chapters. Describe the system condition at the start of CALFED (mid 1990's).

Based on input from the Editorial Board, this chapter will be drafted in-house with outside editorial input. This chapter, along with chapter 1, will be used to provide initial content direction to authors for chapters 3-7.

Chapter Authors: Mike Healey (lead)
Technical Editor: Lauren Hastings

Chapter 3 Water Quality

Chapter to address factors influencing water quality: quantity, flows, timing, diversions, etc. Examine influence of these factors on salinity gradient and sediment transport as it relates to each of the water use categories. Describe present and possible future conditions/ stressors, management options. *LINKS TO CHAPTER 4 (Ecosystem Response) AND 6 (water supply)*
CHAPTER LENGTH ~10 PAGES

1. Drinking water quality
    D. Source water issues: upstream dependencies and challenges resulting from choosing the Delta as a source for drinking water. Importance of watershed perspective in drinking water quality solutions
    E. Water quality and constituents of primary concern
        a. Salinity/Bromide
        b. Organic Carbon/Disinfection Byproduct Precursors
        c. Nutrients
        d. Pathogens and other concerns
    F. Conveyance and water quality south of the Delta
2. Agricultural water quality
    A. Agricultural Water & Agroeconomy
        a. Background: downstream dependencies and challenges resulting from choosing the Delta as a source for irrigation water
        b. Salinity (including source water salts and extra-tidal sea water intrusion events)
        c. Conveyance to point of use challenges
        d. Agricultural return water
        e. State Water Project and Central Valley Project management implications for agricultural use
3. Environmental water quality
    A. Water temperature, timing, clarity, quantify, etc considerations for key species
    B. Implications of a "fresh water" delta system—for key species, invasives, etc/ What does variable salinity mean?
    C. Key contaminants of concern – Hg, Se, pesticides,

Consider joining with conceptual models from DRERIP, especially for key constituents. If well developed, these could provide the links between the various "beneficiaries"

Chapter Authors: Sam Luoma (lead)
Susan Anderson
Brian Bergamashi
Lisa Holm
Cathy Ruhl
David Schoelhammer
Robin Stewart

Technical Editors: Barbara Marcotte
Darcy Jones

Chapter 4 Ecosystem Response

This chapter will look at the natural system function. Consider key requirements and concerns for component, the management and restoration approaches used to enhance or preserve each, and sustainability implication with changing environment (climate, land use, management practices, invasive spp, hydrology, and other stressors). Link with Water Quality chapter (Ch 3) and Water Supply chapter (Ch 6).
CHAPTER LENGTH ~ 15 PAGES
Ecosystem needs and Delta water management

1. Ecological Processes
    a. hydrologic and hydrodynamic regimes
    b. productivity (including food web)
    c. sediment
5. Water temperature, quantity, timing, and constituents
6. Habitats and relationships to water resource management
    a. Wetlands
    b. Pelagic/open water
    c. Shallow water
    d. Benthic
    e. Floodplain
    f. Riparian
7. Key species and relationships to water resource management
    a. At risk species
    b. Anadromous species
    c. Non-native invasive species
    d. Harvested species
8. Other issues, stressors/drivers, conditions for consideration?

KEY ISSUE OF THIS CHAPTER WILL BE HOW TO INTEGRATE ALL OF THE COMPONENTS!!! Link with DRERIP conceptual models

Chapter Authors: Wim Kimmerer (lead)
William Bennett
Larry Brown
Jim Cloern
Peter Moyle
Jan Thompson

Technical Editors: Michelle Shouse
Steve Culberson
Matt Nobriga

Chapter 5 Levee System Integrity

Chapter to describe current state of levees and levee management for water conveyance and flood control. Levee stability impacts with future stressors, ex. changes in ppt patterns, increase frequency and intensity of storms. Description of system vulnerability to current and future fluctuations (inflows, sea level rise, etc). This chapter to have a Delta-centric view and include issues of delta islands and land-use choices including urbanization, restoration, agriculture, etc.
CHAPTER LENGTH ~ 8 PAGES

a. Levee system (includes conveyance and flood control)
    i. Levee construction and maintenance
    ii. Subvention programs and emergency response
    iii. Subsidence
    iv. Risk assessment
    v. Levees as habitat

Chapter Author: Roy Shlemon
Technical Editor: Ladd Lougee

Chapter 6 Water Supply

This chapter to examine considerations of future stressors such as climate change on water supply. Chapter to address changes in precipitation patterns with implications to water storage and storage management. Describe modeling and predictive tools available for managing available water. "Science of water supply" Pick up links from *WATER QUALITY (CH 3), ECO (Ch 4), LEVEES (Ch 5)*
CHAPTER LENGTH ~ 8 PAGES

A. Describe current water supply strategies, demands, beneficiaries
B. Future hydrologic characterization and impacts to beneficial use
9. "Drivers of Change" (critical certainties) and impacts to water use planning
10. Environmental impacts beyond management control (floods, droughts, increased demand, disease, climate change-based habitat degradation)
C. Conflicts between ecosystem "needs" and water user "demands" and implications for ecosystem function and resilience (with illustrations using known examples; for example, winter water quality-based drinking water demand and Delta smelt spawning and rearing patterns)
    i. Tools for managing conflicts and balancing resource needs (e.g. EWA)
    ii. Ecosystem response to hydrologic manipulation (reallocation of energy resources, abundance reduction, reduced species diversity, increased invasion rates, altered foodweb relationships)
D. Water supply impacts/effects with new Delta scenarios?????

Chapter Authors: Noah Knowles (lead)
Kenny Rose
Jay Lund (additional input)
Technical Editors: Steven Culberson

Chapter 7 Summary/Synthesis discussion

This chapter will synthesize the information and issues raised in the previous chapters, focusing on particular points of emphasis—the key linkages and "take home" messages from the chapters.

Chapter content will be developed after first drafts of Ch. 3, 4, 5, and 6 are completed. Ideally, chapter 7 authors will have participated in the workgroups or as lead authors on the preceding chapters.
CHAPTER LENGTH ~ 8 PAGES

Chapter Authors: **TBD**
Technical Editors: Matt Nobriga
Jana Machula
Steve Culberson

Chapter 8 Management tools, science integration, and decision-making

This chapter would focus on decision making and management tools—developing performance measures, indicators, conceptual models-- appropriate applications, uncertainty in decision-making. Adaptive management. Some questions to consider addressing in the chapter: *How can management tools (including indicators and performance measures) best be integrated into upcoming planning and decision-making efforts? Can adaptive management really be applied in a large-scale ecosystem restorations and water management program and if yes, how?*
CHAPTER LENGTH ~5 PAGES

Chapter Author Michael Healey

Technical Editor Lauren Hastings