

**Excerpts from the Draft Science Needs Assessment:
Agency-Spanning Science for a Rapidly-Changing Delta**

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Based on the [recommendations from the Delta Independent Science Board](#) and the endorsement of the Delta Plan Interagency Implementation Committee, a long-term Science Needs Assessment (SNA) is being developed, as part of the [Delta Science Funding and Governance Initiative](#). The SNA will identify key science efforts to provide long-term management insights in the context of rapid environmental change and recommendations for organizing the science enterprise to better address complex and changing problems. Below are preliminary recommendations, along with insights on governance, from the draft SNA that will be discussed at the Delta Independent Science Board’s January 14, 2021, meeting. Two different options for organizing recommendations are presented below.

Option 1: Recommendations

1. Improve predictive capability of Delta science as a centerpiece for integrating science and its applications for policy and management.
2. Develop better causal understanding of Delta ecosystems, water supplies, and lands under changing drivers and ecosystem responses.
3. Develop mechanisms to set high-level, multi-agency priorities.
 - a. Re-think triumvirate of Delta Science Plan, Science Action Agenda and the Science Needs Assessment to better formulate, short, and long-term enterprise-level priorities.
4. Develop a conceptual model or framework that depicts how influences can play out within the Delta.
5. Examine and suggest revisions to ongoing monitoring so that key indicators of change are measured at appropriate scales and that information is included in the decision-making process.
6. Develop and implement an effective stakeholder engagement process.
7. Manage the Delta more explicitly across agencies as a complex, integrated and connected system responding to both natural and human-induced drivers.
8. Develop a collaborative Delta scientific enterprise to address the growing number of problems, which span agency missions (include some implementation steps).
 - a. Expand the Delta Stewardship Council and Delta Science Program to have more authority, funding, capacity, etc.

Option 2: Recommendations

1. Use forecasting as a focus for organizing multi-agency science integration.

Science focused on organized prediction will provide more meaningful input to decision-making and adaptive management. In an era of rapid changes, forecasting and prediction provides time to develop responses and to identify responses likely to bring desirable outcomes. Forecasting relies on both modeling and comprehensive and reliable data as well as coordinated data collection, synthesis, and management. Increasing demand for forecasting will require more collaborative institutional strategies to build and maintain expertise, platforms, and modeling capabilities for effective forecasting.

Such an approach would:

- Require interagency science collaboration and integration.
- Identify critical gaps/needs in our understanding of critical Delta processes and responses to changes in driving forces for each of the Delta's coequal goals (ecosystem health, water supply reliability, and Delta as an evolving place).
- Require a conceptual and numerical modeling frameworks that integrate data and depict how influences are likely to play out within the Delta.
- Prioritize monitoring so key inputs to models and indicators of change are measured at appropriate time and space scales.
- Develop integrated scientific insights and assessments on problems that span the missions of several agencies and improve interagency policy and management discussions.

2. Develop cross-agency mechanisms to set high-level, multi-agency management/policy priorities around forecasting tools and manage the Delta more explicitly across agencies as a complex, integrated and connected system responding to both natural and human-induced drivers.

This would require:

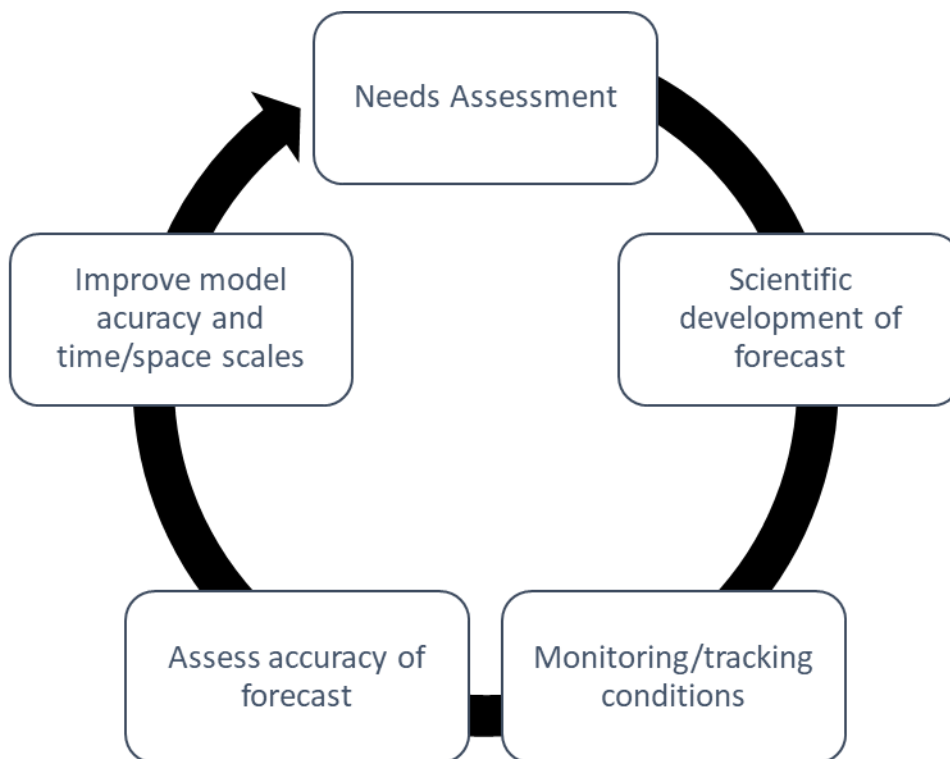
- Delta science managers to organize the triumvirate of Delta Science Plan, Science Action, and the Science Needs Assessment to better formulate science priorities with identified agency responsibilities and collaborations.
- Build connections between forecasting scientific efforts and existing agency and interagency technical, data, and modeling activities at planning and operating levels.
- Develop and implement an effective stakeholder engagement process to assess needs.
- More explicit scientific support for managing with uncertainties.

3. Develop a collaborative and formal Delta scientific enterprise (e.g., a forecasting/prediction center) to address the growing number of problems which span agency missions.

This would include:

- Developing an implementation and science governance plan that supports, funds, and employs interagency science.
- Identified leadership, authority, and resources to persevere in accomplishing its scientific and technical mission.
- Administrative capability (leadership, financial and employment flexibility, etc.) to accomplish integrated scientific and technical activities and deep interagency collaborations.
- Facilitate involvement of a wide range of scientific expertise, synthesis, and collaborative funding, including academic researchers and funding sources (such as a National Science Foundation Long-term Ecological Program) and advances in data science.
- Deeply engage major agencies engaged in Delta science as well as regulatory agencies and stakeholders in setting research agendas, but also bring scientific synthesis, coherence, transparency, and communication to the overall effort.

Ecosystem Forecasting



Leadership and Governance for agency-spanning Delta science

This section presents the scientific and leadership mission needed for California to address the Delta's rapidly changing and agency-spanning problems and enumerates some agency characteristics needed to be effective in accomplishing this mission. After a brief review of the current organization of scientific activities for the Delta and potential approaches to organizing agency-spanning science for the Delta, we then propose an organization to lead the development and communication of agency-spanning scientific activities. The section ends with some discussion of funding and considerations for chartering of such an organization.

A) Scientific leadership and mission

The nature of Delta problems increasingly spans agency missions and require more concerted scientific and technical efforts. The rapid changes in Delta problems exacerbate this need for interagency efforts, and expands the need for developing common scientific understanding of Delta problems for policymaking. Delta scientific work and discussions will need to help agency leaders and policymakers prepare to ask better management questions and provide a wider range of promising solutions for policy deliberations to consider.

In addition to agency-spanning scientific work, individual agencies also need to have internal scientific and technical capabilities to focus on agency-specific missions and to guide and support their participation in multi-agency efforts.

We propose the following objectives for a more formal and ambitious organization of Delta scientific work on issues which span multiple agency missions.

Agency-spanning science organization objectives:

- Organize and support agency-spanning science efforts.
- Coherently forecast and communicate likely future conditions so that they can be prepared for.
- Develop integrated scientific insights and assessments on problems that span the missions of several agencies and improve interagency policy and management discussions.
- Explore strategic problems and solutions, so that they can be explored further technically and in policy discussions.
- Better develop and support agency and inter-agency leaders capable of innovation.
- Deeply engage major agencies engaged in Delta science as well as regulatory agencies and stakeholders in setting research agendas, but also bring scientific synthesis, coherence, transparency, and communication to the overall effort.

B) Desirable organization criteria for agency-spanning science efforts

An organization that can accomplish the ambitious mission specified above must have several characteristics:

- Have sufficient leadership, authority, and resources to persevere in accomplishing its scientific and technical mission.
- Have sufficient administrative capability (leadership, financial and employment flexibility, etc.) to accomplish integrated scientific and technical activities and deep interagency collaborations.
- Facilitate involvement of a wide range of scientific expertise, synthesis, and collaborative funding, including academic researchers and funding sources (such as a National Science Foundation Long-term Ecological Program) and advances in data science.
- Have communication and stakeholder engagement capabilities and commitment to translate scientific accomplishments into support for suitable management and policy discussions and accomplishments.
- Ongoing monitoring of critical indicators and feedback to the adaptive management process.
- Development and use of a conceptual model or framework for estimating how changes within one part of the system may affect other parts.

C) Current organization of expertise

Given the Delta’s highly decentralized governance, scientific efforts on its problems are both surprisingly effective and inadequate. Substantially decentralized Delta governance seems inevitable due to its important advantages in providing voice, expertise, and some wherewithal for local and special concerns, despite its disadvantages for organizing collective science and adaptation. Some level of anarchy seems inevitable but can perhaps be made more broadly functional. Table 2 lists some major science-producing organizations for the Delta, organized broadly.

Table 2. Major Science Producing Organizations for the Sacramento-San Joaquin Delta

Type	Level	Examples
Agencies	State	California Department of Water Resources, California Department of Fish and Wildlife, Delta Stewardship Council, State Water Resources Control Board, Delta Protection Commission, Delta Conservancy, others?
Agencies	Federal	United States Geological Survey, National Oceanic and Atmospheric Administration, United States Fish and Wildlife Services, United States Bureau of Reclamation, United States Army Corps of Engineers, others?

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Type	Level	Examples
Agencies	Local	Metropolitan Water District of Southern California, Contra Cost Water District, East Bay Municipal Bay District, Santa Clara Valley Water District, others?
Interagency	State	California Water Quality Monitoring Council, Delta Independent Science Board
Interagency	Local	State Water Contractors
Interagency	Mixed	San Francisco Estuary Institute/Aquatic Science Center (SFEI-ASC) Interagency Ecological Program
NGOs	Non-advocacy	Public Policy Institute of California, PI, others?
NGOs	Academic	University of California, California State University, University of Specific, Leland Stanford Junior University
NGOs	Stakeholder	The Nature Conservancy, CalTrout, Environmental Defense Fund, National Resources Defense Council, The Bay Institute, Restore the Delta, others?
NGOs	Consulting firms	many
Judicial	Multi-party	Collaborative Science and Adaptive Management Program, Collaborative Adaptive Management Team, San Joaquin Restoration, others?

Table 3. Current Leadership

Leadership	Variants
Existing agencies with siloed Leadership for agency missions	Delta Stewardship Council, Delta Science Program Department of Water Resources (if so, which Division?) State Water Resources Control Board California Department of Fish and Wildlife Delta Protection Commission Delta Conservancy United States Geological Survey US Bureau of Reclamation National Oceanographic and Atmospheric Administration United States Fish and Wildlife Service United States Army Corps of Engineers United States Environmental Protection Agency Federal or US Department of Interior consortium
Multi-agency efforts	Interagency Ecological Program California Water Quality Monitoring Council Joint Powers Authority (JPA) (new or existing, SFEI/ASC) State Water Contractors Delta Plan Interagency Implementation Committee (DPIIC)

D) Approaches for organizing science to support management during rapid change

Table 4. Some Leadership and Governance Options for Agency-spanning Delta Science

Leadership	Variants
Status quo	Little interagency leadership. Usually, agencies go their own way.
Leadership by an existing agency	Department of Water Resources (if so, which Division?) State Water Resources Control Board California Department of Fish and Wildlife Delta Protection Commission Delta Conservancy United States Geological Survey US Bureau of Reclamation National Oceanographic and Atmospheric Administration United States Fish and Wildlife Service United States Army Corps of Engineers United States Environmental Protection Agency Federal or US Department of Interior consortium
Multi-agency leadership options	Interagency Ecological Program California Water Quality Monitoring Council Joint Powers Authority (JPA) (new or existing, SFEI/ASC) State Water Contractors Delta Plan Interagency Implementation Committee or a more specialized Delta interagency science committee (DISC?) Agency-based “Visioning process” State-Federal Delta Science Consortium (perhaps, CALFED 2.0) Others? (series of task forces or technical committees, etc.)
Non-agency leadership options	Voluntary Settlement-specified Judicially-specified State &/or Federal contracts to outside institution: consortium (e.g., California Water Data Consortium), consulting firm, university, etc. Non-agency-led “Visioning process” Delta Science Trust

E) Promising approach(es) for managing science during rapid change

To be drafted.

F) Who should be responsible for organizing and leading agency-spanning Delta science?

At best, existing state agencies lack incentive, resources, or interest in sponsoring or hosting broad and robust inter-agency science, for agency-spanning problems. Federal agencies host and sponsor multi-agency efforts in some other estuaries (e.g., Chesapeake Bay). Some other venues such as the California Water Quality Monitoring Council or the State Water Contractors have narrow responsibilities and would not be appropriate to host a major inter-agency science operation. A judicially-specified program would likely be too narrow and impermanent to

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perform the needed functions. [Chesapeake Bay](#) has had an effective multi-agency science program, focused on eutrophication, with some useful organizational lessons.

Some Federal coordinating efforts combining science and restoration for other estuaries include:

- [Chesapeake – led by USEPA:](#)
https://www.chesapeakebay.net/who/group/scientific_and_technical_analysis_and_reporting
- [Everglades – led mostly by US Army Corps of Engineers:](#)
<https://www.evergladesrestoration.gov/scg/>
- [Gulf of Mexico RESTORE – mostly led by NOAA:](#)
<https://restoreactscienceprogram.noaa.gov/about>
 - NOAA specific; in a sense is a node in the science enterprise network listed on the [Restore the Gulf website](#): <https://restorethegulf.gov/best-available-science> (This is the overall RESTORE Act, which seems to coordinate a bunch of other existing programs).
 - [Mississippi River/Gulf of Mexico Hypoxia Task Force](#): <https://www.epa.gov/ms-htf/history-hypoxia-task-force>

These federal efforts all seem to have in common: 1) federal legislation that establishes them so that federal agencies are required to participate; 2) support a discrete federal “Plan” of some type.

If a broad Delta science program were to develop, it might require an Executive Order, formation of a formal Joint Powers Authority (JPA) or a less formal equivalent, with strong science leadership governed by a consortium board of directors to provide both accountability and insulation. Such an outcome might arise, in part, from legislative action, a comprehensive Voluntary Agreement on environmental regulations for the Delta, or, perhaps less likely, as part of a major multi-agency infrastructure project or lawsuit.