II. Priorities of this Proposal Solicitation Package (PSP)

A. Preamble

The Priority Research Topic List was developed by a Selection Panel through the careful consideration of broad CALFED needs and objectives. The geographical area of interest is the San Francisco Bay-Delta System (Figures 1a and 1b). While viewing the Topic List, proponents should keep in mind several aspects of projects the Selection Panel stressed as areas of great need that would add high value:

- **Interdisciplinary Projects** – the Science Program is in a fairly unique position to fund interdisciplinary projects through this PSP that sometimes are more difficult to fund through other CALFED agency mechanisms. Interdisciplinary studies are crucial to extract the knowledge needed for management to answer extremely complex questions about a correspondingly complex Bay-Delta system whose issues are inherently interconnected across multiple disciplines of study. Additionally, from a CALFED programmatic standpoint, interdisciplinary studies typically cut across multiple CALFED needs thus maximizing the use of scarce funds.
- **Analysis, integration and synthesis of existing information** – the Bay-Delta system has a strong history of monitoring and research that has resulted in a wealth of accessible information. However, much of this information remains only partially analyzed. A very cost effective way to provide CALFED resource managers and policy-makers needed information is to analyze, integrate, and synthesize existing information across data sets in new ways.
- **Models** – models can be an extremely useful tool management uses to make predictions on a variety of scenarios pertinent to CALFED issues. Models are a direct and tangible way science information can be incorporated into management practices and policy decisions (finding direct and practical connections between science and management is a constant challenge for the CALFED community and any projects that help to facilitate this connection will be viewed favorably). Models that incorporate multiple disciplines of study and synthesize information to understand system level responses and connections are especially desirable.

Each of the topics in the Priority Research Topic List (below) is composed of the following sections:

1) the need/importance and relevance for the research tied to specific CALFED programs so that outcomes from the research can be directly tied to a management/policy need;

2) questions that define the unknowns that the research needs to clarify/answer as it relates to the need/importance as stated above;

3) key study components that clarify the type of research efforts expected by the researcher(s) that fit into the broader efforts by CALFED agencies.

All proposals must address at least one of the topic needs and questions and contain at least one of the associated key study components within the selected topic. Cross cutting proposals that address more than one topic need and study question and contain many key components are encouraged. Proposals that address a topic need through additional study questions and key components not present in the Topic List are also encouraged as the Science Program wishes to

stimulate creative thinking and new ideas. A critical aspect of all proposals will be to address the need as directly and clearly as possible.

B. Priority Research Topic List

Topic 1: Environmental Water

Need**:**

To effectively manage water projects in the Delta and upstream watershed to allocate water to protect and recover at risk fish species through both prescriptive standards and flexible, adaptive programs in a way that also provides reliable water supply and water quality.

Questions to be addressed by the research:

- How effective has previous use of discretionary environmental water (i.e. Environmental Water Account and CVPIA (b)(1) and (b)(2)) been for protection and recovery of at-risk fish species of the Bay-Delta estuary?
- How could existing discretionary environmental water supplies be utilized to more effectively protect and recover at-risk fish species?
- What is the relative importance of various key factors such as fish entrainment, Delta inflow (overall or from specific sources such as Sacramento or San Joaquin Rivers), Delta outflow, exports, E/I ratio, channel geometry, invasive species, water quality, temperature, turbidity, toxicants, and others in determining how environmental water of all types should be utilized? What other factors could be considered and what would their relative importance be? Is Delta inflow a more important factor in the South or the North Delta in determining how environmental water should be utilized?
- What effect could a different amount (greater or smaller) of environmental water have on fisheries?
- What alternative or additional ways to manage water would provide fish protection benefits? How would the benefits of those actions compare to current benefits of environmental water use?

Key Components:

- An analysis of the effects of the existing EWA and (b)(2) using modeling and analytical approaches;
- An examination of the amount of environmental water use from (b)(2) and EWA that is needed to show a measurable effect on at-risk fish populations;
- An analysis to determine the most effective way to use environmental water to provide the largest benefits to at-risk fish populations, including an analysis of the most important factors that should be considered in managing environmental water use;
- A study to determine what actions, including environmental water use, could be taken to affect entrainment or migratory movement of fish away from the pumps.

Topic 2: Aquatic Invasive (Exotic) Species

Need**:**

Aquatic invasive species have an impact on at-risk species, water quality, and Delta ecosystems that can severely limit current and future management options including the constraint of water operations.

Questions to be addressed by the research:

- How will aquatic invasive species affect future Delta environmental conditions and what is their impact on the ability to achieve potential desired future conditions in the Delta?
- What are the key factors allowing successful establishment/distribution/survival/control of invasive species?
- What will the response of invasives be to possible future conditions?
- What are some likely future invasives and can actions be taken to reduce the introduction and effects of these invasives?
- How might management options alter likelihood of invasibility?
- To what extent do invasives limit options for managing the Delta?

Key Components:

- The development and application of scenarios and models that could be used to predict successful establishment of invasives under a host of future scenarios including different water management regimes, climate change, land use change, catastrophic events, etc;
- An exploration of invasive control measures or incentive programs successfully used locally and elsewhere;
- Justification of choice of species or group of species in terms of their impact on the Delta ecosystem. Factors to consider:
  - Abiotic: temperature, salinity, depth, flow, turbidity, contaminants, etc.
  - Biotic: natural population cycles, response to other invasives, competitors, predators, etc.
- Example invasives of concern:
  - *Egeria densa* (Common waterweed)
  - *Eichhornia crassipes* (Water hyacinth)
  - *Corbula amurensis* (Overbite clam)
  - *Corbicula fluminea* (Asian clam)
  - *Potamopyrgus antipodarum* (New Zealand mudsnail)
  - *Esox lucius* **(**Northern Pike)
  - Planktonic invaders

Topic 3: Trends and Patterns of Populations and System Response to a Changing Environment

External and internal drivers and environmental changes influence populations of key species such as Delta smelt, important structures such as levees, and system water operations. For example, climate change is expected to not only change the hydrology of watershed rivers, but also raise ocean levels. These two factors alone may alter the salinity balance of the Delta. The pattern of how species, structures and system water operations might respond to these changes is not well understood in that the response may be stepwise, eventually reaching thresholds that cause potential catastrophic changes, or gradual with concomitant gradual or linear responses of the attribute of concern.

Need**:**

To better understand, through use and synthesis of existing information,
present and future dynamics of populations of key species, and/or response of structures and

system operations to anticipated environmental changes which may be a function of natural or human caused phenomena.

Questions to be addressed by the research:

- What are the driver/response relationships of key species, and/or structures (e.g. levees) or system water operations? How are these relationships best described (e.g. continuous, stepwise, other)?
- What are the implications for management strategies of the type of response of species or structures?
- What models are needed to describe these driver/response relationships?

Key Components anticipated to be used in developing a proposal to address the need and questions:

- Response variable selection (e.g. species, structure or operations) and justification;
- Driver (environmental variables that may change and influence the response variable) selection and justification;
- Approach (methods) to determine driver/response relationships;
- Application to selected geographic areas in the Bay-Delta region;
- Model development and management implications;
- Demonstration of heavy use and synthesis of existing information;

Topic 4: Habitat Availability and Response to Change

Need**:**

Habitat availability for key Delta species and communities will change as a result of future changes in Delta configuration and use. Long-term Delta planning requires a better understanding of the effects of anticipated changes (climate, population growth, resource use) and unanticipated changes (earthquakes) on habitats and communities of key species and the potential for remedial action.

Questions to be addressed by the research:

- How will the extent and quality of Delta habitat for key species be affected by a variety of future scenarios such as population growth, invasive species, climate change, sea level rise, subsidence, and earthquakes?
- How will future scenarios affect abiotic and biotic drivers and how will these drivers, in turn, affect key species at different geographic and temporal scales? How will key species respond to these changes?
- How can habitat requirements continue to be met following changes in Delta configuration and use?

Key Components:

- An inventory and analysis of current habitat extent and condition, and spatially explicit data on species relative abundance and demographic characteristics;
- The development and use of spatially-explicit models and databases to analyze and map the potential effects of anticipated stressors on existing habitats;
- The development and use of population models to evaluate effects of changes in habitat on demographic characteristics of key species such as fecundity, growth, survival,

abundance, etc;

- Factors/drivers to consider:
  - Abiotic: temperature, salinity, depth, hydrologic regimes, turbidity, contaminants, etc.
  - Biotic: natural population cycles, response to invasives, competitors, predators, lower trophic levels,
  - How future scenarios of human population growth, resource use, climate change, earthquakes etc. will affect abiotic and biotic factors.

C. Other Desirable Project Features

Collaborative Proposals – The Science Program encourages applicants from different institutions to work together on proposals. Collaborative approaches have been identified as a means of strengthening communication between different institutions; this communication can last well beyond the course of a single study and lead to further collaborative projects, and collaborative proposals typically involve applicants and institutions with different strengths and expertise resulting in stronger interdisciplinary projects.

Matching Funds – Because the CALFED Science Program has limited funds, proposals that can demonstrate they will use other funding sources (matching funds, cost sharing, in kind services, etc.) to leverage Science Program funds will have a greater likelihood of being selected over projects that do not have matching funds.