RESTORING AND SUSTAINING THE SALTON SEA

Supporting Science and Environmental Data Collection & Analysis

Grant Application

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Submitted by

The Salton Sea Authority

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1. PURPOSE

GOAL

The goal is restoration of the Salton Sea, commonly referred to as "saving the Sea." However, this concept means different things to different people. Until recently, "saving the Sea" primarily had a focus of reducing salinity and managing elevation. Large-scale fish kills and bird mortality during recent years have added biological dimensions to this focus and have stimulated scientific workshops to identify research needs to achieve the basic scientific information required to provide the basis for actions for "saving the Sea" (Fish and Wildlife Service, 1997). These and other evaluations have identified critical linkages between the physical and biological aspects of the Salton Sea ecosystem. For example, continued increases in salinity of the Sea will cause fish species to disappear from this ecosystem. As fish species are lost, the food base for the Sea's fish eating birds will be diminished with a resulting departure of this important component of the Sea. Thus, salinity threatens wildlife values of the Sea. Other interactions between biotic and abiotic factors that result in fish and wildlife mortality are inadequately understood. Considerable study is required to better understand, describe, and model these relations. Information obtained is critical for management agencies that must balance a variety of needs in addressing the health of this ecosystem

The broad goal of "saving the Salton Sea" requires a restoration effort that must satisfy and sustain several major values and uses of the Sea. Sound judgements are required to assure that all of these needs are retained in a manner consistent with the values of the local community and society in general. These judgements will be guided by the scientific evaluations undertaken under this project. The primary values to be served by the scientific and other activities being undertaken are:

Safe, productive environment for resident and migratory birds and endangered species: Five endangered species are found at the Salton Sea. Of these, the California brown pelican (Pelecanus occidentalis), Yuma clapper rail (Rallus longirostris yumaensis), and desert pupfish (Cyprinodon macularis) are the most important. The peregrine falcon (Falco peregrinus) and bald eagle (Haliaeetus leucocephalus) are also present but in small numbers and as transient visitors. The Salton Sea is also a critical component of the Pacific Flyway, serving as winter habitat for millions of waterbirds and as a breeding area for a number of species (Collins and Garrett, 1996; Jehl, 1988; Page, et. al., 1992; Parnell, 1995; Shuford et. al., 1996). This role of the Sea has increased in importance during the past quarter century due to loss of wetland habitat within the Flyway and specifically within California, but has become compromised by avian mortality events and perhaps other impacts on avian health.

The role of the Sea in providing for the conservation of migratory birds, and resident wildlife, and endangered species has become increasingly challenged during the 1990's by an increasing number of disease outbreaks due to a variety of causes (National Wildlife Health Center records). The ecological basis for the occurrence of these events is inadequately understood and will be the subject for research being conducted to guide decision processes for goal attainment of

"saving the Sea." Compounding factors that will be evaluated in these assessments are the roles of nutrient loads within the Sea, contaminant concentrations of pesticides such as DDE, heavy metals such as selenium, and salinity. The ideal goal is to maintain the abundance, variety, and seasonal distribution of birds using the Salton Sea.

Maintenance of a viable fishery: The fishery of the Sea has been of significant recreational and economic value (CIC Research, 1989). Salt tolerant species such as sargo (Anisotremus davidsoni), orange-mouth corvina (Cynoscion xanthulus), and tilapia (Tilapia spp.) have provided a sport fishery of great interest within Southern California. Large number of tilapia can be caught with relatively little effort and trophy size corvina of 20 to 30 pounds bring people to the Sea to fish for recreation and to supplement their food base. Little is known of the reproductive biology and population dynamics of these species within the Sea but unchecked levels of salinity will impact on reproduction of these species. While there is some uncertainty on salinity concentrations at which these fish will cease to reproduce, it is generally accepted that the Sea is reaching the level at which at least some species will be adversely effected and there is some fear that the fishery is on the verge of collapse (Fish and Wildlife Service, 1997). Further elucidation of factors influencing fish populations within the Sea is required to protect this fishery and will be a subject for investigation.

Restoration of recreation: Water-based recreation has been a major use of the Sea in the past. Through the 1970's sunbathing, water skiing, boating, fishing, swimming, camping, and picnicking were enjoyed by locals and visitors alike. The Salton Sea State Recreation Area was established along 20 miles of the northeastern shoreline to accommodate recreational visitors. Since the 1970's visitation to the Sea has declined sharply as the Sea has become less attractive (Johnson, 1994). It is uncertain what has made the Sea undesirable as a recreational destination, but it is probable that nuisance factors, such as odor, dead fish, dead birds, and algal blooms are major reasons. The perception that the Sea is a repository of toxic wastes from Mexicali could also be a factor. A California Department of Health Services health advisory on fish taken from the Sea may also have had a chilling effect on visitation. Research will be done to better understand the reasons why water-based recreation has declined and the factors needing to be addressed in the restoration effort if the Sea is to be returned to and maintained as an environment that meets the values of these user groups.

Agricultural drainage reservoir: Agriculture constitutes the major economic base in Imperial County and a significant economy in Riverside County. The Imperial and Coachella Valley's provide an important source of vegetables, fruit, and other produce to the nation, particularly in the winter. Because of the importance of drainage to maintenance of the agricultural economy and the lack of an alternative disposal site, the Sea has served as the repository for agricultural drainage. In 1924 and again in 1928, President Coolidge issued Executive Orders setting aside federal land under the Sea as a public water reserve for irrigation drainage. In 1968, the State of California declared by statute that the primary use of the Sea is for the collection of agricultural drainwater, seepage, leaching, and control waters. Agriculture in its present form

relies upon the ability to discharge drainage into the Sea and the Sea is dependent upon this drainage as a buffer against accelerated rates of increased salinity and drying up due to the hot desert environment that results in an evaporation rate of 5.8 feet per year against annual precipitation of approximately 2.8 inches per year. Agricultural drainage has sustained the Sea for ninety years. This drainage water includes nutrients and other constituents that affect water quality within the Sea. Studies supported by this grant will help to define the limnology of the Sea and the factors influencing the ecological relations involved.

Economic development: Economic activity surrounding the Sea has been in a depressed state for a number of years. Residential lots have been laid out, but remain vacant. Businesses have closed or are struggling. Retail revenue for many businesses is flat. Many commercial and residential buildings are unoccupied and in disrepair. Since many of the businesses depend upon revenue from visitors to the area, the decline in visitation has had a direct impact on business success. Motels, restaurants, fishing tackle and supply stores, recreation vehicle parks, and other businesses have seen a shrinking market and losses of revenue. Flooding has contributed to some of the decline. The two water districts have spent $44 million to construct dikes and purchase property to address flooding. Despite this bleak situation, a recent economic analysis of the Sea indicated that the economic benefit from cleanup from $270 to $360 million per year (Bazdarich, 1998). Activities to cleanup the Sea and re-stimulate economic growth require a sound scientific basis to avoid undesirable environmental impacts.

PROJECT OBJECTIVE

While "saving the sea" is the ultimate goal, the specific objective of this work program is more immediate and tangible:

Provide resources to undertake syntheses and evaluations of existing scientific information and initiate and carry out the highest priority research needed to inform the selection and evaluation processes associated with developing sustainable environmental conditions at the Salton Sea that support the values identified above.

The Salton Sea Authority as the lead local agency and the Bureau of Reclamation as the lead federal agency are undertaking a coordinated state / federal effort to assure a viable Salton Sea ecosystem that meets user needs. A work plan has been developed to guide this effort. A Science Subcommittee has been established to provide scientific evaluations and identify priority research needs to be addressed to provide the scientific basis for improving conditions at the Sea. It is anticipated that scoping, evaluation, and public comment will form the basis for narrowing a broad array of management alternatives down to one or two that will be selected for evaluation at the feasibility level. Environmental considerations, cost, operational conditions, and public acceptance will be major factors in this evaluation. Environmental mitigation will be included as a project feature, if required. The entire planning/environmental compliance process will be open for review and input by the public and all agencies with an interest in the Sea.

The information synthesis, evaluations, and research funded by this grant will provide scientific assessments and recommendations required to inform this process toward sound conclusions regarding the management alternatives. These activities will help determine and fill information gaps.

Research and other science needs associated with restoration of the Salton Sea are inseparable from the engineering and environmental scoping aspects of this effort. Different levels of intensity for these different types of activities are needed as the project moves towards completion. Initially scoping efforts, including feasibility studies, require the greatest efforts and are guided by scientific evaluations at each decision point. These efforts will progressively give way to pure science activities which will in turn begin to involve scientific monitoring as a feedback loop to assess progress and additional science needs. This process of adaptive environmental management requires a strong science support base throughout the life of the project. Therefore, we seek flexibility in the use of proposed funds to address the most critical science needs as they appear along the continuum of needs identified above.

Each specific scientific activity to be undertaken will be developed into a work plan / study that is evaluated by the Science Subcommittee (described in the following section) and is also subject to peer review to maintain the scientific integrity of the process. Each work plan / study will be provided to the Environmental Protection Agency.

2. HISTORY AND BACKGROUND

HISTORY

The Salton Basin is a closed, sub-sea level basin in the low desert of southern California and northern Mexico. The basin is actually part of the Colorado River delta. In the last thousand years, the Colorado River has meandered west and completely filled the basin at least three times forming a freshwater lake called Lake Cahuilla. Each time, the River eventually returned to its more easterly channel leaving the lake to evaporate.

The Salton Sea was formed in 1905 when massive flooding caused the Colorado River to break through an irrigation canal headworks and flow freely into the Salton Basin for 18 months. Since then, the Sea's existence has been maintained primarily by agricultural return flows from the Imperial, Coachella, and Mexicali Valleys.

The Salton Sea is California's largest lake. At a surface elevation of 227 feet below sea level, the Sea has a surface area of 243,718 acres (381 square miles). Its maximum depth is about 51 feet and its average depth 31 feet.

ENVIRONMENTAL VALUES OF THE SALTON SEA

The Sea's great wildlife stewardship role is founded in the habitat it provides for migratory waterbirds and the endangered desert pupfish, Yuma clapper rail, and California brown pelican. The Sea is an important wetland for migratory birds within the Pacific Flyway, a role that is enhanced by the loss of more than 90 percent of historic wetland acreage in California (Dahl and Johnson, 1991). Nearly 400 species of birds have been recorded at the Sea (Fish and Wildlife Service, 1997) and result in the Sea and surrounding area being one of the most popular bird watching areas within the nation.

SALTON SEA PROBLEMS

The Salton Sea is beset by several serious problems. Because the Sea has no outlet, water is lost only through evaporation, leaving dissolved salts behind and gradually raising salinity. Salts originate from the Colorado River and are concentrated in the rivers and drains that feed the Sea. The Sea's salinity has now reached 44,000 parts per million (ppm), about 25 percent higher than ocean water. Unless salt loading can be reversed there will be a collapse of important biological components of this ecosystem as fish populations are lost, then the bird species that rely on the fish as a food base, followed by predatory and scavenger species that rely on birds as major component of their food base.

Fish and bird mortality at the Sea have increased greatly during recent years and have become a focus for concern by the U.S. Fish and Wildlife Service and the California Department of Fish and Game. Multiple causes are involved, some of which such as the estimated loss of 150,000 eared grebes (Podiceps caspicus) during a 1992 die-off have not been identified despite considerable study. Fish-eating birds such as white pelicans (Pelecanus erythrorhynchos) and brown pelicans have suffered major losses from type C botulism, double-crested cormorants (Phalaorocorax acritus) have suffered mass mortality due to Newcastle disease, avian cholera is a frequent cause of mortality in

ruddy ducks (Oxyera jamaicensis) and other waterfowl, and salmonellosis has caused considerable mortality in colonial nesting water birds at the Sea. Nearly all of these problems have become recognized since 1992 due to the magnitude of die-offs occurring since then (National Wildlife Health Center). Pathogens identified as causes of fish kills include the parasite Amyloodinium ocellation (U.S. Geological Survey, 1997) and various bacteria, primarily of the genus Vibro (Western Fisheries Research Center recores). Algal toxins, oxygen depletion, and decreased water temperatures during winter have also been identified as causes of fish kills (Fish and Wildlife Service, 1997). In addition, recent studies by scientists at San Diego State University have identified heavy burdens of parasites that have not yet been identified which also may be involved as causes of mortality.

The trace element selenium has caused mortality and/or developmental deformities among wildlife at several irrigated areas in the western U.S. and has been studied in the Salton Basin by the U.S. Department of the Interior. Unlike the situation at Kesterson reservoir in central California -- the most infamous case of selenium poisoning -- selenium in the Salton Sea is derived from irrigation water, not irrigated soils. The selenium concentration in Salton Sea water is very low -- about one part per billion -- but levels in the Sea's sediment and biota are at levels of concern. Selenium is unlikely to be a direct cause of wildlife mortality at the Sea but may be contributing to mortality through immunosuppression. Selenium originates from the Colorado River. Studies by the National Wildlife Health Center disclosed increased susceptibility of mallard ducklings (Anas platyrhynchos) to duck virus hepatitis following environmental exposure to low levels of selenium (Whiteley and Yuill, 1989).

Because the Sea is located in a closed basin with evaporation as the only discharge, constituents in the inflow accumulate over time. Salt, nutrients, organic compounds, and other constituents can reach toxic levels and are likely contributing to the degradation and recreational use of the Sea. Halting and reversing these accumulations will need to be addressed in actions to restore the Sea to a more desirable level of environmental quality.

The Sea's elevation has also gradually risen. Homes and businesses which developed to take advantage of the sportfishery and local attributes have been flooded and abandoned. Paradoxically, the rise in the Sea's level has also been beneficial by keeping salinity from rising even higher. Inflows to the Sea contain high levels of nutrients making it a very productive body of water. This high primary productivity explains the productivity of the fishery but also contributes to the periodic fish kills via deoxyenation due to resuspension of the heavily organic sediment or decomposition of planktonic algae after "red tide" blooms.

Approximately 10 percent of the inflow to the Salton Sea originates in Mexico and is carried to the Sea via the New River. Because of the discharge of industrial pollutants and poorly treated sewage in the Mexican city of Mexicali, the New River has been called the most polluted river in the country. However, the discharge of at least some industrial pollutants has declined in recent years and the sewage essentially undergoes natural treatment during its 50-mile passage to the Sea.

PREVIOUS STUDIES

Studies directed toward managing the salinity of the Sea date back to the 1960's when the Bureau of Reclamation and the California Department of Water Resources performed a joint evaluation of possible alternatives (Department of the Interior, 1969). Results from that study led to a joint feasibility study completed in 1974 (Department of the Interior, 1974).

In 1994, the Salton Sea Authority received a grant from the U.S. Environmental Protection Agency's Clean Lakes Program to conduct environmental and economic analysis of salinity and elevation management options for the Salton Sea. The final document prepared under the Clean Lakes Program, "The Salton Sea Management Project Evaluation of Salinity and Elevation Management Alternatives" (Ogden Report 1996) was prepared by Ogden Environmental and Energy Services.

The Bureau of Reclamation, the Authority, and the California Department of Water Resources again engaged in studies of the Sea following passage of Public Law 102-575 in 1992 and the formation of the Salton Sea Authority in 1993. In addition to some characteristic studies, a preliminary study of alternatives was completed (Bureau of Reclamation, et. al., 1997).

The U.S. Geological Surveys National Wildlife Health Center hosted an October 1996 workshop that resulted in an ecosystem issue paper to address the issues at the Salton Sea (National Wildlife Health Center, 1997). This effort was followed by an August 1997 workshop hosted by the Bureau of Reclamation and U.S. Fish and Wildlife Service. Findings were published in a report, "Saving the Salton Sea: A Research Needs Assessment" (Fish and Wildlife Service, 1997). That report identified a broad range of biological, physical, cultural, chemical and disease investigations relative to providing information needs for addressing the problems of the Sea.

SALTON SEA AUTHORITY

In 1993, the counties of Riverside and Imperial, the Imperial Irrigation District and the Coachella Valley Water District entered into a Joint Powers Agreement, creating the Salton Sea Authority (Authority). The Authority has joined with the State of California and Federal agencies to chart a course for "saving the Sea." This collaborative effort brings together the major parties with environmental stewardship responsibilities for biological resources within the Salton Sea ecosystem and the counties and the water agencies that manage the majority of water resources of the Imperial and Coachella Valleys that support those biological resources. The Authority, by directing and coordinating actions relating to improvement of water quality, and stabilization of water elevation also enhances recreational and economic development potential of the Salton Sea, and other beneficial uses, while also providing for the dynamic agricultural economy in Imperial and Riverside counties and other user groups of the Sea.

RESEARCH MANAGEMENT COMMITTEE & SCIENCE SUBCOMMITTEE

In December, 1997, the Secretary of the Interior met with the Salton Sea Authority and other stakeholders to affirm the Department of Interior's commitment to addressing the issues of the Salton Sea. He affirmed the Bureau of Reclamation and the Authority as co-lead agencies to complete the NEPA (National Environmental Policy Act) / CEQA

(California Environmental Quality Act) process that they had initiated and, with the concurrence of both agencies and other stakeholders, established a process for prioritizing and undertaking science needs to support the NEPA / CEQA decision process.

A Research Management Committee was established of high-level managers from the Salton Sea Authority, State of California, U.S. Department of Interior, and the Torres Martinez Desert Cahuilla Indians. This Committee makes funding and other relevant decisions regarding science to be funded to support the NEPA / CEQA process.

A Science Subcommittee (hereafter referred to as the Subcommittee) was established to serve as an objective advisory committee to provide scientific evaluations and recommendations to the Research Management Committee. The Subcommittee functions as a coordinated body to determine information gaps, identify science / information needs, and provide the Research Management Committee with recommendations for funding priorities. These needs are directly linked to the Salton Sea Work Plan jointly developed by the Authority and Bureau of Reclamation and provide the scientific foundation for management decisions regarding actions to be taken to "save the Sea." Thus, the Subcommittee is the focal and pivotal science body for scientific efforts to be undertaken with the funding provided by this grant.

3. APPROACH

GENERAL DESCRIPTION

The following science needs are provided to illustrate the types of activities to be funded through this grant. These illustrations are relatively generic as it is the responsibility of the Science Subcommittee to develop detailed solicitations based on their evaluations. Proposals received from scientists will be evaluated and peer reviewed in accordance with the Administrative Plan provided in the next section. Each science need is designed to inform the restoration process. In addition to the following needs, funding for public outreach and development of an internet web page are provided in the budget. The intent is to inform all stakeholders of the progress and results of Science Subcommittee efforts.

Preliminary evaluations have disclosed several critical science needs that must be addressed irrespective of management alternatives to be considered. These science needs are representative of and consistent with those identified as the result of an independent needs assessment workshop held August 1997 attended by nearly 100 scientists representing 21 Federal, State, and local agencies, universities, and government officials (Fish and Wildlife Service, 1997). Specifically, there are pressing needs for:

- Baseline environmental data;
- Modeling to predict outcomes;
- Determining disease ecology underlying the cause of massive fish and bird mortality on the Sea;
- Fully describing the nature and composition (physical, chemical, and biological) of sediments throughout the Sea;
- Limnology characterization of the Sea; and
- Evaluating management action environmental impacts.

This proposal provides funding to support these evaluations and associated needs that will arise from studies undertaken to address these and other critical needs. The following descriptions provide some dimensions for each of the needs just identified:

BASELINE ENVIRONMENTAL DATA

Future conditions with and without management actions project cannot be predicted nor change evaluated without the knowledge of baseline conditions. Therefore, a number of baseline studies will need to be undertaken in order to establish a basis for analyzing and determining impacts of management alternatives. Baseline conditions in the areas of biology, sociology, cultural resources, air quality, land use, hydrology, etc., will need to be established. This task will include the identification of areas where additional data are needed or existing data need to be substantiated. Mapping the distribution of

biological and cultural resources, current land use, and hydrologic parameters is expected[1].

Specific baseline data studies include:

Biological Assessment
A detailed assessment of the biological impacts on listed and threatened species and critical habitat of the preferred management action(s) for "saving the Sea" will be made under this task. The Science Subcommittee will provide assistance in recommending assessments to be made, identifying the scope of studies, and obtaining peer review. Information from these assessments will provide guidance for determining the final approach among those being considered.

Hydrology and Water Quality Analysis
Management actions being considered to address salinity problems within the Sea may result in the construction of physical structures within the Sea. That construction may alter a number of physical or chemical conditions of the Sea or portions of the Sea which will in turn effect biological processes, including food chains and disease occurrence. Investigations will need to be conducted to determine baseline water quality across the Sea, contaminant levels, temperature gradients, dissolved oxygen saturation levels, odor-generating mechanisms and other chemical, biological (microbes), and physical parameters that are important factors relative to restoration goals for the Sea. Baseline hydrology and water movement patterns within the Sea will also need to be established. Data from these studies will be incorporated within predictive and systems models being developed for evaluations of changes over time and those occurring in response to management actions that affect the Sea.

Cultural Resources
This task will assure compliance with the National Historic Preservation Act, the Native American Graves Protection and Repatriation Act, Antiquities Act, and Archaeological Resources Protection Act, as well as active coordination with affected parties in accordance with good planning practices. A Class 3 cultural survey will need to be performed prior to any significant management actions that impact the Sea. This effort will consist of an on-the-ground survey of 100 percent of the area impacted by the project, to the extent physically possible. However, because it would be prohibitively expensive and time consuming to perform this level of survey for multiple potential management actions, a "programmatic agreement" among all interested parties could be entered into that stipulates roles and responsibilities for the future protection of cultural resources. This would allow the postponement of Class 3 surveys until the final designs for probable approaches are near completion. At that point, the management approach to be undertaken will have been determined and the surveys could be done more efficiently. This task also includes continued contact with appropriate entities to coordinate cultural aspects of the project.

Hazards, traffic, aesthetics, planning, and land use
Environmental evaluations are also needed to assess the impacts of management alternatives on existing hazards, traffic, aesthetics, and local planning and land uses. This task may be subdivided into more specific subtasks in each of the

[1] Utilization of the University of Redlands Salton Sea Database Program and GIS is proposed.

subject areas when needs require extensive or involved evaluations. The outcomes for various scenarios will need to be predicted and evaluated. Some modeling may be required for these purposes.

Air Quality

Concerns regarding chemical contaminant loads and other potential pathogens within sediments and soils of the shoreline of the Sea extend to those materials becoming airborne as a result of construction activities that may result from management actions. Increased areas of dry shoreline might occur if there are reduced levels of the Se and airborne movement of that material is of concern. Therefore, it is important to establish baseline air quality data for the areas at and adjacent to the Sea. This information will be integrated with other information being gathered to predict the outcomes of various actions and activities on changes in air quality.

Geotechnical

Depending upon the preferred management action(s), a number of geologic evaluations may be required. Any civil structures will require an analysis of foundation conditions; it may be necessary to identify burrow material (earth, rock, dredged sediments) locations and determine if those materials that are structurally acceptable are free from significant hazards such as toxic chemicals or elements or microbial disease agents; seismic risk will need to be evaluated; and other assessments may be required. Both field work and laboratory analyses may be required. More detailed topography may also need to be acquired, depending upon the management actions being considered to restore the Sea.

MODELING

Management decisions and science evaluations for the Sea will be highly dependent upon predictive models that can provide insight needed to select among alternative courses for action. Several models addressing various important parameters exist including a three-dimensional hydrodynamic circulation model of the Sea (Cook and Orlob, 1996), a Salton Sea Operational Model (Thiery, 1998), and a model of environmental factors driving avian botulism outbreaks (National Wildlife Health Center). These models have been developed for independent purposes yet the factors involved are interrelated. This task will involve the integration of independent models in the context of a larger ecosystem model, refinement of the existing models as required to improve their predictability, and the modeling of other components of the physical and biological components of the ecosystem where such models are needed for evaluations and to provide enhanced perspectives for guiding decision processes. Additional modeling will be required to evaluate socio-economic components and will fully utilize evaluations already conducted such as the economic assessment by the University of California – Riverside (Bazdarich, 1998).

DISEASE ECOLOGY

The occurrence of disease is an outcome resulting from specific conditions that involve relations between the species impacted (affected host), the agent causing disease (chemical, microbial, and other agents), and environmental factors that facilitate the

host-agent interactions. A variety of agents have been identified as the cause of fish and wildlife mortality at the Salton Sea. The ecological basis for these occurrences must be adequately understood to prevent management actions from enhancing the potential for disease. This task will involve defining the ecology of disease processes at the Sea in a manner that provides for enhanced understanding of the role of physical and chemical components of the environment in influencing disease outcomes. Findings will feed into modeling projects and will be a critical aspect of management decision processes.

SEDIMENT EVALUATION

The resuspension and transport of sediments of the Salton Sea is likely regarding any management actions taken. Knowledge is lacking regarding the basin-wide distribution and concentrations of hazardous chemicals, bacterial spores that are part of the ecology of avian botulism, and other potential hazards associated with these sediments. This task addresses evaluations that will provide critical information relative to management alternatives that directly utilize sediments as material for diking, deposit sediments in new locations outside the Sea, expose sediments to drying and subsequent movement by wind, or result in enhanced movement of sediments within the Sea due to altered wind driven circulation patterns due to reduced water levels or the creation of artificial structures within the Sea.

LIMNOLOGICAL CHARACTERIZATION

Most other investigations will require basic limnological data from the Salton Sea. This task will assemble and evaluate existing information, thereby identifying data gaps and establishing research needs. Studies to be conducted will focus on providing information on how the physical, chemical and biological conditions that exist within the Sea vary seasonally and spatially, and how they will respond to implementation of the management alternatives being considered. Findings from these studies will feed into the system model and also generate a model to depict the limnology of the Sea.

MANAGEMENT ACTION ENVIRONMENTAL IMPACTS

A sound understanding of the various components of the Salton Sea ecosystem and the functional relations of the different components to one another and external factors is basic knowledge that must be considered in deciding upon actions to restore the Sea. These considerations also are important aspects of projecting the environmental consequences of actions being considered and form the basis for evaluation processes required by state and federal environmental laws. The necessary analyses to determine environmental impacts of management alternatives being considered will be carried out under this activity.

SCHEDULE

The schedule for this proposal is linked to the joint Authority / Bureau of Reclamation Work Plan for restoration of the Salton Sea schedule. That schedule is currently being revised and may need to be further revised based on proposed legislation introduced into the House of Representatives and Senate this session. It is expected that the

evaluation process to decide upon a preferred management approach for restoration of the Sea will require 18 months.

Key milestones for this proposal include:

- Agreement signed between the U.S. Environmental Protection Agency and Salton Sea Authority providing project funding
- Scoping by the Science Subcommittee to identify and develop priority science information and research needs (note that this will be an ongoing iterative process)
- Quality Assurance Program
- Project descriptions to address priority science information and research needs
- Specific Work Programs / Contracts awarded
- Science Findings/Results
- Progress Reports of work being conducted
- Placement of samples in appropriate repositories and data within scientific databases

The selection and award process for individual studies / evaluations is described in the Administrative Plan section. Scoping of topics and needs is occurring today. Scoping begins the selection and award process. Currently, scoping is targeted to baseline data needs. Scoping for the other general needs identified above will begin shortly. As the management alternatives are identified during the restoration process, scoping or data analysis associated with those alternatives will occur. Scoping and the selection and award process for information and other science needs is iterative and flows from general evaluations identifying synthesis needs that in turn identify specific study needs which in turn identify other studies to fill newly recognized critical data needs. Resynthesis of information that includes newly completed evaluations and studies may generate one or more additional cycles of evaluations and research studies involving needs identified above and others that are relevant to the management alternatives being considered.

4. ADMINISTRATIVE PLAN

PROJECT MANAGEMENT

The Salton Sea Authority is responsible for project management. As discussed under "history and background", the Authority is a joint powers agency and the local lead agency on the Salton Sea restoration project. The Authority is currently working under an agreement with the Bureau of Reclamation to complete planning, environmental, and engineering work. The Authority's Executive Director, will serve as project manager.

The project manager is responsible for resource allocation, contracting, timelines, program administration and communication with the U.S. Environmental Protection Agency. The project manager is the link between the Research Management Committee and the lead agencies' development of the management approaches for restoration of the Salton Sea.

The project manager will work within the framework of the Research Management Committee (and its Science Subcommittee) to ensure the objectives of the science program are met. The overall project management structure is depicted on Figure 1 and includes the relationship between the grantee / project manager, Federal lead agency, Research Management Committee / Science Subcommittee, Science manager, QA/QC Officer, and independent researchers.

The County of Riverside provides financial and auditing services for the Salton Sea Authority.

TECHNICAL DIRECTION: SCIENCE SUBCOMMITTEE

The Science Subcommittee is an interagency body that provides an extensive network of scientific expertise that can be called upon for input through the agency representatives that serve on this body. Further, the Subcommittee is empowered to seek out and utilize external expertise that may become needed in its evaluations of specific scientific issues. External parties may be invited to participate in Subcommittee meetings, requested to provide written evaluations, and participate in other ways.

Subcommittee members are not eligible to receive Research Management Committee distributed funds awarded for the conduct of scientific investigations nor can they directly supervise individuals or have direct management responsibility for groups carrying out such studies. These standards are imposed to maintain scientific objectivity and to avoid any appearance of conflict of interest regarding recommendations and evaluations and the awarding of resources to address science needs. Peer review will be fully utilized throughout this process to further enhance the basis for establishing and funding scientific needs. The Subcommittee Chairperson is charged with primary responsibility for assuring the integrity of these standards. That individual serves as the scientific project officer for this proposal, is a highly credentialed scientist (see Curriculum Vitae section), is not employed by the Authority, and does not supervise or have line authority responsibility for any members of the Subcommittee. The Subcommittee reports to the Research Management Committee (described under the History and Background section).

The Subcommittee also coordinates scientific efforts being undertaken by stakeholders. This coordination is for the purpose of information transfer between scientists conducting research on the Sea, to avoid duplication of effort, and to enhance investigations through collaboration and consolidation of efforts when feasible. A Science Coordinator serves this role and also provides for the preparation of Project science solicitations, progress reports of Project scientific activities and accomplishments, and tracks scientific studies funded under this Project.

RESTORATION WORK PLAN

The restoration work plan (already in process) involves development of an Environmental Impact Statement (EIS) under the National Environmental Protection Act and a Environmental Impact Report (EIR) under the California Environmental Quality Act. The work plan also involves appraisal and feasibility level engineering. For the EIS/EIR processes, the Bureau of Reclamation and the Salton Sea Authority are joint lead agencies.

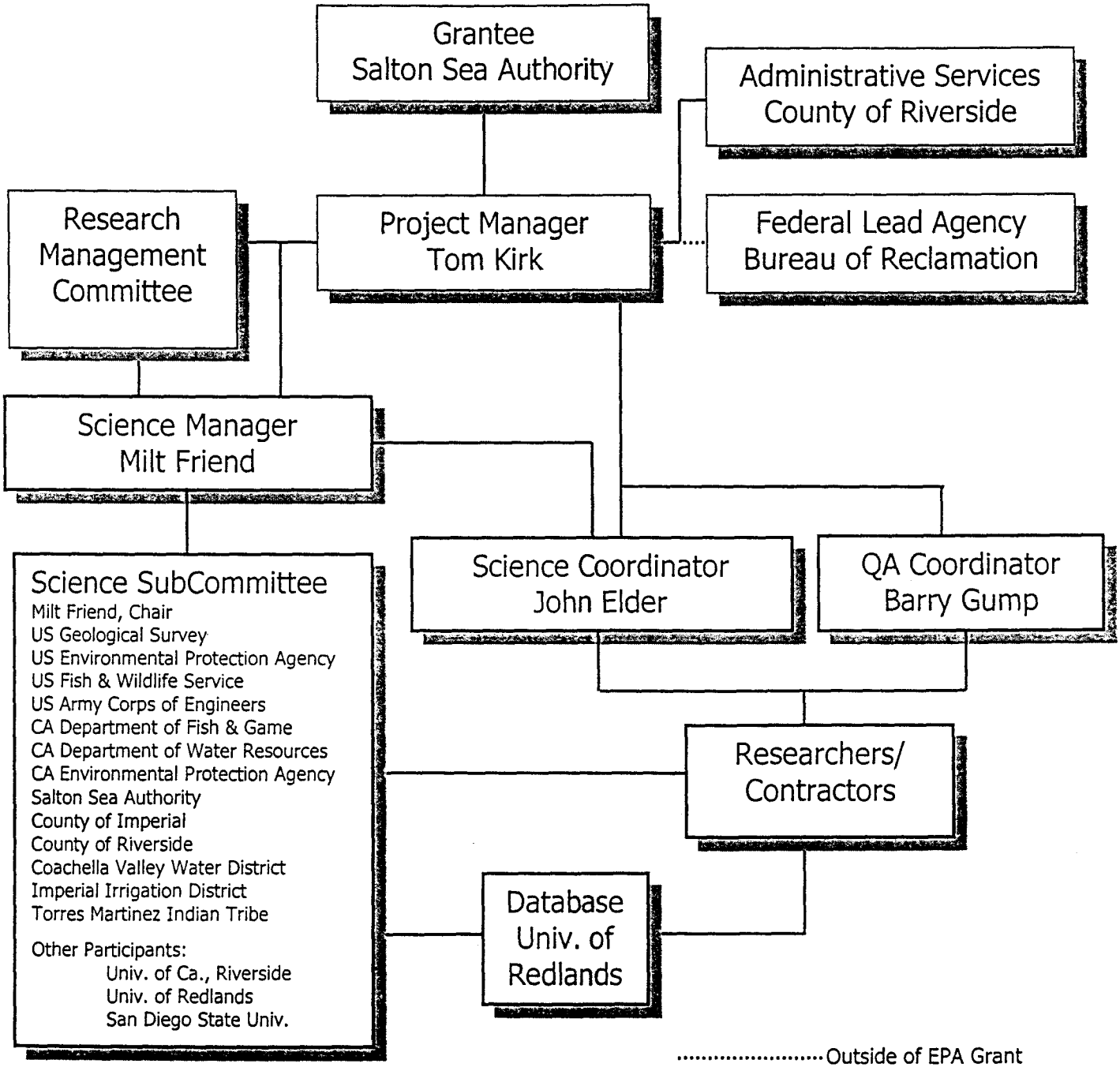
The Bureau of Reclamation has been designated by the Secretary of the Interior as the lead agency for the Department of Interior because of its mission in water resource protection and development; its responsibilities for managing the Colorado River; its capabilities in the areas of planning, design, and construction; and an ongoing successful relationship with the Salton Sea Authority. The Bureau's Regional Director in Boulder City, Nevada is the Federal lead person for the restoration work plan process. The Regional Director is responsible for maintaining productive relationships with the cooperating Federal agencies, and for ensuring regular communication the Salton Sea Authority. In addition, the Regional Director is responsible for hiring and supervising the Bureau of Reclamation Program Manager.

The Salton Sea is the local lead agency for the restoration work plan process. The Authority's formal members include the County of Imperial, the Imperial Irrigation District, the Coachella Valley Water District and the County of Riverside. Each has a direct stake in the restoration of the Sea. The Authority also includes *ex-officio* representation from several State and Federal agencies and the Torres-Martinez Desert Cahuilla Indians. The Salton Sea Authority's Executive Director will serve as the Authority's Program Manager.

It is intended that the Authority and the Bureau of Reclamation will participate as equal partners in completing the environmental compliance process and proceeding with other activities required for project implementation. However, in order to facilitate the efficient and effective progress of project planning and environmental compliance, the two Program Managers will have primary responsibility for different aspects of the effort. The Authority's Program Manager will focus on funding, state/local/tribal involvement, public involvement, and assuring that scientific evaluations and the resulting recommendations from the Research Management Committee and Science Subcommittee are appropriately incorporated into the NEPA/CEQA process. The Bureau's Program Manager will focus on completion of engineering and other tasks. Bureau of Reclamation staff and contractor resources will be utilized to carry out engineering and associated tasks as appropriate.

Figure 1

Project Management Structure



SELECTING TOPICS AND ENGAGING RESEARCHERS – THE PROCESS

The Science Subcommittee exists for the primary purpose of providing objective and timely scientific information, evaluations, and recommendations for priority research needed to guide the lead agencies in making informed, sound decision in selecting a preferred management alternative. Therefore, the Subcommittee process is driven by the management alternatives being considered and involves independent evaluations for each. That is, each alternative is evaluated as an entity and not compared with other alternatives. These evaluations identify, based on existing information the predicted consequences of the management alternative relative to desired objectives for restoration of the Salton Sea. These evaluations also include an identification of information needs, that if satisfied, would provide for a more robust assessment and enhanced evaluation of the alternative. The information needs identified will be further evaluated relative to their priority for accomplishment and recommendations made to the Research Management Committee for addressing these needs.

Support by the Research Management Committee to purse specific science / information needs will result in the following process for satisfying the need and incorporating information obtained into the decision process (see Figure 2 "Selection and Award Process"):

1. Scoping – the need will be defined by the Science Subcommittee in a conceptual context for solicitation of proposals. Timeliness, project scope, and expected deliverables will be components of the project description. These conceptual needs will be provided to the Research Management Committee for feedback regarding tentative support for the study.

2. Subgroups of appropriate expertise from within the Subcommittee, augmented by external expertise as needed, will develop a draft project description for science needs receiving Research Management Committee support.

3. Internal review by the full Subcommittee for adjustments and consensus for project context will result in issuance of requests for proposals. The outcome of reviews will be documented for the files.

4. Solicitations will be for minimum time periods due to the time constraints imposed for management selection of a preferred approach, will identify a concise format for proposal submissions, and be broadly advertised through a website and other means. Pre-notification of where and how posting are to be made will begin shortly to ensure broad opportunity for those wishing to compete for awards.

5. Proposals received will be evaluated for content, relevance, and other appropriate factors by multi-disciplinary subgroups organized within the Science Subcommittee. This first level of review involves scientific assessments (peer review) of whether the right science is being proposed to address the solicitation.

6. Those proposals deemed appropriate by the internal Subcommittee scientific evaluations will be subjected to a second level of in-depth peer review to assess whether the science being proposed is being done right and has scientific merit.

Reviewers that are subject matter experts will be utilized for those evaluations. In most instances three reviewers will be used, at least two of which must be external to the Subcommittee. External reviewers will always constitute a minimum of one-half the individuals providing reviews for each proposal.

7. Those proposals receiving favorable reviews will be forwarded by the Subcommittee chairperson to the Research Management Committee. Subcommittee funding priorities and recommendations for actions to be taken will be included with the proposals and the peer reviews.

8. Research Management Committee actions regarding the recommendations will be documented for the files. Project awards will be made through contracts and other means vested in the Salton Sea Authority. Project awards will have several important conditions. Data must be recorded in a manner consistent with database standards for the centralized database established for the Salton Sea project at the University of Redlands; findings must be shared with other scientists working on the Sea, with the Science Subcommittee, and with management officials as appropriate; and coordination of studies with other ongoing investigations will be required when this will enhance scientific returns and prevent duplication of effort.

9. The Science Subcommittee will track all studies awarded through mandatory progress reports submitted by the awardee. The Subcommittee will also maintain an inventory of all on-going studies, regardless of sources of funding, their objectives, expected products, and timelines for achievement of important milestones and completion.

10. In addition, the Subcommittee will provide evaluations for products resulting from completed studies and for continuation or expansion of studies beyond initial funding support

SCIENCE SUBCOMMITTEE PRINCIPALS

The Subcommittee is a working committee that produces information and products that are time sensitive to management needs. A high level of accountability is expected for each member. The members will confine their involvement to objective evaluations of the issues at hand and will not be advocates for partisan viewpoints regarding those issues that may exist within their source of employment. The Subcommittee Chair has established the following key words and philosophy to guide the actions of members.

1. Professional – in members actions and approach to the task at hand;

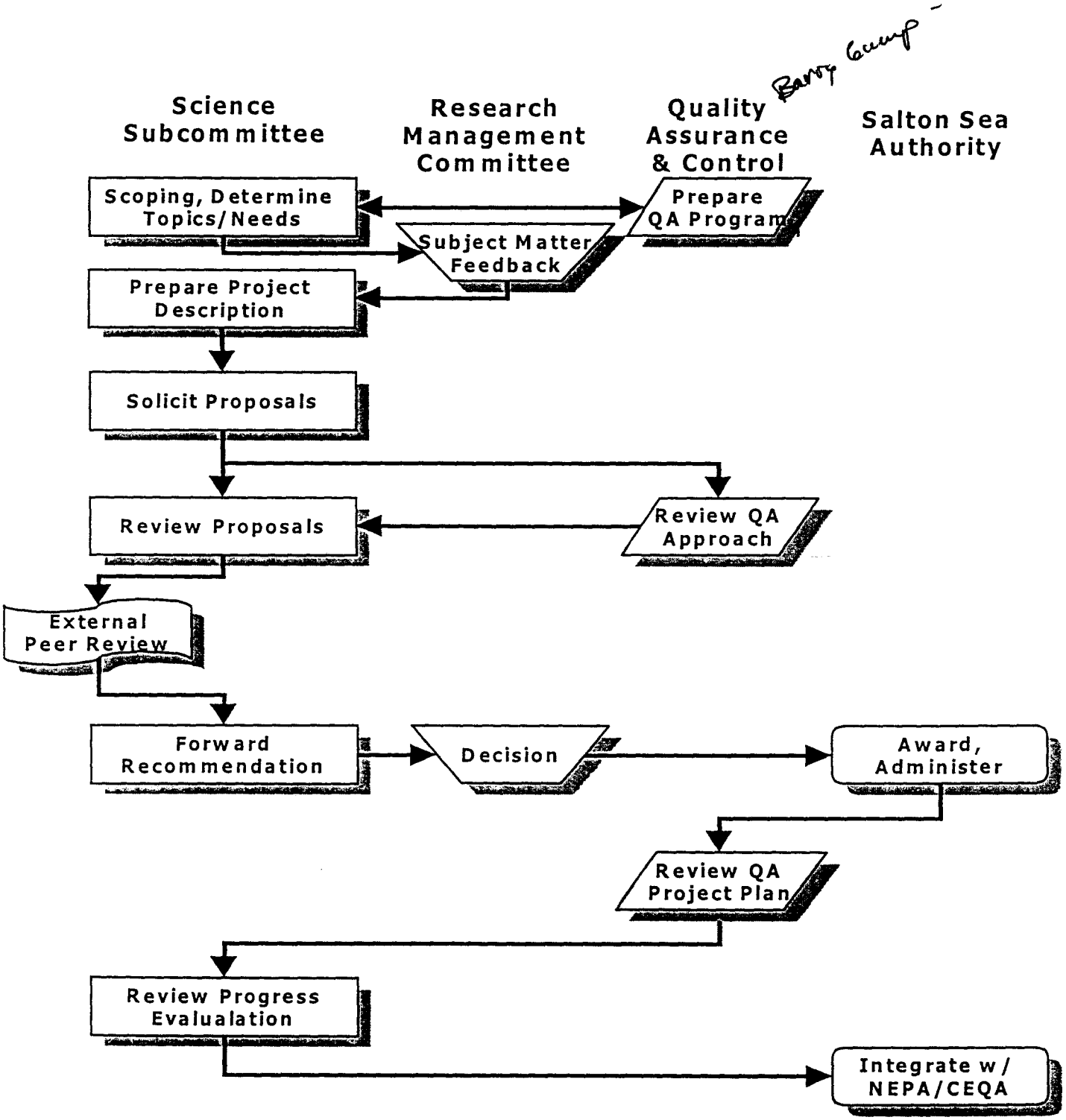
2. Excellence – in the products prepared and guidance provided;

3. Ethical – in the manner in which data, information, fellow member and external parties are dealt with;

4. Responsive – to the needs of the process and the issue being dealt with; and

5. Commitment – to successful task completion.

Figure 2
Selection and Award Process



QUALITY ASSURANCE PROGRAM

The Salton Sea Authority, Research Management Committee and Science Sub-committee are committed to high quality science being the foundation for the management decisions associated with the selection of preferred approaches for restoration of the Salton Sea. Through this grant, the Authority will establish a Quality Assurance program to help reach this goal.

Under a contract with the Salton Sea Authority, the California Department of Water Resources will provide staff services for administration of the Quality Assurance/Quality Control Program for the project selection and award process. Department of Water Resources staff will also provide management of the ongoing QA/QC Program through project implementation and completion. Basic functions of the QA/QC program include:

- Development of QA/QC goals for overall program
- Provide QA/QC guidance for solicitation of projects
- Review QA/QC components of initial project proposals
- Review proposed QA/QC procedures in detailed project workplans
- Review QA/QC components of individual project quarterly reports and prepare quarterly quarterly QA/QC progress reports for the Science Subcommittee, Science Manager and Project Manager's review
- Participate in meetings and provide appropriate input to the Science Subcommittee and Research Management Committee
- Maintain QA/QC files

Staff services for the QA/QC program will be provided by the QA/QC unit, which is located in the Water Quality Assessment Branch of DWR's Division of Planning and Local Assistance. The lead person assigned as QA Coordinator for the Program will be a full university professor currently employed as staff in the QA/QC Unit. His resume is attached. Input and review by management staff above this level will be provided on an as-needed basis.

The California Department of Water Resources QA/QC program is described in Appendix A.