Salton Sea Ecosystem Management Decision Support System

System Planning, Design and Implementation Refinement Workplan

PRELIMINARY DRAFT 12/29/98

Introduction

<u>Background.</u> The Salton Sea Reclamation Act of 1998 formally established the decisionmaking heirarchy to evaluate restoration alternatives to remediate environmental degradation in the Sea. Title I of the Act authorizes preparation of a feasibility study to evaluate restoration alternatives, and prepare wildlife resource and baseline reconnaissance studies to support this evaluation. The Lead Agencies for preparation of the feasibility study are the Salton Sea Authority (the State lead agency established under a Joint Powers Agreement between the Imperial and Riverside Counties and the Imperial Valley and Coachella Valley Water Districts), and the Bureau of Reclamation (the Federal lead agency).

The Environmental Management Center (EMC) at the University of Redlands was commissioned to provide information compilation, management and coordination for the Salton Sea restoration effort. The Salton Sea Database Program (SSDP) was established within the EMC to administer and carry out the program. The SSDP grant assistance award commenced on February 17, 1998. Since then, the role of the SSDP has evolved as the information clearinghouse for the baseline reconnaissance studies and other investigations being directed by the Salton Sea Science Subcommittee. The SSDP also supports the Research Management Committee (RMC) and other agency, institutional and private stakeholders with an interest in the Salton Sea restoration initiative.

The Salton Sea Restoration project has developed significantly since its inception, and the range of stakeholders involved continues to expand. With this expansion has come an increasing demand for informational resources. It is expected that this demand will continue to grow, and that the sophistication of the requests will rise as system users become more familiar with the powerful data query, spatial analysis and visualization tools available in the system. The SDDP wishes to take proactive steps to effectively meet this demand, and is undertaking this update study to better understand and project future user needs, and to develop a strategic plan for accommodating them.

<u>Ecosystem Management and the Decision Support System Concept</u>. The Salton Sea restoration effort represents one increment in an ongoing process for developing a comprehensive understanding of the natural and cultural environmental factors affecting the health and stability of the Sea, and in developing engineering and management

strategies for its restoration. Once a final restoration plan is adopted it will take many years and rigorous long term monitoring and adaptive management to sustain the environmental integrity of the Sea and its environs.

The term "ecosystem management" is widely discussed among resource planners and managers, and has many definitions and forms in practice. Essentially the concept involves understanding the natural and cultural environmental dynamics affecting a "place", and use of this knowledge in defining and applying various management practices. Proponents of ecosystem management differ in their values and emphasis, ranging from a strict anthropocentric interpretation that stresses first and foremost the use of resources for human benefit, and on the other end of the spectrum the strict restriction of any form of human interaction in favor of other non-human values, such as biological preservation and biodiversity. The Salton Sea restoration project is intended to support a multiple-use scenario, whereby a balance is struck between human use and biological values, preserving the essential ecological integrity of the Sea while simultaneously supporting various economic, recreational, agricultural, commercial, residential and other uses.

Ecosystem management is inherently geographic, and better information and tools for accessing and using the information can support more effective management decision making. This is especially important in efforts like the Salton Sea restoration project where the range and complexity of topics are broad and complex, the interrelationships among them are numerous, and the opinions and values of the stakeholders are diverse. Geographic Information System (GIS) and related technologies provide powerful tools for data management and analysis. When properly structured, these tools can go far beyond simple inventory and mapping applications to provide an essential infrastructure of information that can be used throughout the ecosystem management lifecycle, from baseline reconnaissance and original data collection, through resource inventory and mapping, powerful analytical tools for resource assessment and modeling, engineering and management alternative development and evaluation, policy/regulatory framework development, plan implementation, and ongoing monitoring and adaptive management.

<u>Strategic Direction for SSDP System Refinement and Expansion</u>. To date, the SSDP has established an important "data clearinghouse" to support the coordinated collection and management of the baseline reconnaissance and other foundation information. The project is now moving from the information collection stage towards advanced resource assessment, and evaluation of various engineering and management alternatives. To support these new analytical requirements and to leverage the current investment in base information, it is now necessary to take steps to evolve the SSDP towards a more analytical, decision support emphasis.

The Salton Sea Ecosystem Management Decision Support System (DSS) is intended to provide an essential "infrastructure" of data management and analysis tools to support multi-disciplinary and coordinated decision-making across all the professional and scientific teams and stakeholders involved in the project. It must also provide tools for communicating issues and alternatives in informative, graphic, compelling and understandable forms that can be readily grasped by a non-technical audience consisting of public representatives and policy makers, community decision-makers, government and non-government organizations, commercial interests, private land owners, and the general public. This infrastructure will be built on the existing foundation of baseline information, and will be further evolved towards a "living" system structured to support resource modeling and assessment, conceptualization and evaluation of engineering and management alternatives, and the ongoing monitoring and adaptive management of the Salton Sea into the future. The system must be structured to respond directly to immediate project needs, as well as provide a well-considered foundation for future development and refinement.

The workplan described below is structured to identify present and future informational needs of the Salton Sea restoration project, and to translate these to a SSDP expansion strategic plan. This plan will outline a design and implementation steps for the expansion and refinement of the existing data clearinghouse, user-oriented application software to streamline data access and query, analytical models for resource assessment and scenario evaluation, graphic production tools to streamline the development of maps, tabular reports and other products, and other project-support issues. It will also articulate the framework for a long-term plan that will leverage public investment in the SSDP as the foundation for a comprehensive decision support system that will yield benefits far into the future.

Task 1 - Compile Stakeholder List

The Salton Sea Restoration Project involves a wide range of stakeholders, with many interests, concerns, roles, areas of expertise, and project-related responsibilities. Selected stakeholders that are most involved will be selected for interviews to represent the overall informational needs of the project. It is expected that other stakeholders will be added to this list based on feedback during the first round of interviews, and during agency and public review of the early EIS/EIR findings.

An initial stakeholder list will be developed as the starting point for refining the present system, and determining an effective and strategic method for expanding and refining the system to meet user needs. The initial list will be restricted to those groups that are directly involved in carrying out the project outlined in the Salton Sea Reclamation Act of 1998. It is expected that the initial list will include approximately 35 functional groups, representing the various teams involved in different aspects of the project. The list may be expanded to include other stakeholders and potential user groups in the future.

Task 2 - Develop System Refinement Workplan.

This system refinement workplan is being prepared as a "road map" for carrying out a structured system planning and design process as the basis for expanding and refining the project support functions of the SSDP facility. There has already been significant development of the Salton Sea Database Program as a clearinghouse of information for the project. It is also recognized that the project has now progressed to the point where a

broader and more detailed assessment of database and analytical requirements is vital to the full utilization of the system and its capabilities.

The workplan presented in this document will be used as an initial structure for the system refinement process. This will be subject to further adaptation and refinement based on input from project teams, and the progress of the project.

Task 3 - Develop Schedule

Consideration of critical project timeline considerations and milestones will in large part dictate implementation priorities for some system components. Understanding how all the project team workplans fit together, and their interrelationships and dependencies will be critical to the design and implementation of the decision support system.

SSDP staff will review current workplans from all the project teams. This information will be used to gain an understanding of the overall flow of all the key project components and decision points that will need to be supported with data, analysis and informational product generation. This effort will be coordinated directly with the Salton Sea Authority and the EIS/EIR contractor (Tetra-Tech), and a final target schedule will be developed for all the remaining tasks outlined in this workplan.

The project has progressed to the point where many teams are working in parallel, and ideas concerning resource management issues, data compilation, analysis, and evaluation of engineering and management alternatives are becoming more detailed and specific. Understanding current user needs will be critical to the expansion and refinement of the decision support system. Carrying out the user needs interviews is critical to gaining this understanding and will be dependent on the availability of staff from the various teams. SSDP will work directly with lead agency managers to determine a detailed schedule for staff interviews, as described in the "context interviews" part of the Task 5 - User Needs Interviews task described later.

Task 4 - Tiger Team Presentation

The full potential of the Salton Sea Ecosystem Management Decision Support System can only be realized if all the team members are fully aware of its capabilities. The "Clearinghouse" concept under which the initial system has been developed is one key facet of this full potential. The project has now progressed to the point where additional facets can be explored, to ensure that the system evolves towards the full lifecycle decision support "infrastructure" that will be needed to most effectively support the current project, and the ongoing monitoring and adaptive management that will follow.

The first opportunity to begin exploring this expanded concept with groups of team member is the upcoming "Tiger Team" meetings to be held in Redlands beginning January 5, 1999. The purpose of the meeting is to lay out a framework for the ongoing monitoring effort, and many of the major project Science Subcommittee members will be present at this meeting. A presentation will be prepared by SSDP staff to describe the

expanded ecosystem management decision support system concept, and the steps to be taken to achieve it.

Task 5 - User Needs Interviews

A series of interviews will be held with key participants in the Salton Sea project to further refine understandings regarding their need for spatial data and analytical products. A certain level of these needs was identified and compiled during the early stages of the project. Since that time there has been a great deal more dialog and refinement of the basic concepts and workplan. The interview process presented here is designed to provide the SSDP with new information that is needed to acknowledge those refinements in the strategic planning, design, implementation, and expansion of the evolving GIS-based information management and decision support system.

Interviews will focus on clarifying needs in the context of each participant's role, responsibilities, and specific tasks to be carried out within the overall effort. They will also address the need for information sharing among participant teams, and the support of multi-factor ecosystem modeling that will ultimately be needed to assess the implications of various engineering and management alternatives.

Three teams of two persons each from the SSDP will conduct the interview sessions. A minimum of approximately 35 interviews is expected to ensure that the full range of issues and needs of the project are adequately represented. Several of these will be "context" interviews to be conducted with the project's lead agency managers. Context interviews will be focused on understanding the general mission and responsibilities of each group of participants, and the functional interrelationships among groups. More specific and focused interviews will be carried out with representatives from all the operational teams involved in the project, as identified by lead agency management staff.

5.1 Context Interviews.

High level interviews will be held with various executive and management staff who have coordination and oversight responsibilities for the project's major operational teams. These interviews will focus on refining understandings regarding the overall responsibilities of each major group, and management's perspective on information collection and analysis coordination among groups. High level context interviews are to be held with the following, at a minimum:

- Salton Sea Authority (SSA);
- Bureau of Reclamation (BOR);
- Salton Sea Science Subcommittee (SSSS);
- Research Management Committee
- Tetra-Tech.

Context interviews will address, at a minimum, the following major topics:

- · Confirmation of agency and team mission;
- · Current team configuration and responsibilities;
- · General workplan and critical path scheduling and timing issues;
- · Coordination methods and protocols within the team;
- · Coordination methods and protocols with other participants;
- Major decision points and related informational requirements;
- Priorities and directives;
- Confirm concept and components of a comprehensive ecosystem management decision support system for the Salton Sea;
- Confirm groups and specific staff to participate in detailed interviews.

Information from the context interviews will be used to develop a brief "White Paper" refining the concept and components of a comprehensive ecosystem management decision support system for the Salton Sea, and the process being undertaken for its implementation. It will also outline any outstanding technical, administrative, and logistical issues that will need to be addressed to ensure effective application of the system throughout the project lifecycle. A draft report will be provided to project managers for review and comment. This input will be used to prepare a final document that will be distributed to appropriate team leaders and staff who have been identified to participate in the interview process.

A final interview roster will also be developed during this step. Groups and individuals identified to participate in the detailed interviews will then be contacted to determine their availability, and a final interview schedule will be developed.

5.2 Conduct Detailed Interviews

Detailed interviews will be held with key representatives from each functional group to refine understandings about their data needs and analytical requirements. It is anticipated that this will require approximately 30 interviews, each requiring approximately 2-3 hours to accomplish. A structured interview technique will be used to effectively gather the required information, while allowing for sufficient interaction and idea-sharing with the participants.

Prior to the interview session, each participant will be provided with the White Paper mentioned previously, and an outline of what is expected from them during the interview sessions. Needs assessment interviews will be generally focused around the following structured line of inquiry:

- Specific roles and responsibilities;
- · Existing or planned work processes;
- Data used and generated;
- Data collection guidelines and standards;
- Data manipulation requirements (input, management, query, and analysis);

- Informational product requirements;
- · Computing infrastructure currently in use or planned;
- Human resource capability, including staff experience with general computing and GIS;
- Special concerns and issues.

Other topics and issues may be explored based on the specific situation of each group being interviewed. Interviews will be held in a structured, but informal format for maximum interaction and information sharing. Participants should be prepared to address the listed issues and to provide any current or updated documentation regarding their activities that may not already be in the possession of the SSDP. They should also be prepared to provide samples of data being generated or used, and to discuss data compilation techniques, classification schemes, analytical models and other issues that could affect how data and analytical tools are addressed in the final system.

Information collected during the interviews will be compiled initially to a draft "Needs Assessment Report". This will be provided to participants for review and comment. Specific input will be incorporated to a final version of the report, to be used later in the refinement of the system design and implementation plan.

Task 6 - Data Inventory and Evaluation

New potential data sources uncovered during the user interviews will be added to the existing inventory and evaluated in this task. While the evaluation will consider the full range of existing and potential data sources to support all the applications identified in the user interviews, detailed assessment will be focused on those key, high priority data sources most needed to support time-critical analysis, such as the EIS/EIR preparation process.

This part of the work will focus on developing a comprehensive inventory of the "fundamental" geographic data to be considered in the conceptual design of the Salton Sea Ecosystem Management Decision Support GIS. Existing and planned systems for the management and manipulation of these data will be inventoried. The inventory of the geographic data will include map and tabular (Attribute) data as well as other forms and formats of data including drawings, text, photographs, micrographics and others. Data sample information sheets will be prepared for each data sample obtained during the interviews. Emphasis will be placed on characteristics of the data, and how they are to be used in support of resource assessment and decision making. Information from the data collection effort will be added to the metadata database presently being compiled by SSDP staff.

The GIS team will evaluate each data sample provided to determine the additional characteristics that may affect data capture, management and use. Among the factors to be considered during the evaluation of the data will be: breadth of data need, format (manual or automated) source, potential redundancy, and methods and systems for

collecting and/or maintaining the data. Map data will also be evaluated for scale and accuracy (absolute and relative), input options, and user output requirements. The evaluation will also consider spatial relationships among datasets, and potential for integration of coincident features, reconciliation of data classification schemes, and other data compatibility issues.

The evaluation discussed above will address the technical GIS issues associated with each potential source. Other evaluations by the Tetra-Tech resource specialists and/or Science Subcommittee members may be needed to determine the appropriateness of these sources to meet the short and long-term requirements of the project. SSDP will provide Tetra-Tech and the Science Subcommittee with the full metadata database to surface potential sources in both digital and manual form, and will work with those groups to determine which are most appropriate for use in the project, and which are of highest priority.

The product of this task will be an expanded metadata database, and a Data Evaluation Technical Memorandum discussing the findings of the assessment. This Memorandum will cover both GIS technical aspects of each source and any evaluation feedback from the Science Subcommittee and Tetra-Tech, as appropriate.

Task 7 – Requirements Analysis, Conceptual System Design and Implementation Plan

The information collected in the previous two tasks will be further analyzed and used to identify the GIS data and applications that will be needed to support the Salton Sea Ecosystem Management DSS. This information will be used to develop a "framework" design for the system that will outline the basic structure and interrelationships between the data topics to be maintained on the system, applications to be supported, computing infrastructure, and any staff orientation and training needed.

Application Software Framework. An application framework will be outlined to articulate the functional application software modules and spatial analysis and statistical models that will be needed to support the activities of the Salton Sea restoration project teams. These will be mostly organized around the existing work programs of the teams, as well as opportunities for streamlining existing operations using capabilities of the system. Application software and/or analytical model descriptions will include, at a minimum, the following:

- Application software objective:
- · Workflow or analysis process to be supported;
- Number of users and benefits to be accrued;
- Basic functional description;
- Data stores maintained or used by application or model (graphic and nongraphic input and output);
- Data layer implications and recommendations (data format and content requirements);

- Analytical algorithms to be developed or integrated;
- · Existing models to be emulated or integrated;
- Products to be generated;
- Computing infrastructure requirements and impacts (hardware and base software requirements, operating system implications, potential network traffic, and other issues);
- Implementation implications (potential for incremental implementation, dependency upon other functional modules, and other issues);
- Implementation costs (based on implementation options).

Data Framework. A conceptual design for the Salton Sea GIS database framework will be developed. This will summarize the content and form of the database, including the definition of graphic layers and non-graphic tabular data stores. The framework may be structured around several geographic scales of concern as needed to support the various project activities identified previously. Once completed, the data evaluation information will be used to formulate a conceptual design for a data framework to support the system.

Data framework descriptions will include, at a minimum, the following:

- Mapping scales of concern;
- Geographic framework for data integration, organization and management;
- Graphic layer description and purpose;
- Sources for initial data conversion;
- Integration of data capture with field reconnaissance activities;
- Implications for future data maintenance;
- Level of data resolution;
- Data form (line, point, polygon, raster, surface, etc.)
- · Basic data content and structure;
- Relationships and integration dependencies with other layers and tabular databases;
- Relate key relationships to tabular data stores;
- Data format technical specifications and guidelines;
- Implementation implications (potential for incremental implementation to respond to immediate needs and priorities, dependencies with other data stores and applications, and other issues).

<u>Computing Infrastructure</u>. Existing and planned computerized systems and related databases will be evaluated for their adequacy to support the Salton Sea restoration project. The evaluation will consider the capabilities and the limitations of these systems to respond to the needs of the potential users involved in the project, including the existing capacity of the SSDP, and any needs for direct data access and use by the user community. A conceptual design for the full system functionality needed to support the project will be developed. Priorities and timing for specific components will be identified where these are needed to address time-critical project milestones.

The SSDP has already implemented significant computing and other technological infrastructure to support the project. It is expected that this infrastructure will require some updating and extension to provide a broader range of capabilities and information resources as the project requirements become more detailed and specific. A computing infrastructure framework will be developed addressing the following issues, at a minimum:

- · Existing and proposed hardware, software, data communications;
- · Computer Aided Design and Drafting (CADD) systems;
- Geographic Positioning Satellite (GPS) technology;
- Photogrammetry;
- Remote sensing;
- Orthophotography;
- Environmental monitoring stations;
- · Data sampling and compilation technologies;
- Data communication networks and access considerations;
- Field communications, and others.

<u>Organizational Framework</u>. Free flow of information across many organizations will require the development of agreements, methods and protocols for data access and sharing. An organizational framework will be built around the foundation of agreements already established or under development by the SSDP. At a minimum, the organizational framework will address:

- · Data acquisition, access and dissemination arrangements;
- Identify database maintenance responsibilities;
- Metadata input and maintenance responsibilities:
- · Request for information policy and protocols;
- Intra-team staff support policy and agreements.

<u>Project Staff Skill Development</u>. Optimum development and use of the Salton Sea database requires that project staff are familiar with the technology and breadth of data management, access and analytical capabilities. Also, SSDP staff are able to provide technical support to the user community, but users may desire direct access to the databases and analytical tools. Based on the earlier interviews and subsequent assessment, the SSDP team will identify specific orientation and training needs that might help other project teams to use the system more effectively. This will likely range from orientation seminars to explain the technology and its potential, to application software user training to allow users to access the system and data directly. This may also include the development of on-line tutorials, application "wizards", and special-function application software to help project teams use the system to its fullest potential.

Implementation Strategy. Once the conceptual design of the Salton Sea decision support system has been formulated, the SSDP team will prepare a general strategy for the

expansion and refinement of the existing system. This will be based on priorities as identified in earlier tasks, and functional considerations among the system components.

Technology and project requirements will continue to evolve. It is therefore important that the implementation strategy be flexible to accommodate future refinement and adaptation.

The Implementation Plan prepared as part of the conceptual system design will describe basic activities to be carried out in phases over some period of time, and will identify functional, technical, and administrative dependencies among components. Two levels of implementation planning will be addressed. The first phase of system development will be a "pilot" based on the needs of the EIS/EIR effort. The pilot effort will address the immediate needs of the EIS/EIR effort, including establishing basic data requirements, resource assessment and analytical products, scenario analysis support, and other related applications. A more general implementation framework for the overall system will also be explored as context for the pilot implementation, and as reference for the incremental expansion of the system over the lifetime of the current project, and beyond to support ongoing monitoring and adaptive management in the future. Both plans will be structured flexibly to accommodate ongoing expansion and refinement of the system over time.

The conceptual system design and implementation strategy information will be compiled to a Conceptual System Design and Implementation Plan report. Sections of the report will address, at a minimum, the following:

- · Conceptual database design ;
- Hardware system design;
- · Define priority application software and spatial modeling requirements;
- Organizational evolution;
- Staff training program;
- Pilot program and other high priority activities to be accommodated in the near term;
- · Budget planning and allocation;
- · General implementation tasks and schedule.

Task 8 - Pilot Design

The EIS/EIR under development by Tetra-Tech is one of the early, time-critical activities that will require extensive use and analysis of the Salton Sea database. Under NEPA/CEQA guidelines, it will cover a broad range of environmental and cultural issues, and evaluation of selected restoration engineering and management alternatives. This activity can be used to further test and refine the system and database design concepts developed previously. This will also help the EIS/EIR contractor to carry out the task more efficiently, and with full access to the project's best informational resources. This will be critical to carrying out the study in a timely manner and to the integrity and defensibility of the EIS/EIR analysis and findings.

The pilot design to be prepared in this task will draw upon ideas presented in the conceptual system design, and the EIS/EIR user requirements identified earlier. The SSDP team will work closely with SSA and Tetra-Tech to further develop ideas about how the system can be used most effectively to support this effort. Topics that the pilot design will likely address include:

- · Access to baseline environmental information;
- Identification of additional data collection needs, and strategies for their compilation and integration to the comprehensive digital database;
- · Data analysis and modeling requirements;
- Online data access and query tools;
- Scenario analysis tools;
- Informational product needs, including in-house decision support products, report exhibits, graphics to support public presentation and briefings for decision makers and other uses.

The pilot design will be documented to a technical memorandum, in direct collaboration with SSA and Tetra-Tech staff, including priorities and specific tasking for implementation. The pilot design process will likely be "fast-tracked" before the full system design and implementation plan are completed to provide early support to the initial EIS/EIR effort.

Task 9 - Pilot Implementation

This task will involve the implementation of the pilot design components developed in the previous task, according to the implementation priorities and schedule. This will likely include several basic "tracks", including:

<u>Database compilation</u>. Ensure that the data from the reconnaissance teams and any other relevant baseline and other information needed for the environmental assessment and evaluation of alternatives are available on the system.

<u>Resource assessment modeling</u>. Some analysis will require the development of topicspecific resources assessment models. The SSDP staff will work closely with resource scientists to ensure that pilot data are structured to meet modeling needs. They will also investigate implementation of requisite models using the GIS software directly, or method for exporting data to support analysis within existing external models and importing of analysis results back to the decision support database to support common effort of other project teams.

<u>Staff orientation and training</u>. Staff involved in the EIS/EIR process will need to be aware of the full capabilities of the Salton Sea database if they are to take maximum advantage of what it has to offer. This may require some combination of orientation and training seminars to develop this awareness, and the skills to use appropriate parts of the

system. User interviews will have revealed the extent of existing staff familiarity and skills with GIS software. This information will be used to structure an appropriate user development approach for the pilot system.

<u>Data access and analysis infrastructure</u>. The SSDP staff will be available to support some of the data manipulation requirements of the EIS/EIR project. It is likely that Tetra-Tech and SSA staff will also desire direct access to the database for their own dayto-day uses. Potential mechanisms for supplying this access will be discussed, including web-based access, data and application publishing to CD, dial-up access, and others.

The findings of the pilot program will be documented to a Technical Memorandum. This information may be used to further refine the strategic plan for the SSDP, and both short and long term implementation workplans.

Task 10 - Full Implementation

The long-term implementation plan developed in Task 7 – Requirements Analysis, Conceptual System Design and Implementation Plan will be used as a general roadmap for further expansion and refinement of the Salton Sea Ecosystem Management DSS over time. The project needs for informational and analytical resources will likely continue to expand. Also, technology is changing at a rapid pace, and new tools and opportunities will become available over the lifetime of the project. The SSDP will continue working closely with all the project participants to accommodate system needs and technological opportunities on behalf of all the team members. It is expected that the system will continue to evolve with the needs of the project, thus establishing the foundation for a comprehensive information system to support the restoration and sustaining the long term environmental health of the Salton Sea through ongoing monitoring and adaptive management.