

REVISED DRAFT

**Implementation Plan
for the
Salton Sea Database Program
and GIS**

**A Preliminary Implementation Plan for the
Bi-national, Bioregional Decision Support Initiative
for the Salton Sea**

RE: Grant Application R825793010

Submitted by

Doug Mende and Tim Krantz

on behalf of the

University of Redlands

October 23, 1997

1. PROGRAM REQUIREMENTS

1.1 Background

The Salton Sea is California's largest lake, comprising 378 square miles within an 8,000 square mile watershed, encompassing the Coachella Valley to the north and including Mexicali and the U.S.—Mexico border to the south. It sits in a closed basin with no outlets. Annual inflow is about 1.3 million acre-feet, with an annual salt load of approximately 4 million tons. The Salton Sea is a major site for migratory birds on the Pacific Flyway and supports a highly productive fishery, as well as habitat for several endangered species. It is the repository for agricultural drainage, municipal wastewater discharges, and floodwaters. The agricultural industry, primarily at the south end of the sea, produces an annual GNP of over \$1 billion.

The Salton Sea is an ecosystem in collapse. The salinity of 44 parts per thousand is 25% higher than ocean water. The sportfish population has experienced massive die-offs, most recently over one million fish during the first weeks of September, 1997. Waterfowl have also experienced periodic die-offs, including a massive episode in 1996 involving more than 20,000 pelicans and other birds. The loss of the fishery is threatening the viability of the sea to support other wildlife. The fish kills and poor water quality have resulted in human health alerts being issued for the area. At a recent Congressional field hearing held in Indio on October 3, the Salton Sea Authority presented evidence that the Sea may have only 15 remaining years of ecological productivity, given current rates of increasing salinity.

The Salton Sea Ecosystem Initiative (SSEI), a consortium of Federal, State and local government agencies, together with private and public stakeholders, has developed the following goals for a prioritized tactical approach to natural and cultural resources investigation needs. These goals were set at the Salton Sea Workshop in Palm Springs, California in August, 1997.

1. Develop an understanding of the Salton Sea Ecosystem.
2. Develop an understanding of the factors driving massive fish and waterfowl die-offs in the Salton Sea and environs, devise methods for interrupting this mortality, and determine the potential risks to human health.
3. Develop methodology for managing the Salton Sea ecosystem for sustainability of cultural and biological resources, while maintaining viable agricultural resources and the economy of the area.

To participate in the SSEI and receive funding from the Environmental Protection Agency (EPA), the University of Redlands proposes to establish and maintain a clearinghouse of environmental resource data for the Salton Sea ecosystem in support of these three goals. In doing so, the University of Redlands accepts the responsibility to cooperate with Federal, State and local government agencies, universities, and private organizations and individuals in maintaining the data clearinghouse.

The University of Redlands realizes the size and scope of this study. The interagency research needs assessment calls for \$36,097,600 to implement the 31 proposals generated at the Salton Sea Workshop. As we contemplate making even a portion of this investment, a comprehensive database program is required to capture, organize,

and distribute information in a common format. Because of the spatial nature of the data to be collected and the required ability to analyze the data thoroughly, a Geographic Information System (GIS) is necessary to provide the framework for the database program.

The University of Redlands also realizes that compliance with environmental law on the state and federal level involve the ability to access information in a thorough and timely manner. The National Environmental Policy Act (NEPA), requires the categorical assessment of environmental resources, the evaluation of impacts a proposed action may have on those resources, and identification of mitigation measures necessary to reduce or limit those impacts. A similar obligation exists for state and local agencies under the California Environmental Quality Act (CEQA) prior to permitting projects. By making inventories of existing environmental data accessible to the agencies, stakeholders, and the general public in GIS format, the Salton Sea Database Program (SSDP) will save considerable time and money in the environmental review of proposed engineering solutions to the Salton Sea problems, with an increased level of certainty (QA/QC) of data analysis and reliability and, consequently, greater service to the public.

To accomplish this, the University of Redlands has established the Center for Environmental Management and Policy (CEMP) to assist with the planning and management efforts regarding Salton Sea environmental resources. The CEMP would support the proposed data clearinghouse. Currently, GIS capability exists at the University of Redlands in a training lab equipped for small GIS projects. These GIS facilities have been used to facilitate the successful resolution of several other Southern California environmental resource issues. Particularly, the University of Redlands coordinated the development of a Carbonate Resources Management Plan GIS for the San Bernardino National Forest, receiving commendations from Vice President Gore for resolving this otherwise contentious issue between the mining industry and Federally-endangered plant species.

1.2 Objectives

The University of Redlands proposes to establish the SSDP to integrate information covering the physical, natural, and cultural resources data pertaining to the Salton Sea in a common GIS environment, thereby supporting both agency and interagency decision-making and planning efforts. In order to facilitate evaluation of the proposed engineering alternatives (*Salton Sea Alternative Evaluation*, September 1997, prepared by the Salton Sea Authority, California State Department of Water Resources, and Bureau of Reclamation) and coordinate the proposed research projects (*Saving the Salton Sea—a Research Needs Assessment*, October 1997, prepared by the U.S. Fish and Wildlife Service), a strong GIS program is required in order to coordinate, standardize, integrate, and analyze a wide range of data for each prospective project.

The SSDP offers the unique opportunity of developing a GIS database for the management of environmental resources in the Salton Sea basin and the California—Mexico Sonora Desert region. The University of Redlands, by increasing its presence and investment in GIS, will provide a data clearinghouse for researchers, resulting in better resource management within the Salton Sea basin, provide GIS training for researchers and students, and provide better information to the public.

The goal of the University of Redlands is to establish the capability to integrate physical, natural, and cultural resources information with other data in support of agency and interagency planning and decision-making efforts. To achieve this goal the University of Redlands will establish the SSDP as the data “clearinghouse.” The

primary users of this system will be the Salton Sea Authority and other stakeholders, researchers, students, and project staff. Based on this goal, the supporting objectives have been identified for the CEMP.

- < Identify existing data and data gaps for information pertinent to evaluation of engineering alternatives and resource management objectives for the Salton Sea
- < Establish and maintain an internet home page displaying information about the SSEI and the SSDP.
- < Establish the capability to capture, maintain, and update spatial data resources in a standardized, watershed-scale database with GIS format.
- < Design and develop databases and database products for stakeholders, researchers, and students.
- < Provide the capability to store and manage the estimated 18 GB of data
- < Establish the SSDP and provide for transfers of data to and from the SSDP using standard communication networks.
- < Provide on-going training for students, researchers, and stakeholders with regard to GIS data and the use of the SSDP for land use planning and resource management.

1.3 Functional Requirements

The functional requirements for the SSDP comprise four major elements: data requirements, system requirements, user requirements, and procedural requirements.

1.3.1 Data Requirements

Data Sources

The data will be based on the primary data sources, plus the data from the Salton Sea research effort. These primary data sources include:

- < USGS
- < Teale Data Center (farmland mapping, land ownership, soils)
- < California Natural Diversity Database (CNDDDB)
- < California Historical Resources Information System (CHRIS)
- < Local Water Districts (IID, CWD)
- < USFWS
- < EPA
- < BR, et al.

Data Products

The data will contain the following potential GIS Layers with associated attribute information.

- < Satellite Images
 - § LANDSAT, GOES, SPOT, Topex, et al.

- < Geology
 - § Lithology
 - § Pedology
 - § Hydrogeology (groundwater basins)
 - § Well log data
 - § Sedimentation
 - § Geothermal resources
 - § Geologic hazards
- < Atmosphere
 - § Climate data (temperature, precipitation, meteorology)
 - § Aeolian sediments
 - § Aeolian salts deposition
- < Hydrology
 - § Limnological characterization (inflows, evaporation)
 - § Water circulation models
 - § Salinity models
 - § Contaminant loading
 - § Water quality monitoring
 - § Toxicity of salt precipitates
 - § Selenium
 - § Associated wetlands (riparian, canal and agricultural)
- < Biological resources
 - § Vegetation
 - § Benthos
 - § Plankton
 - § Fish ecology
 - § Bird ecology
 - § Other vertebrates
 - § Special status species
- < Biological morbidity/mortality data
 - § Fish mortality data
 - § Avian mortality data
 - § Avian botulism
 - § Algal biotoxins
 - § Newcastle Disease
 - § Vibrio
 - § Hunting
- < Land use
 - § Land use plan designations, zoning
 - § Recreation
 - § Roads and infrastructure
- < USGS quads
- < Control survey points

- < Wetlands resource management
 - § Salton Sea NWR management zones
 - § Treatment marsh site suitability analysis (for influent streams)
 - § Wetlands restoration and enhancement potential
- < Historical and cultural resources
 - § Field inventory
 - § Archaeological resources
 - § Holocene reconstruction
 - § Prehistoric human ecology
 - § Native American consultation

Data Access

The data must be shared with approximately 30 Federal and non-Federal agencies.

Data Maintenance

The collection and update of the data must be provided by the University of Redlands under the procedures established by the Technical Advisory Committee.

Metadata

A process of metadata analysis will establish a statement of quality and describe the characteristics and methods used to create each data set. Because existing data have been created using many different formats, quality assurance is necessary for the development of the metadata. Each data set requires a standard approach to qualitative metadata evaluation.

1.3.2 System Requirements

Functional Objectives

The system must provide the capability to meet the data requirements while providing for data input, output, storage, and processing. The system must function as a typical enterprise data server on a TCP/IP network.

Input of Data

The system must be able to capture the data referenced in Section 1.3.1. The system must permit the input of data from stakeholders and researchers.

- < Data layer creation at 40 hours per week
- < Data integration at 40 hours per week
- < Data update requests at 20 per week

The system must provide input on the following data types:

- < GIS data layer and attribute data
- < Textual data
- < Document image data

For input of data, the system will use the internet/FTP as its primary method for data transfer. It is anticipated that a majority of users will require a minimum transfer rate of 28KB/sec and 24-hour access.

Output of Data

The system must be capable of providing electronic data in an organized format to approximately:

- < 100 general users
- < 10 local agency users
- < 10 State users
- < 15 Federal users

The system must be capable of providing text-based information and data downloading at 1000 requests per week.

The system must be capable of providing an on-line data dictionary based on Federal Geographic Data Committee (FGDC) Standards.

Storage of Data

The system must be capable of storing the data referenced in Section 1.3.1, approximately 18 GB of machine-readable files.

Security

The system must be capable of providing industry standard security provisions. System security must take into account the sensitivity of certain data resources.

1.3.3 User Requirements

There are approximately 135 users in the service area. They consist almost entirely of:

- < Federal, State and local government agencies
- < Water management and irrigation service districts
- < Professionals, faculty, or students conducting research

Both the users and staff require the appropriate expertise of the data and the system.

1.3.4 Procedural Requirements

This system must comply with the Federal Geographic Data Committee (FGDC) standards and will conform to any specific EPA data standards. The GIS system will conform to CERES standards for similar compatibility with state agencies and other interstate/international coordination efforts.

The SSDP shall review all data sets for completeness, resolution and overall quality. QA/QC protocols will be developed for evaluation of all data sets.

The SSDP shall meet regularly with the stakeholders and the Technical Advisory Committee to review and develop data collection and sharing protocols.

2. SSDP DESIGN

2.1 Salton Sea Database Program Specifications

Status

The current situation is inadequate for supporting sound resource management and alternative evaluations in the Salton Sea. There is a complete lack of organized databases and database services for the region. Specifically, the existing data are improperly coded and presented for GIS system consideration. This situation is not uncommon in the kinds of data requests and services historically provided for EIS, EIR and related inquiries. Today's environmental regulation and monitoring requires a more sophisticated approach. Developers and potential land users must provide multi-level integrated environmental presentations that must utilize advanced techniques involving GIS analysis. The evaluation of these physical and cultural resources requires a GIS, as they are spatial in nature and usually interact with other location-specific spatial elements.

The SSDP would adequately support the resource management needs and meet federal data requirements by allowing the stakeholders and users to share the responsibility of data management. The stakeholders and users would provide data in directed and standardized format to the SSDP. The SSDP would provide data screening for data format and integration into the SSDP, with the ability to assist with technical and GIS issues.

System Layout

A data server and two GIS workstations with digitizers, two NT workstations with peripherals, a scanner, and a plotter will be needed to manage data entry and distribution to the stakeholders and users. Existing telecommunication lines will be used for data distribution.

Procurement

The University of Redlands intends to purchase a system in FY 1997-1998 that will include appropriate hardware and software for the client/server network.

Technical Approach

A typical data recordation will be carried out by the stakeholders and the users in the following manner:

- < the mapped or digitally-recorded locational shape information will be received by the SSDP
- < the attribute record data file will be received by the SSDP
- < the attribute record data file will be checked for completeness
- < the attribute record file will be checked for consistency with mapped locations
- < the map would be digitized or the digital locations would be converted into a GIS coverage

- < the GIS coverage will be checked for accuracy (QA/QC)
- < The GIS coverage and the attribute data will be integrated into the database design (data dictionary)
- < the information will be uploaded onto the SSDP server

By this means, the SSDP will also support data recovery through the browse, display, and download of data from the server.

The database format will be converted into a Relational Database Management System (RDBMS) and loaded onto the SSDP server.

Server

A departmental server will be established that will be dedicated to the SSDP. The server will be scalable to enterprise-level, capable of managing 18 GB of data, such as an HP Netserver LX Pro with NT Server 4.0 or better.

GIS Workstations

Two (2) GIS workstations will be acquired, with Arc/Info NT 7.1 software and digitizer configuration, such as:

- < HP Vectra XU Pentium Pro 200
- < HP4c Scanner
- < HP Laserjet 5n Printer
- < Calcomp Drawing Board III Digitizing Tablet
- < HP 755cm Plotter

Workstations

Two (2) 64 MB Pentium PCs, such as Gateway E-series (E3100-1233) with HP4c Scanners will be located at the individual information centers and the OHP.

Operating System

Microsoft Windows NT Server platform technology will be used. The NT Server is advantageous for three reasons: it is less expensive to operate, provide software, and administer than alternative systems; is compatible with most existing client platforms; and it is compatible with common user software applications.

Network

TCP/IP will be used throughout the system. FTP will be installed for file transfer. An internet server will also be installed to handle the public access web page through one of the workstations for security purposes.

Document Image Management

Document imaging provides a bridge from the current paper-based system to a proposed system. Document imaging is the process of raster-digitizing paper and film documents, in a manner similar to a high-resolution fax machine, for electronic storage and transmission.

GIS Data Management

The GIS platform objective will be able to use ESRI GIS software whenever possible. ESRI GIS products have been recommended by the SSDP to provide spatial information functionality. There is also a degree of commonality within the region over the use of Arc/Info and other ESRI products (used by USGS, the SSA, and Riverside County governments). Arc/Info will be the editing platform used to manage all GIS layers.

The ARC/INFO Version 7.1 Intel NT and DEC Alpha NT release, with few exceptions, provides the same functions and capabilities provided for UNIX platforms.

ARC/INFO for NT includes:

- < The native Windows look and feel
- < Performance comparable to UNIX platforms
- < Full support for ARC Macro Language (AML) applications
- < The same data file formats as workstation ARC/INFO
- < Transparent data sharing between UNIX and NT
- < Key Windows-specific features including Windows Help

The GIS format for storing data will be based on the shapefile (.shp) and the coverage. ESRI has established the shapefile as the most open form of data storage.

Data Capture

The University of Redlands intends to digitize and integrate all data resources identified in section 1.3.1 for the study area. This data will be incorporated onto the SSDP server.

Standard data creation products will be evaluated for their use in the data collection and update method. Data, produced in the field or at remote sites will be uploaded to the SSDP server using a minimum transfer rate of 28KB/sec.

The following software modules will be used to create and update remote data records:

- < Microsoft Excel
- < Microsoft Access
- < Other SSDP approved software

Confidentiality and Privacy

Confidentiality and privacy, required for certain data sets, will be maintained by keeping on-line confidential and private documents password-protected and encrypted so that violation will not occur. Security requirements are built into the system so that data confidentiality is not compromised. The University of Redlands will provide campus security and policing for theft prevention and system security for the Salton Sea Database Program office operation.

3. MANAGEMENT PLAN

3.1 Project Responsibilities

3.1.1 Program Management

The Center for Environmental Management and Policy provides general administrative overview of GIS and database projects. The CEMP is established under the Environmental Studies Program at the University of. The SSDP will be administered through the Center.

Duties and responsibilities of the University of Redlands include the formulation of the implementation schedule, resource allocation, equipment approval, and acceptance criteria. General accounting and other administrative functions will also be provided.

3.1.2 Project Management

The Project Manager (PM) will supervise the construction and ongoing operation of the SSDP. The PM will facilitate communication between external EPA reviewers, political and regulatory agency representatives, and internal University and program administration to ensure that the SSDP meets the needs of stakeholders, regulators, and the concerned public.

The PM will coordinate the construction of the SSDP with other users and data-generating agencies to reduce duplication of efforts and will ensure complete data coverage to the fullest extent that it is available. The PM will coordinate the SSDP with ongoing research efforts, as proposed by the Salton Sea Ecosystem Initiative research needs assessment (FWS, October 1997).

The PM will convene the Technical Advisory Committee, and schedule and chair regular meetings of the TAC to review SSDP design and operational procedures. The PM will supervise the production and dissemination of regular progress reports and program updates; and respond to general inquiries from the press and other constituents.

3.1.3 Technical Management

The GIS Technical Manager will be responsible for the preparation of an operational-level implementation plan, development of system specifications, accomplishment of the implementation schedule, acceptance of equipment and software, review and acceptance of the data products and . Management of the SSDP facilities will be the joint responsibility of the Project Manager and GIS Technical Manager.

3.2 Project Management Schedule

3.2.1 Schedule

Task	Start Date	End Date
Submit Implementation Plan	11/1997	
IP Approval, Award	11/1997	
Equipment Purchases	11/1997	
Site Preparation	11/1997	
Equipment Installed	12/1997	
Operation Begins	1/1998	
Install Internet Site	2/1998	
Data Inventory	1/1998	3/1998
Data Needs/Acquisition Plan	1/1998	4/1998
Stakeholders Workshop	2/1998	
Database Design	3/1998	10/1998
Data Collection	1/1998	10/2000
Design Data Models and Products	3/1998	10/2000

Project Management Structure

