The Salton Sea Restoration Project: Opportunities and Challenges

HISTORY

The Salton Basin, a below sea-level topographic depression extending from Palm Springs, California, on the north to the Gulf California on the south, has undergone historic cycles of filling with water and drying up. Lake Cahuilla, the most recent predecessor to the Sea, last filled between 300 to 500 years ago and at one time had a surface elevation slightly above sea level.

In 1905, the flooding Colorado River was accidentally diverted into the Salton Trough, thus creating the current Salton Sea. When the Colorado River flood flows diminished in 1907, the surface elevation began to drop until 1930's when agricultural drainage inflows from the nearby developing Imperial and Coachella Valleys sustained the Sea level. This " Sea in the desert" soon developed into a major state recreation area, wildlife refuge, and sport fishery. To this day, irrigation drainage is the primary source of inflow.

People and wildlife adapted to this new body of water and took advantage of the opportunities it offered. The rich agriculture of the Imperial Valley would not be possible without the drainage repository of the Salton Sea. The Sea also attracted recreationists from the nearby metropolitan areas and became so popular that the Salton Sea State Recreation Area was developed along the northeast shoreline. With the high salinity content and introduction of marine fish species, the area also became a major sport fishery. The robust economy of the 1950's lured real estate speculators to the Sea in their efforts to market the area as a thriving resort. Even flocks of migratory birds began to take advantage of this critical link in the Pacific Flyway. The Salton Sea National Wildlife Refuge was established on the south end of the Sea to enhance its wildlife values.

However, as the Sea has aged, its attractiveness has waned. In the 1980's, high water levels encroached upon prime shoreline locations creating abandoned businesses, deteriorating structures, and vacant beaches. Because evaporation is the only outlet, salinity has increased to about 45,000 parts per million (ppm) - the Pacific Ocean is about 35,000 ppm. This has resulted in a treat to the continued viability of the sport fishery and associated recreational and economic activities. Publicity about the New River - - "the most polluted waterway in the nation" - - which flows from Mexico and terminates in the Sea, has also contributed to the decline of the area. At the international boundary, the New River's flow consists mainly of partially treated and raw sewage, agricultural drainage water, and powerplant effluent. It also contains detergents, pesticides, and other industrial, municipal, and agricultural chemicals. However, by the time the River reaches the Sea, the water quality is improved through natural cleansing that occurs in the intervening 50 miles.

PLANNING AND RESEARCH EFFORTS

Several efforts have and are being made to address these problems and "save the Sea." Since the mid-1960's, studies have been conducted to reduce the Sea's salinity and maintain its agricultural, environmental, and recreational values. One of the biggest obstacles to these efforts has been money. In 1986, the State of California created a task force that helped obtain Congressional authorization for a $10 million planning and research effort by the Bureau of Reclamation.

In June 1993, the Imperial Irrigation District, Coachella Valley Water District,

and Imperial and Riverside Counties formed the Salton Sea Authority. This group works with State and Federal government entities to develop plans to improve water quality, stabilize water elevation, and enhance recreational and economic development potential of the Sea. The Authority's efforts have been supported through public meetings with the Citizens Advisory Group, which offered local residents an opportunity to provide on Authority activities, including the development of potential remediation plans.

In August 1994, the Salton Sea Authority, Bureau of Reclamation, and California Department of Water Resources signed an agreement that provided the basis for a cooperative effort to evaluate problems at the Sea. Under the original agreement that provided the basis for a cooperative effort to evaluate problems at the Sea. Under the original agreement and subsequent amendments, several technical studies were completed including collecting localized weather data, modeling water currents, charting underwater topography, and evaluating potential methods of dike construction. In addition, a major effort was made to identify and compile potential solutions to the Sea's problems. A succeeding agreement has been signed between the Authority and Reclamation that provides for jointly comprising feasibility engineering and environmental compliance for a salinity and water surface evaluation management project. While reducing salinity is not an objectives, or end, in itself, it is an acknowledged urgency action that must be addressed by this restoration effort.

Congressmen representing the local area have also formed a Congressional Task Force to provide political guidance and Federal funding for the efforts.

Salton Sea Map

Salton Sea Facts:

Contains 7.3 million acre-feet of water and evaporates 1.3 maf each year
Water surface is 227 feet below sea level
Only 5 feet higher than the lowest spot in Death Valley

DESCRIPTION OF PROPOSALS

Over the past 25 years, many proposals have been suggested for managing

salinity of the Salton Sea. To ensure all possible solutions to the salinity and elevation problems were considered, proposals were gleaned from past studies, new ideas were developed by current study participants, and media announcements and public meetings invited submission of new alternatives from the public.

From these sources, the joint Authority/Reclamation study identified 54 alternatives representing a wide variety of solutions for controlling the Sea's salinity, thereby improving its physical, chemical, and biological conditions. These alternatives included options for pumping-out highly saline water (16), impoundment by a system of dikes (9), combinations of the impoundment and pump-out ideas (4), salt removal (5), water importation (2), and 18 various other proposed solutions. General details about these options are described here:

Pump-out Options

Several proposed alternatives involved pumping water out of the Sea to reduce salinity. These "pump-out" options propose that Sea to reduce salinity. These "pump-out" options propose that Sea water be pumped to a receiving body of water like the Gulf of California, Laguna Salada in Mexico, the Pacific Ocean, or some other water sink, such as a deep groundwater aquifer.

Salts would be exported through the outflow rather than remaining in the Sea and increasing in concentration as water evaporates from the surface. Since Sea water has a higher salt content than inflow from the Alamo River, New River, and other sources, the salt load in the Sea would decline over time, thereby reducing salinity concentrations.

However, through this alternative, the Sea's total water volume would be reduced, resulting in a short period of initially higher concentrations of salt and a declining water surface elevation. A reduction in water surface elevation would create greater distances between shoreline developments and the water. To mitigate these undesirable effects, some alternatives included two-way pumping - - pumping out to a receiving water body and pumping fresher water back into the Sea. While water in the Sea would become less saline until it reaches some equilibrium level, the receiving water body would become more concentrated. This would not be a problem for the ocean or Gulf of California, but it could be an issue for a dry lake or some other repository.

Dike Impoundment Options

Like the pump-out alternative, managing salinity with a diked impoundment is based on the concept of providing the Sea an artificial outlet. But in with this option, the main body of the Sea is separated from an evaporation

section by an earthen dike creating a "within-the-Sea evaporation pond."

In this concept, water flowing into the impoundment area carries a heavy salt load, while inflows to the main body of the Sea from the Alamo River, New River, and other sources carry a smaller salt load , thereby decreasing the salt concentration of the main body of the Sea. The impoundment would receive water from the main body of the Sea through gated inlets in a dike, concentrate it through evaporation, and store the removed solids from the Sea for an indefinite period of time. Eventually, the impoundment would become full and salt disposal would be necessary.

Unless inflows decrease in volume, an in-Sea impoundment would change the elevation of the Sea very little. Although the surface area of the main body of the Sea would be reduced, the total surface area of the Sea would be essentially unchanged.

Except for alternatives with dikes connecting specific portions of shoreline, impoundments could be placed anywhere within the Sea. Environmental considerations, construction costs, and public opinion would be the major factors in determining location, configuration, and size of those impoundments.

Combinations Options

A number of alternatives were proposed that would combine various techniques including dikes impoundments, pump-out, enhanced evaporation, solar power generation, or others. The combinations were developed in an effort to exploit unique advantages of each technique and obtain synergistic effects.

These alternatives combine several technologies to address the many varied, and sometimes conflicting, objectives being considered to save the Sea. Such conflicting objectives are demonstrated in the difficulty associated with simultaneous elevation control and salinity control. The balance between evaporation and inflow is presently the only factor controlling water surface elevation. Events that may lower the Sea's water surface elevation will result in increasing the Sea's salinity. Thus, management techniques to address individual problems often result in conflicting outcomes.

To resolve these conflicting alternatives, two or more techniques could be combined to take advantage of strengths and minimize weaknesses of each. For example, if a small area of the Sea were enclosed to provide some salt concentration, then the pump-out costs for salt removal from this enclosure would be reduced because less liquid would have to be pumped to remove the same amount of salt. The combination of diked impoundment and pump-out could enhance both management methods and address both elevation and

salinity.

Removal of Salt Inflows Options

A major issue facing the Sea is the increased salinity level in the water. If salts could be removed before they entered the Sea, these concerns and costs would be reduced. However, moving millions of tons of salt over mountain ranges or long distances would be expensive and disposal could have environmental and political consequences.

Alternatives were offered that focus on removing salts from tributaries to the Sea before they become a problem. These proposals, however, would only slow the Sea's increasing salinity. Therefore, additional features would have to be added to remove salt from the Sea itself.

Water Import Options

Some alternatives involve reducing salinity by dilution with imported water. With the scarcity of good quality water in the area, implementation may be difficult. One of the sources of proposed water supply - - the Colorado River - - has priority users that would supersede use of that source for Sea dilution. Additionally, importing water alone could cause some flooding around the Sea and these proposals would have to be combined with some other feature to accomplish targeted salinity reductions.

Other Options

A significant number of alternatives remain that do not fit in the categories discussed. These options range from research proposals designed to obtain additional information about the Sea to innovative or emerging technology that could reduce costs or add to the performance of previous proposals.

EVALUATION OF PROPOSALS

Recognizing that it would be prohibitive to complete detailed analyses the alternatives, criteria established by the Salton Sea Authority, Reclamation, the State of California, other interested parties were used in an evaluation and screening process. This selections process involved two steps. First, four elimination criteria - - target salinity and elevation levels, does not involve unproven technology, and operation and maintenance costs under $10 million per year - - were established and applied to all submitted alternatives.

Alternatives which did not meet one or more of the elimination criteria were considered poor candidates for further consideration. The remaining alternatives were then subjected to evaluation criteria that were established to further rank the alternatives.

THE RESULTS

Evaluations performed on all proposed alternatives indicate that creating an evaporation impoundment in the Sea is a promising method of salinity management. This alternative, along with other feasible alternatives will be fully considered in the formal National Environmental Policy Act and California Environmental Quality Act processes. Final selection of a preferred alternative will depend on a number of factors, including the type of features, location, size, and operational details. The effect of these factors will be evaluated in greater detail during the process to select and implement an alternative that will bring the greatest overall benefit to the area. In addition, biological, chemical, and pathogenic studies must be performed to provide assurance that correcting the salinity and elevation problems will not exacerbate wildlife mortality events and will maintain a safe environment for migratory and resident wildlife.

CURRENT ISSUES

In addition to the diked impoundment concept, there may be other proposals that warrant further serious consideration. For example, the concept of creating an outlet for the Sea by pumping water from the Sea to the Laguna

Salada - - a dry lake in Mexico - - may hold promise as a viable project that needs further evaluation. This proposal, the impacts of no action, and perhaps other solutions that are proposed in the future that may have merit must be addressed during the scoping phase of the environmental compliance process.

During a biological needs assessment workshop sponsored by the Fish and Wildlife Service in cooperation with Reclamation, California Department of Fish and Game, and U.S. Geological Survey, a number of research needs were identified. Estimates for completing those research needs totaled about $35 million. Since funding for such a large effort is not available and parties recognize that a less ambitious program may satisfy project environmental compliance requirements, there must be a cooperative effort among resource and regulatory agencies to negotiate an acceptable level of biological studies and research.

Salton Sea Facts:

Last formed between 1905 and 1907
Dimensions - 35 miles x 15 miles
Average depth - 29.9 feet
Deepest point - 51 feet

NEXT STEPS

Because detailed analyses required for project implementation are expensive to perform, such analyses should be completed for a limited number of alternatives. Consequently, an effort must be made to obtain consensus on a limited number of projects that will be the subject of further investigation.

All technical evaluations completed to date have been done at a preliminary or appraisal level. At this level of evaluation, existing data are used and gross assumptions are made, resulting in a wide range of potential costs and high levels of impact uncertainty. To reduce the risk of under-estimating project costs and providing more assurance of project impacts, additional design data will need to be collected, more detailed designs must be prepared, better cost estimates must be made, and considerable biological information will need to be obtained.

The Authority and Reclamation have entered into an agreement to complete the technical and compliance work necessary for project implementation. Additionally, project construction and operation funding possibilities must be

identified and pursued.

Salton Sea Facts:

The lake is know as the fastest boat racing lake in the nation because its salt content causes vessels to be more buoyant. And at 227 feet below sea level, its high atmospheric density (because of the low elevation) causes engines to perform much more powerfully than on other latest.

The State Recreation Area has 1400 campsites in 5 campgrounds, hundreds of day-use and picnic sites, trails, a Visitor Center, playground and boat ramp.

CEQA/NEPA ACTIVITIES

The Authority and Reclamation have officially begun the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) process on the Salton Sea Restoration Project. A Notice of Preparation (NOP) has been sent out soliciting participation from California State agencies and involved federal agencies. A Notice of Intent (NOI) has also been published in the Federal Register. The Authority and Reclamation will prepare a document to assess the impacts of alternative solutions for restoring the Salton Sea.

The purpose of the project is to identify a plan that improves the human environment and ecological conditions of the Sea. Based on past studies, various alternatives to control salinity in the Sea have been investigated. These alternatives include diked impoundments, pump-out, a combination of impoundment and pump-out alternatives, and salt removal from inflow to the Sea. Other options may surface during the scoping process.

Salton Sea Facts:

Four million birds are estimated to use the Sea each day in winter, more than any other resource in the nation.
More than 400 species of birds have been observed at the Sea -- almost half of the 900 species known to exist on the North American continent.

Opportunities to address other environmental issues facing the Sea, including issues related to wildlife resources, will be investigated and considered for implementation as we increase our understanding of the Sea's ecology.

A Research Management Committee has been established by the Secretary of the

Department of the Interior made up of high-level managers from Interior, the Authority, State of California, and the Torres Martinez Desert Cahuilla Indians. This Committee will make funding and other relevant decisions regarding the science efforts to be funded to support the CEQA/NEPA process. A Science Subcommittee has also been established to serve as an advisory committee to provide scientific evaluations and recommendations to the Committee. The Subcommittee functions as a coordinated body to determine information gaps, identify science/information needs, and provide the Committee with recommendations for funding priorities regarding the science activities.

The final EIR/EIS is expected to be completed by the end of December 1999.

CONCLUSION

The Authority and Reclamation, working with cooperating agencies and other interested entities, anticipate that current efforts will result in the selection of the most appropriate and acceptable project that has support of the environmental community; is accepted by local residents; has approval of local, State, and Federal agencies; and has a realistic potential for funding.

The Salton Sea and the benefits associated with it have developed from human induced changes and natural processes. Local, state, and federal entities are, and will continue to be, actively involved in efforts to deal with Salton Sea issues and preserve the values associated with the Sea. This intervention will not come cheaply in financial, social, institutional, or environmental terms, but the entities involved in these studies will continue to cooperatively work toward the common goal to save the Sea's environmental, economic, and recreational values.

[TOP OF PAGE | LCR HOME PAGE | FEEDBACK | LINKS | DISCLAIMER]

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