Chapter 8. Economic Analyses

Conceptual Overview

Federal standards for planning and economic evaluation of water resource projects are contained in the 1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, commonly referred to as the P&Gs. In terms of economic analysis, the P&Gs establish two accounts to facilitate the evaluation and display of the effects of alternative plans: national economic development (NED) and regional economic development (RED). As implied, the NED account shows effects on the entire national economy, while the RED account shows the regional (or local) income and employment effects. Most "multiplier" effects, which occur as dollars initially spent in the regional economy are successively re-spent, are considered to be transfers from other locations in the Nation and are not counted as NED benefits.

The P&Gs establish that the beneficial and adverse effects of all alternative plans should be measured incrementally against the most likely future condition without a plan – the No-Project Alternative. To the extent possible, the economic analysis quantified NED benefits and costs for a 72-year period of analysis, 2006–2077. This period of analysis was selected because the 75-year project period for the existing Salton Sea Ecosystem Restoration Program ends in 2077. In accordance with the P&Gs, quantifiable benefits and costs over this period of analysis were converted to 2006 present worth values using the fiscal year 2006 Federal discount rate of 5.125 percent. Any economic effects beyond the period of analysis have minimal value in present worth terms.

The present worth costs presented in this chapter differ from the implementation costs shown in Chapter 7. Present worth analysis requires the conversion of all cash flows to a common point in time—the present. As such, it requires consideration of the time value of money, and all future cash flows are discounted back to the present. Comparison of the equivalent worth of competing alternatives allows comparison of alternatives on the basis of economics. This type of analysis is normally prepared when conducting Reclamation feasibility studies, and the process is followed to the best degree possible in this study.

For the purposes of comparing cost of alternatives as designed and estimated by other agencies, such as the DWR and the SSA, care should be taken to determine what types of costs they are reporting. Most likely they are not performing present worth analyses and are presenting implementation costs as presented in **Table 7.1**.

National Economic Development (NED) Costs

From a national perspective, all costs potentially incurred for the Salton Sea restoration alternatives and the No-Project Alternative are relevant without respect to whether those costs are incurred by the Federal Government, the State of California, local governmental agencies, or private citizens. In this study, NED costs consist of initial implementation costs for construction and program development, plus recurring annual operation, maintenance, energy, replacement, and risk (OMER&R) costs, as described and displayed in Chapter 7.

All NED costs were adjusted for time of occurrence and converted to present worth values in year 2006 dollars, as shown in **Table 8.1**. For purposes of this analysis, it was assumed that project implementation costs would begin to be expended in year 2008 and would be expended in equal annual increments. It was further assumed that construction of restoration features for any of the alternatives would be completed in year 2024, and AQM construction costs would be incurred through 2040. Under this schedule, prorated OMER&R costs for AQM would begin in 2009, but OMER&R costs for restoration features would not begin until 2025, the first year after those features are complete.

The incremental NED costs of each alternative, over and above those of the No-Project Alternative, also are shown in **Table 8.1**. NED costs are only provided for embankment design concepts that have been determined to meet Reclamation's design criteria and guidelines as described in Chapter 3. NED costs in **Table 8.1** for the Concentric Lakes Alternative (Alternative No. 3A) represent costs for three concentric lakes as required under mean possible future inflow conditions.

The present worth project implementation costs are less than the project implementation costs displayed in **Table 7.1** to represent the fact that project costs would be expended over time, and, due to interest accumulation, the amount needed in 2006 would be less than if all costs were expended in that year. The present worth OMER&R costs in **Table 8.1** are more than the OMER&R costs in **Table 7.1** because **Table 7.**1 displays costs for only one year, and **Table 8.1** displays the present worth of the total amount for the 72-year period of analysis.

NED Benefits

The potential environmental improvements at the Salton Sea, as compared to the No-Project Alternative, represent the basis for NED benefits for each alternative. Although there are risks and uncertainties, each of the alternatives might prevent further environmental degradation in varying degrees. These risks and uncertainties involve future inflows, biology, and environmental viability issues as presented in Chapters 4, 5, and 6 of this report.

Table 8.1 NED costs of alternatives, present worth basis, expressed in 2006 millions of dollars using 5.125% discount rate

Alternative	Project Implementation Costs	OMER&R Costs	Total	Incremental to No-Project Alternative
Alternative No. 1A: Mid-Sea Dam with North Marine Lake Using Sand Dam Design with Stone Columns	5,500	1,900	7,400	5,400
Alternative No. 2A: Mid-Sea Barrier with South Marine Lake Using Sand Dam Design with Stone Columns	2,000	1,100	3,100	1,100
Alternative No. 3A: Concentric Lakes Using Sand Dam Design with Stone Columns [1]	8,600	1,000	9,600	7,600
Alternative No. 4: North-Sea Dam with Marine Lake Using Sand Dam Design with Stone Columns	6,600	1,400	8,000	6,000
Alternative No. 5: Habitat Enhancement Without Marine Lake	2,000	1,300	3,300	1,300
Alternative No. 6: No-Project	600	1,400	2,000	0

[1] Values shown are for three concentric lakes as required under mean possible future inflow conditions.

Economists typically distinguish between use values and nonuse values in addressing benefits to be gained from enhancement of environmental resources. Use values refer to the values derived by individuals who physically "use" the resource; in the case of Salton Sea, these are the recreation visitors who come to the Sea. Nonuse values relate to the values ascribed by other individuals who may never visit or otherwise "use" the resource. Some people may derive satisfaction, or value, from potential habitat improvements at the Salton Sea, both for their own sake and for future human generations. However, as explained later in this chapter, it was not possible to compute dollar estimates of nonuse value for the Salton Sea alternatives considered in this study.

Recreation Benefits

Although recreation visitation at the Salton Sea has diminished from historical highs, current visitation is still significant, estimated at approximately 340,000 visits annually. The most popular activities include bird-watching, fishing, boating, camping, picnicking, and hunting. The largest single recreation attraction is the Salton Sea State Recreation Area, followed by the Sonny Bono Salton Sea NWR, and the Wister Unit of the Imperial Wildlife Area. Recreation also occurs at a number of unmanaged public and private access points around the Sea. Based on a number of studies across the West, the average value for primary recreation activities was estimated be about $63 per visit, or $21.4 million total annually.

Under the No-Project Alternative and all restoration alternatives, the present worth of recreation is expected to significantly decline, as compared to the current level. Under the No-Project Alternative, there would be large reductions in surface elevation and area of the Sea. It is estimated that even under the restoration alternatives, environmental degradation would occur at the Sea for the next 18 years in the same pattern as under the No-Project Alternative, until facilities and programs are in place and the process of restoration begins. Therefore, under such a future, because benefits are measured against the No-Project Alternative, there would be no recreation benefits realized in that time period.

Most recreation benefits for the restoration alternatives would be realized in the years after the Sea begins to recover, when they are worth much less than current value in present worth terms. Some small benefits would be realized early on as the early start habitat areas are constructed. Given the significant risk and uncertainty associated with alternatives and the distant time frame involved, recreation benefits were not estimated individually for each of the alternatives. However, under an assumed recovery period with restoration, the present worth of NED recreation benefits would be about $106 million. These benefits are far less than the present worth of incremental NED costs for any of the restoration alternatives, which range from $1.1 to $7.6 billion, as presented in **Table 8.1**.

Nonuse Environmental Benefits

Reclamation acknowledges that the Salton Sea has non-use environmental benefits. The Salton Sea ecosystem supports some of the highest avian biological diversity in North America as well as the world. The more than 400 bird species that have been reported within the Salton Sea ecosystem comprise approximately 70 percent of all the bird species recorded in California. In addition, several species listed under the Federal Endangered Species Act use habitat resources associated with the Salton Sea. This combination of avian biodiversity and importance as breeding habitat is unsurpassed by any limited geographic area within the contiguous 48 states and Latin America. As such, the benefits of Salton Sea environmental enhancements may be higher to some individuals across the Nation who never visit the Sea than to the individuals who do. A common technique used to determine nonuse values is “contingent valuation,” a rather complex and lengthy survey process in which individuals are asked to express their willingness to pay for enhancements. It is important in this technique to be specific about the nature of the environmental improvements, and it is desirable to quantify the improvements in physical terms. There are significant risks and uncertainties concerning the quantity of future inflows, quality of habitat, and associated water quality conditions to be achieved under each of the alternatives. Due to a lack of funding and adequate time, a site-specific contingent valuation survey was not conducted. If a survey had been conducted that presented to the participants the high uncertainty of success associated with any of the alternatives,

it is likely that respondents would have returned relatively low willingness to pay values. A survey would have to clearly identify these uncertainties. The fact that restoration alternatives have continued to evolve through the study would have further complicated a survey process.

Reclamation acknowledges the $1-5 billion annual non-use economic benefit estimated by K2 Economics in its report prepared for the Salton Sea Authority (K2 Economics, 2007). However, the K2 study does not take into consideration risks and uncertainties associated with alternatives to restore the Salton Sea. The study also fails to differentiate between alternatives.

Without a dollar measure of nonuse benefits, it is not possible to complete the benefit-cost analysis of alternatives contemplated by the P&Gs. However, with such high NED costs and the potential that survey responses could result in low willingness to pay values, it is not clear that that any of the restoration alternatives would have NED benefits that exceed NED costs.

As a means to analyze the worth of alternatives in a relative sense, a cost effectiveness technique was employed that considered risk and uncertainty. Cost effectiveness cannot be used to identify whether the NED benefits of any or all of the alternatives exceed the NED costs, but it can be used to assess the relative cost between alternatives of creating habitat acres whereby it is assumed that habitat acres are proportionate to the economic benefits.

Cost Effectiveness and Risk

For the cost effectiveness analysis for the Salton Sea, the incremental NED cost of a restoration alternative was divided by the number of habitat acres (combined open water and shoreline habitat) developed by the alternatives by the year 2040, resulting in a derived “dollars per acre” value. Habitat acres serve as a “proxy” for environmental improvement benefits; in other words, it is assumed that habitat acres are proportionate to the economic benefits, had the latter been quantified. With substantial risks associated with each alterative this approach must be tempered with consideration of risk, and the potential variability in these risks, in an attempt to minimize costs per acre while at the same time minimizing risks. Without consideration of risk, alternatives with lower costs per acre could be viewed more favorably than other alternatives with higher costs per acre. Risk factors considered are as follows:

- Se risks to fish-eating birds
- Se risks to invertebrate-eating birds
- Hydrodynamic/stratification risks
- Eutrophication risks

- Fishery sustainability risks
- Future inflow risks

The risks for each of these factors are qualitatively identified in Chapters 4 and 6.

Figure 8.1 displays the results of the cost effectiveness and risk evaluation for the Salton Sea. Both NED costs and habitat acres are incremental to the No-Project Alternative. (There are no productive habitat acres in 2040 under the No-Project Alternative.) Composite risks are not quantified numerically, but are displayed in **Figure 8.1** as low, moderate, serious, or high. The relative composite risks shown are an average of all the risks listed above and represent an index of risk to be used for comparison purposes. Some viability risks shown in **Table 6.3** are shown as ranges. The variability in composite risks shown in **Figure 8.1** are in a

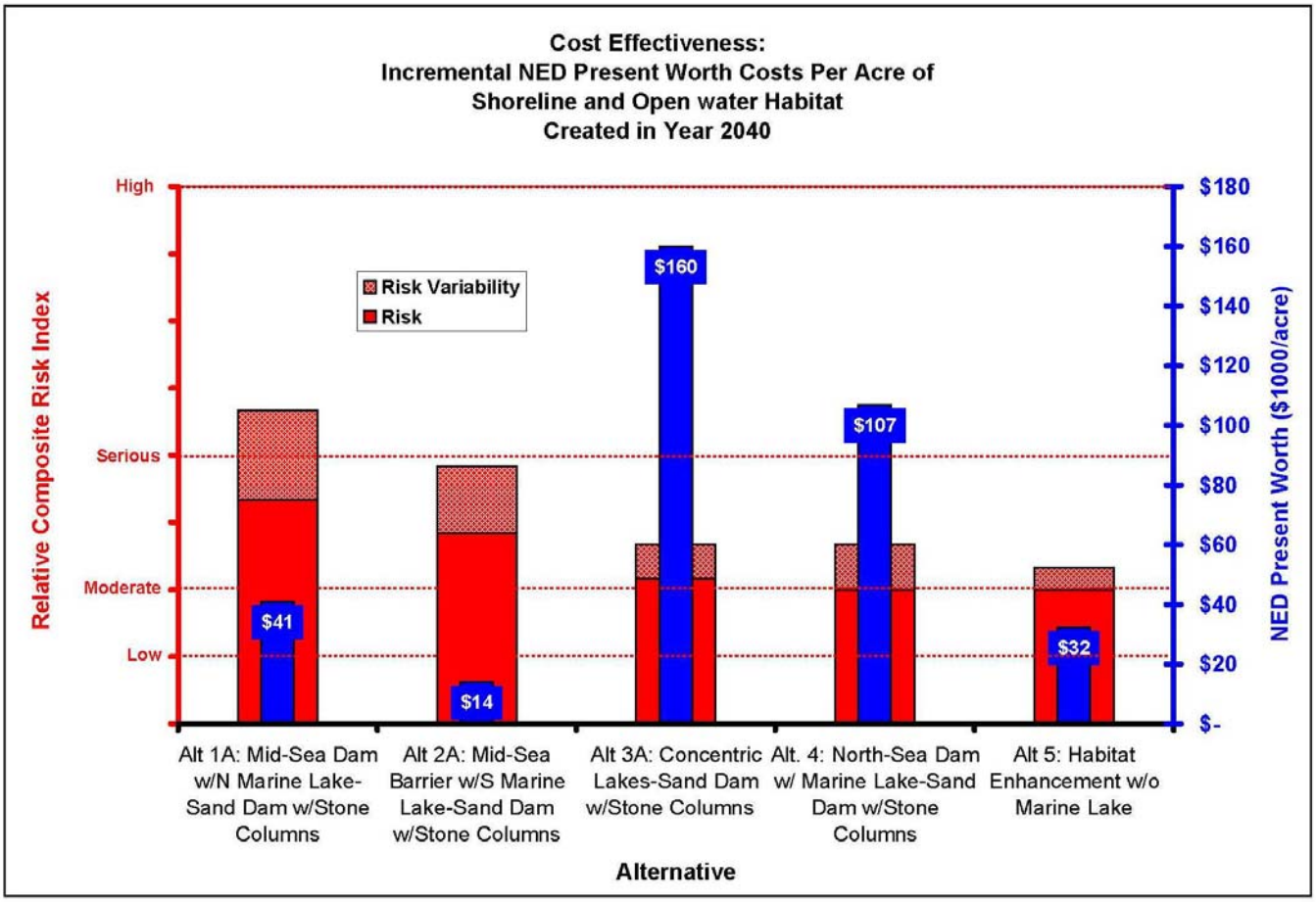

Figure 8.1 Cost effectiveness (NED present worth costs per acre of shoreline and open water habitat created in year 2040).

lighter color of red. The mid-Sea barrier alternative (No. 2A) minimizes the costs per acre of habitat created without consideration of risk and would appear to be the most cost effective. However, the risks associated with this alternative are higher than for all other alternatives, except Alternative No. 1. Of the alternatives that offer less risk than Alternative No. 2A, Habitat Enhancement without Marine Lake (Alternative No. 5), has the next lowest cost and is the alternative that has the least risk. In consideration of both costs and risks, Alternative No. 5 minimizes both risk and costs as a means for providing shoreline and open water habitat. The composite risks index for this alternative is **moderate,** which would indicate that "on average" problems would potentially be significant and may require mitigation. When looking at specific risks listed in **Table 6.3,** it is clear that Se risks to breeding birds and fishery sustainability problems would be serious under this alternative, which implies that these problems would create significant threats that may be tolerable with significant mitigation measures in place.

Regional Economic Development (RED)

The preceding discussion dealt with the NED account. At the regional level, any of the restoration alternatives would cause positive economic output, as compared to the No-Project Alternative. There are three potential sources of these regional effects: recreation visitor expenditures, induced economic growth, and project construction and operation expenditures. Of these, construction expenditures is considered to be the most significant and is the only impact evaluated in dollar terms.

It was assumed that because the No-Project and the restoration alternatives would result in the same pattern of environmental degradation for the next 18 years until restoration facilities and programs are operational, there will be no differences in recreation expenditures or in residential and commercial activity around the Sea in that time frame. As previously noted, recreation visitation will increase after year 25 as the Sea recovers, as compared to No-Project. To the extent that the increased visitation comes from individuals outside the region, and they spend money for food, lodging, gasoline, and other travel-related items, then RED effects (income and employment) would occur.

Similarly, to the extent that the Sea starts becoming a more aesthetically pleasing location to reside and work after year 18, and any increased residential and commercial development near the Sea would not have occurred elsewhere in the region, there would be a positive impact on the regional economy. Growth has recently been occurring around the Sea, but it is likely due to the availability of affordable housing for service workers in the relatively more expensive greater Palm Springs area.

Property values could diminish from current levels until restoration begins, and increase after that. Because there is no incremental impact on property values for nearly two decades, with the restoration alternatives compared to the No-Project, these values were not estimated.

The main near-term RED effect between the restoration alternatives and the No Project Alternative would be the considerable construction expenditures that occur as soon as one of the alternatives is implemented.

The modeling package used in this study to assess the regional economic effects of construction of each alternative is IMPLAN (IMpact Analysis for PLANning). IMPLAN is an economic input-output modeling system that estimates the effects of economic changes in an economic region.

IMPLAN data files were compiled for the study area from a variety of sources, including the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor, and the U.S. Census Bureau. This analysis uses 2003 IMPLAN data for California's Imperial and Riverside Counties. The total of these two counties comprises the study area for the RED analysis.

The expenditures associated with each of the alternatives were placed into categories that represent different sectors of production in the economy. The expenditures that are made inside the study region were considered in the regional impact analysis. Expenditures made outside the two-county area were considered "leakages" and would have no impact on the local economy.

Because of the enormous scale of the restoration alternatives, it was assumed that local suppliers and contractors would be able to supply only a small portion (1 percent) of the necessary materials, equipment, and expertise. Construction of the restoration alternatives would involve major construction companies that do not have a presence within the study area. Therefore, the RED study assumed that the workforce associated with these major construction companies would temporarily move to the region and spend their wages inside the area during the construction period. In contrast to the restoration features, 50 percent of the water efficient vegetation AQM expenditures (for AQM projects) take place in the region because of the large number of irrigation related suppliers and service companies within the region. The analysis also assumed that 30 percent of the other AQM expenditures would take place within the region.

This analysis also assumed that the vast majority of the construction expenditures would be funded from sources outside the two-county study area. Money from outside the region that is spent on goods and services within the region would contribute to regional economic impacts, while money that originates from within the study region is much less likely to generate regional economic impacts. Spending from sources within the region represents a redistribution of income and output rather than an increase in economic activity.

For the purpose of this study, the total implementation costs less non-contract costs were used to measure the overall regional impacts. These overall impacts would be spread over the construction period and would vary year-by-year proportionate to actual expenditures.

RED Results

Regional economic impacts, incremental to the No-Project Alternative, for each restoration alternative that includes embankment design concepts that have been determined to be acceptable relative to Reclamation's design criteria and guidelines are shown in **Table 8.2**. Impacts shown in **Table 8.2** for the Concentric Lakes Alternative (Alternative No. 3) are representative of developing three concentric lakes as required under mean possible future inflow conditions.

The employment, output, and income generated from each alternative's expenditures are compared to the overall regional economy. The majority of the employment, output, and income impacts are due to the expenditures of the wages earned by the workforce involved in the construction project. Employment is measured in the number of jobs. Output represents the dollar value of industry production. Income is the dollar value of total payroll (including benefits) for each industry in the region plus income received by self-employed individuals located within the region.

Table 8.2 Regional economic impacts from construction of each alternative, incremental to No-Project Alternative, compared to the economy of Imperial and Riverside Counties

Alternative	Employment [1] (number of jobs)		Output [2] ($ millions)		Income [3] ($ millions)	
	Total	Percent of the Total Regional Economy	Total	Percent of the Total Regional Economy	Total	Percent of the Total Regional Economy
Regional Economy	771,690		75,488		16,306	
Alternative No. 1A: Mid-Sea Dam with North Marine Lake Using Sand Dam Design with Stone Columns	22,767	3%	2,302	3%	760	5%
Alternative No. 2A: Mid-Sea Barrier with South Marine Lake Using Sand Dam Design with Stone Columns	4,819	1%	485	1%	151	1%
Alternative No. 3A: Concentric Lakes Using Sand Dam Design with Stone Columns [4]	35,493	5%	3,590	5%	1,171	7%
Alternative No. 4: North-Sea Dam with Marine Lake Using Sand Dam Design with Stone Columns	27,250	4%	2,756	4%	903	6%
Alternative No. 5: Habitat Enhancement Without Marine Lake	5,258	1%	528	1%	165	1%

[1] Employment is measured in the number of jobs.

[2] Output represents the value of industry production.

[3] Income is the value of total payroll (including benefits) for each industry in the region plus income received by self-employed individuals located within the region.

[4] Values shown are for three concentric lakes as required under mean possible future inflow conditions.