RECLAMATION

Managing Water in the West

San Luis Drainage Feature Re-evaluation

Feasibility Report

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Sacramento, California

March 2008

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Summary

Study Purpose

The purpose of this study is to determine if the proposed action is feasible and warrants Federal implementation. The study re-examines the Federal interest, documents the estimated total cost of the two proposed action alternatives, allocates costs, determines the beneficiaries' ability to repay costs, and supports a recommendation from the Secretary of the Interior to the Congress leading either to construction or concluding the proposed action.

Project Purpose

The project purpose is to provide agricultural drainage service to the San Luis Unit (Unit) to achieve a long-term, sustainable salt and water balance in the root zone of irrigated lands in the San Luis Unit and adjacent areas. A long-term sustainable salt and water balance is needed to maintain sustainable agriculture in the Unit and the region.

Study Area

The project area consists of the drainage study area in the San Joaquin Valley, California, and other areas affected by alternative features, such as conveyance, treatment facilities, and discharge locations. Features of the action alternatives are located in Fresno, Kings, and Merced Counties.

The drainage study area includes the area where the drainage is produced, western San Joaquin Valley, and consists primarily of the lands lying within the boundary of the Central Valley Project San Luis Unit and the Grassland Drainage Area as shown on figure S-1. The Unit, defined by the authorized service area, encompasses the Westlands, Broadview[1], Panoche, and Pacheco Water Districts and the southern portion of the San Luis Water District. For this study, the drainage study area has been subdivided into the Westlands Water District (north, central, and south sections) and the Northerly Area.

[1] Note to the reader: At the time this study was initiated, Broadview Water District was a separate entity. Broadview Water District was annexed by Westlands Water District as of March 2007. Broadview will continue to be referred to throughout this report as part of the Northerly Area; however, for the purposes of the repayment analysis, Broadview's acreage, financial obligations, and water allocations are included with Westlands Water District.

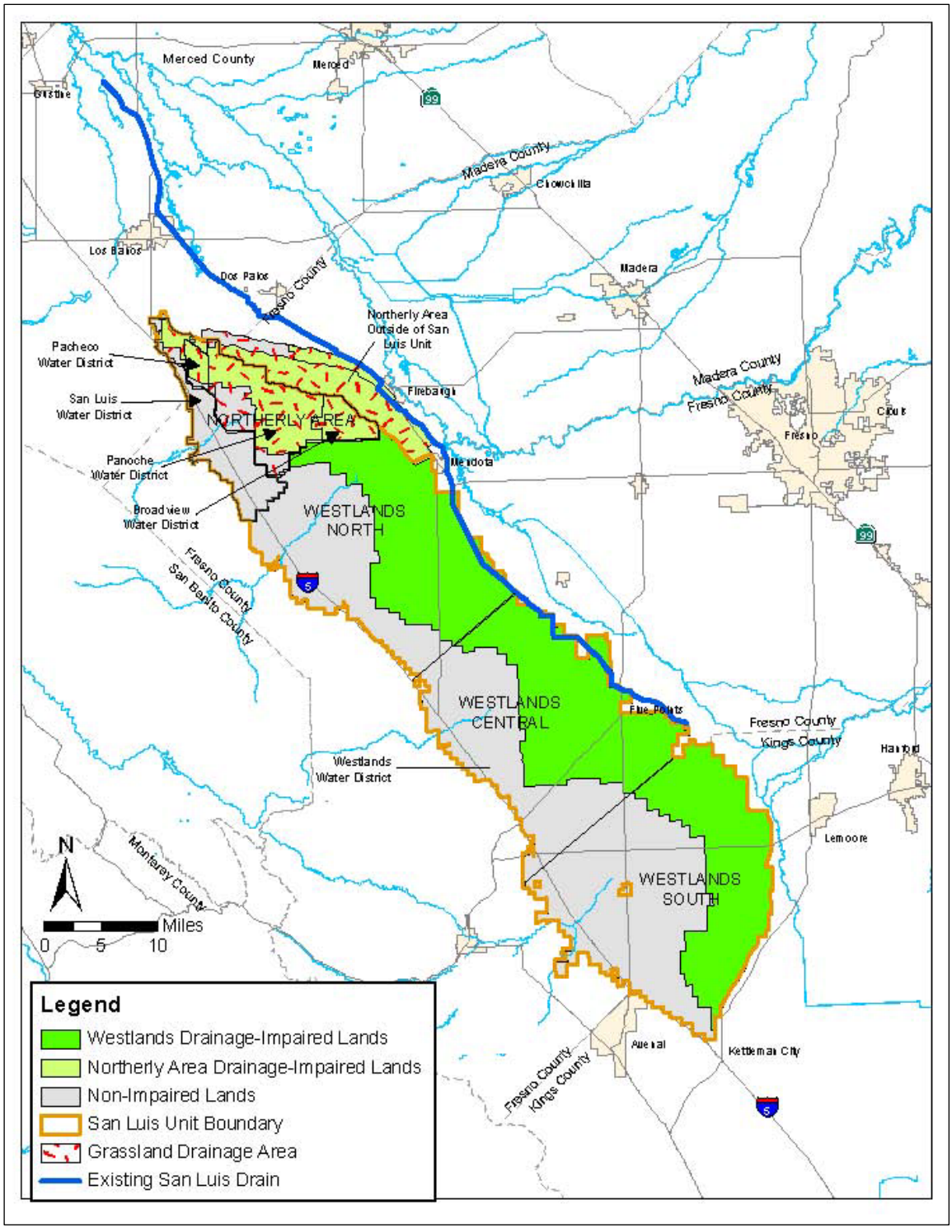

Figure S-1. Study Area, Westlands Water District and Northerly Area lands

The drainage study area (including the lands to the north and outside of the Unit of 40,400 acres) totals approximately 730,000 acres, as shown in table S-1.

Table S-1. Drainage study area[1]

District	Area (acres)
Westlands Water District	604,000
Northern San Luis Unit Districts	85,600
Northerly Area Outside of San Luis Unit	40,400
Total	**730,000**

[1] All areas are based on acreage reported by the water districts except the San Luis Water District, which was calculated using Arc Geographic information System (GIS).

Of the 730,000 acres in the drainage study area, about 379,000 acres are drainage-impaired and constitute the drainage service area. The Bureau of Reclamation (Reclamation) estimates that the installation of subsurface drainage systems in two-thirds of this area by the end of the 50-year planning horizon would maintain arability of the root zone throughout the entire 379,000 acres.

Table S-2 summarizes the areas needing drainage service for both the Westlands Water District (Westlands) and Northerly Area.

Table S-2. Area needing drainage service[1]

District	Area (acres)
Westlands North	102,000
Westlands Central	104,000
Westlands South	92,000
Subtotal (Westlands Water District)	298,000
Northern San Luis Unit Districts	45,000
Northerly Area Outside of San Luis Unit	36,000
Subtotal (Northerly Area)	81,000
Total	379,000

[1] Based on projections in the environmental impact statement (EIS), appendix C.

Authority

The San Luis Unit was authorized by the Congress in Public Law 86-488, 74 Statute 156, June 3, 1960, as amended by section 101(e) of the Act of October 18, 1986, Public Law 99-500; and this re-evaluation is being completed under that authority.

Federal Interest

Federal interest is established either by legislation or through an evaluation of a proposed action relative to the agency's mission. For an action to be federally implementable, it must be feasible as defined by the *Economic and Environmental Principles and Guidelines* (*Principles and Guidelines*). The *Principles and Guidelines* require Federal actions contribute to the national economic development (NED). The San Luis Act of 1960 as amended establishes the Reclamation's Federal interest in the proposed action. This interest was reaffirmed by the Federal District Court Order dated November 29, 2000.

However, the requirement for a net positive contribution to the Nation's economy cannot be met by either of the two action alternatives. This report details the analysis surrounding that conclusion.

Background

Reclamation has been planning for drainage facilities to serve the San Joaquin Valley since the mid-1950s. Drainage facilities were discussed when Reclamation studied the feasibility of water supply development for the Unit. In the 1957 California Water Plan, the California Department of Water Resources (DWR) also planned for drainage facilities near the Buena Vista lakebed in Tulare Basin to the Sacramento-San Joaquin River Delta (Delta). A brief historical overview of events for the San Joaquin Valley drainage planning is shown in table S-3.

Table S-3. Drainage planning history

1960	Congress enacted Public Law 86-488 (San Luis Act) authorizing construction of the San Luis Unit of the Central Valley Project (CVP).
	California voters approved the Burns-Porter Act authorizing the State water project. Both of these acts included facilities to remove drainwater from the San Joaquin Valley.
1968	Reclamation began construction of the Drain and the first stage of Kesterson Reservoir.
1975	82-mile segment of the Drain (ending at Kesterson Reservoir) was completed; and subsequently, 120 miles of collector drains were constructed in a 42,000-acre area of the northeast portion of Westlands.
1975 to 1979	San Joaquin Valley Interagency Drainage Program, a joint effort between Reclamation, DWR, and the State Water Resources Control Board (State Board) was formed to find an economically, environmentally, and politically acceptable solution to San Joaquin Valley drainage problems.
1983	Discovery of embryonic deformities of aquatic birds at Kesterson Reservoir significantly changed the approach to drainage solutions in San Joaquin Valley.
	San Luis Unit Special Study was suspended.

Table S-3. Drainage planning history (continued)

1985	Following a Nuisance and Abatement Order issued by the State Board, discharges to Kesterson Reservoir were halted; and feeder drains leading to the Drain were plugged. In response to the Kesterson problems, the San Joaquin Valley Drainage Program (SJVDP) was formed by the governor of California and the Secretary of the Interior.
1986	Barcellos Judgment - Federal court order settles a lawsuit among Westlands, Reclamation, and various classes of landowners and water users in Westlands. It directs Reclamation to develop, adopt, and submit a plan to Westlands for drainage service facilities by the end of 1991, leading to preparing the *San Luis Unit Drainage Program Plan Formulation Report* and the related draft environmental impact statement.
1987	Policy decision limits studies to in-valley drainage management measures, based on a recommendation from a citizen's advisory committee consisting of water users, environmental advocates, and public interests.
1990	SJVDP's final report recommended an in-valley solution that included source reduction, drainage reuse, land retirement, evaporation basins, groundwater management, San Joaquin River discharge, and institutional changes.
1995	District court issues a partial judgment stating that the San Luis Act established a mandatory duty to provide drainage. The judgment ordered the U.S. Department of the Interior (Interior) to promptly prepare, file, and pursue an application for a discharge permit with the State Board to complete the San Luis Drain to the Delta. Interior appeals the judgment.
2000	U.S. Court of Appeals concluded that Interior must provide drainage service but held that Interior had the discretion to meet the court order with a plan other than the interceptor drain solution.
2001	Reclamation develops a Plan of Action outlining its proposed efforts to provide prompt drainage service considering a variety of options. Preliminary Alternatives Report (PAR), San Luis Unit Drainage Feature Re-evaluation, is published in December 2001.
2002	Plan Formulation Report (PFR), San Luis Drainage Feature Re-evaluation, is published in December 2002.
2004	Reclamation submitted to the Court an Amended Plan of Action for Drainage to the San Luis Unit. The Amended Plan of Action states that Reclamation will continue to refine and evaluate all five alternatives described in the PFR for inclusion in the environmental impact statement. Additionally, Reclamation formulated alternative(s) that use land retirement as a method to control drainage need.
2006	Reclamation files the *Final Environmental Impact Statement, San Luis Drainage Feature Re-evaluation* in May 2006. The EIS identifies two in-valley alternatives for further feasibility analysis.
2007	Reclamation issues a Record of Decision (ROD) for the San Luis Drainage Feature Re-evaluation in March 2007. The ROD selects the In-Valley/Water Needs/Land Retirement Alternative, the locally preferred alternative, for implementation.

The courts found that Reclamation is obligated to provide drainage service and several attempts at providing such service have been developed and litigated since the 1980s.

Appropriation Ceiling

The San Luis Unit was authorized with two appropriation ceilings. The construction of project works, except for distribution systems and drains, are covered by an indexable ceiling. The ceiling for the distribution systems and drains is not subject to indexing. The combined remaining construction cost ceiling for the San Luis Unit is $428,674,777. The total estimated cost to implement the In-Valley/Drainage-Impaired Land Retirement Alternative is $2.24 billion. The total estimated cost to implement the In-Valley/Water Needs Land Retirement Alternative is $2.69 billion. Thus, implementation of either of these action alternatives would exceed the combined remaining construction cost ceilings for the San Luis Unit.

Drainwater Quantity

Reclamation identified drainwater reduction measures, the cost of reducing an acre-foot of drainwater, would be less than the cost of collecting, treating, reusing, managing, and disposing of that same acre-foot of drainwater. Reclamation evaluated a variety of drainwater reduction measures and found four to be cost effective—drainwater recycling, shallow groundwater management, seepage reduction, and irrigation system improvements. Reclamation developed drainage quantities and flow rates based upon assumed drainage reduction measures.

In addition, the total area needing drainage service was reduced through land retirement options that would remove lands from irrigated agricultural production either by purchase or lease for project facilities or through non-irrigation covenants. Drainwater flows for treatment and disposal range from 8,100 acre-feet per year (acre-ft/yr) to 21,000 acre-ft/yr, depending on the amount of land retirement in the alternatives.

Resources, Opportunities, and Constraints

Multiple resources were necessary to formulate viable alternative plans for a drainage system for the San Luis Unit. Improvement of the quality in the existing water resources and the required agricultural drainage service to the San Luis Unit, within the constraints of water rights laws, other State and Federal laws, and environmental constraints, constitute the statutory underpinning of this re-evaluation.

A long-term sustainable salt and water balance is needed to maintain sustainable agriculture in the Unit and the region. A Court Order stating that drainage service must be provided promptly resulted in a planning constraint that drainage service facilities of this project must be technically proven and cost effective. Constraints that would limit the project include the physical, statutory, and institutional limitations and environmental factors discussed in the associated environmental impact statement and summarized in chapter 9 of the EIS (Reclamation 2006).

Appraisal Evaluation of Alternatives

The alternative formulation process at the appraisal level resulted with the selection of two action alternatives for feasibility analysis, the In-Valley/ Drainage-Impaired Land Retirement Alternative and In-Valley/Water Needs Land Retirement Alternative.

Action Alternatives Selected for Feasibility Study

In-Valley/Drainage-Impaired Area Land Retirement Alternative

The In-Valley/Drainage-Impaired Area Land Retirement Alternative is recommended for selection in the EIS as the preferred plan because it is the most beneficial plan for the economy on a national perspective (the NED plan). Reclamation completed feasibility-level designs and cost estimates for this alternative.

In-Valley/Water Needs Land Retirement Alternative

This alternative was considered as the locally preferred alternative because it most closely parallels a locally developed drainage plan—the Westside Regional Drainage Plan. Reclamation completed feasibility-level designs and cost estimates for this alternative.

The In-Valley/Water Needs Land Retirement Alternative would retire sufficient lands to balance long-term water needs in the San Luis Unit. Farmers would receive adequate water supplies to meet crop demand of land remaining in production.

Feasibility Evaluation of Alternatives

Feasibility-level designs and cost estimates are presented for two action alternatives. The term “in-valley” indicates that drainage service features are constructed entirely within the geographic boundaries of the project area in the San Joaquin Valley. The term “drainage-impaired” refers to lands that are not capable of sustaining commercial agricultural production without the installation of subsurface tile drains to collect and remove drainage and shallow groundwater from the root zone. Drainage-impaired lands arise from a combination of subsurface hydrogeologic properties that naturally impede the removal or

drainage of shallow groundwater. The term "land retirement" indicates that both alternatives would remove lands from irrigated agricultural production either by purchase or lease for project facilities or through non-irrigation covenants as a significant component of drainage service.

In-Valley/Drainage-Impaired Land Retirement Alternative

The In-Valley/Drainage-Impaired Land Retirement Alternative would include retiring all drainage-impaired lands within Westlands (298,000 acres) and 10,000 acres in the Broadview Water District in the Northerly Area. Retired lands in Westlands would include 44,106 acres retired under a previous agreement plus 253,894 acres proposed under this alternative.

Drainage service features would be constructed for approximately 71,000 acres of drainage-impaired lands in the Northerly Area. This drainage service area would incorporate and modify existing infrastructure that currently provides drainage to the Northerly Area districts.

In-Valley/Water Needs Land Retirement Alternative

The In-Valley/Water Needs Land Retirement Alternative would retire about 184,000 acres (44,106 previous acres plus 139,850 additional acres) of drainage-impaired lands within Westlands to balance the projected available water supply with the irrigation demand for farmland that would remain in production. Drainage service features would be constructed for the drainage-impaired lands remaining in production in Westlands—about 114,000 acres.

This alternative also would include retirement of 10,000 acres in Broadview Water District and construction of drainage service features for approximately 71,000 acres of drainage-impaired lands in the Northerly Area.

Common Facilities proposed for both Alternatives

The proposed Federal drainage service features common for both alternatives are described below. The primary differences between the two alternatives are the amount of land that would be retired from irrigation and the corresponding size of drainage service features for lands that remain in production.

- **Land Retirement**: Would consist of real estate interests that would be acquired through the purchase of non-irrigation covenants that restrict using irrigation water but permit the land to be used for grazing, fallowing, and dryland farming. Land retirement is considered a feature of drainage service because it reduces contributions of water to the shallow groundwater table.

- **Drainage Collection System**: Would consist of a combination of existing open drainage ditches and new closed pressurized pipelines that collect

and convey drainage from farmlands to regional reuse facilities. A combination of existing open drainage ditches and proposed closed pressurized pipelines that collect and convey drainage from farmlands to regional reuse facilities.

- **Regional Drainage Reuse Facilities**: Would consist of agricultural lands that utilize drainage collected from surrounding farmlands to irrigate salt tolerant crops. The purpose of reuse facilities is to reduce the volume of drainage that requires further treatment and disposal through evapotranspiration of irrigated crops.

- **Conveyance System**: Would consist of a network of pumping plants and pipelines that convey drainage collected from regional reuse facilities to reverse osmosis (RO) treatment plants.

- **Reverse Osmosis Treatment**: Would consist of desalination treatment of drainage using RO membranes to recover approximately 50 percent of drainage as desalted product water. The desalted product water would be available for reuse as an irrigation supply for commercial farmlands. The remaining 50 percent of the drainage would be concentrated wastewater requiring further treatment and disposal.

- **Selenium Biotreatment**: Would consist of enclosed media-filled bioreactor tanks utilizing microbes to remove selenium from the concentrated waste stream from the RO plants.

- **Evaporation Ponds**: Would consist of interconnected storage fields surrounded by embankments that impound the treated effluent from the biotreatment plants for sequential solar evaporation, leaving dry salts for in-place burial.

- **Mitigation Facilities**: Would consist of wetland habitats constructed to mitigate potential adverse environmental impacts of the evaporation ponds.

Cost Estimates

A review of Appendix A, Feasibility Design Appendix was performed in accordance with the Reclamation manual temporary release of Policy, Independent Oversight of Design, Cost Estimating, and Construction (DEC) (FAC TRMR-12). The Feasibility Design Appendix addresses and incorporates the DEC recommendations as agreed to by the Directors of the Mid-Pacific Region and Technical Resources. With the exception of the cost estimates for the RO treatment plants, the construction cost estimates for each action alternative are at feasibility level. The cost estimates for the RO treatment plants include higher than normal contingency allowances to address the uncertainties regarding

treatment technologies. Project cost estimates and detailed construction cost estimates for both alternatives are presented in Appendix A, Feasibility Design Appendix, attachment 3, and summarized in table S-4 below.

Table S-4. Summary cost estimates of action alternatives[1]

Alternative	Total Field Cost	Non-contract Cost	Total Construction Cost
In-Valley/Drainage-Impaired Land Retirement Alternative	**$1,975,907,000**	**262,242,000**	**2,238,149,000**
Project Facilities	$775,907,000	212,242,000	988,149,000
Retired Lands	$1,200,000,000	50,000,000	1,250,000,000
In-Valley/Water Needs Land Retirement Alternative	**$2,222,852,500**	**$464,262,500**	**$2,687,115,000**
Project Facilities	$1,592,852,500	$434,262,500	$2,027,115,000
Northerly Area	$775,907,000	$212,242,000	$988,149,000
Westlands	$816,945,500	$222,020,500	$1,038,966,000
Retired Lands	$630,000,000	$30,000,000	$660,000,000

[1] All values are shown in 2006 dollars.

Non-contract costs include costs for work or services provided in support of the project, such as facilitating services, investigations, designs and specifications, construction management, environmental compliance, and archeological considerations.

Implementation

The In-Valley/Drainage-Impaired Land Retirement Alternative requires approximately 6 years to substantially complete construction of the Northerly Area drainage features. After monitoring the initial mitigation areas for a period of 5 years, a second construction phase for additional mitigation facilities could be implemented depending upon results of the initial phase of monitoring impacts.

The In-Valley/Water Needs Land Retirement Alternative requires approximately 10 years of design and construction work to provide drainage service to the Northerly Area and Westlands. After monitoring the initial mitigation areas for a year, a second construction phase for additional mitigation facilities could be implemented depending upon results of the initial phase of monitoring impacts.

Project Feasibility

Project feasibility consists of four parts—technical, environmental, economic, and financial. Technical feasibility consists of engineering, operations, and

constructability analyses verifying that the project can be constructed, operated, and maintained. Environmental feasibility consists of analyses verifying that constructing or operating the project will not result in unacceptable environmental consequences to endangered species, cultural, Indian trust, or other resources. Economic feasibility consists of analyses verifying that constructing the project is an economically sound investment of capital (i.e., that the project would result in positive net benefits or the project's benefits would exceed the costs). Financial feasibility consists of (1) an allocation of costs to project purposes, (2) determination of reimbursable and non-reimbursable costs, (3) commitment on the part of project beneficiaries to pay the reimbursable costs, and (4) a determination of project beneficiaries' ability to pay their allocated costs, including capital costs and long-term operation, maintenance, and replacement costs.

Technical Feasibility

Both action alternatives are technically feasible, constructible, and can be operated and maintained. Though the reverse osmosis treatment plants are not at a feasibility level design, this does not affect the finding of technical feasibility. Reverse osmosis technology is continually evolving and improving over time. The Report anticipates these improvements will be incorporated as they become available over the 50-year life of the project.

Environmental Feasibility

Both action alternatives are environmentally feasible. Both action alternatives, as well as the No-Action Alternative, were included in a final environmental impact statement, which was filed in May 2006. The environmental impacts were evaluated and a mitigation plan was included in the final EIS. The In-Valley/Drainage-Impaired Land Retirement Alternative was identified as the environmentally preferred alternative. In a March 16, 2006, biological opinion, the U.S. Fish and Wildlife Service concluded that the In-Valley/Water Needs Land Retirement Alternative would likely have adverse effects to San Joaquin kit fox, giant garter snake, and California least tern and authorized incidental take of those three species.

Economic Feasibility

Using the four account methodology mandated by the *Principles and Guidelines*, the study examined the economic justifiability of the two action alternative relative to the No-Action Alternative. Four accounts, NED, environmental quality (EQ), regional economic development (RED), and other social effects (OSE), are established to facilitate evaluation and display of the effects of alternative plans and encompass all significant effects of a plan on the human environment as required by the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [U.S.C.] 4321 *et seq.*). The NED account is the only required account.

Environmental Quality and Other Social Effects Accounts

A thorough evaluation of the EQ and OSE accounts was performed as part of the study's environmental documentation process, and no significant effects were identified that would have a material bearing on the decisionmaking process. The analysis is documented in the *San Luis Drainage Feature Re-evaluation Final Environmental Impact Statement,* May 2006, and accompanying appendices. Feasibility level evaluation of these two accounts was considered unnecessary.

Regional Economic Development Account

Both the In-Valley/Water Needs Land Retirement Alternative and the In-Valley/Drainage-Impaired Impaired Land Retirement Alternative have a slightly negative effect on the regional economy when compared to the No-Action Alternative. However, none of the effects would be significant, because total projected employment and labor income effects generated by any action alternative are less than 1.0 percent of the affected region's total for those indicators.

Both alternatives are projected to cause a reduction in the value of crop production and decreased regional economic activity over the life of the project. However, no mitigation measures are identified for minimal effects to agricultural production and economics.

National Economic Development Account

Contributions to national economic development are measured as increases in the net value of the national output of goods and services, expressed in monetary units and are the direct net benefits that accrue in the project area and the rest of the Nation. Contributions to NED include increases in the net value of goods and services that are marketed, as well as those that may not be marketed.

The benefits of the action alternatives are estimated relative to the No-Action Alternative and are based on providing drainage service to drainage-impaired lands within the San Luis Unit service area converting them from drainage impaired to drained lands. For the In-Valley/Water Needs Land Retirement Alternative, the net acreage in Westlands is 113,000 acres and 66,533 in the Northerly Area. For the In-Valley/Drainage-Impaired Land Retirement Alternative, the net acreage in the Northerly Area is 66,533 acres and 0 in Westlands.

The benefits resulting from reclaiming drainage-impaired lands that would otherwise be removed from agricultural production without the provision of adequate drainage service is estimated as the avoided loss of net farm revenue from lands removed from agricultural production. With adequate drainage conditions, crops are projected to shift toward a more revenue intensive crop mix. In Westlands, the weighted increase in net revenue expected from the crop mix change is $101.49 per acre. For the Northerly Area, with slightly lower estimated

natural drainage on its most impaired lands, the projected change in crop mix results in a weighted increase in net revenue of $160.03 per acre.

This analysis only represents a typical or average situation, wherein individual growers would make their decisions based on specific site and market conditions.

The estimated values of benefits projected to occur as a result of providing adequate collection, treatment, and disposal of drainwater for drainage-impaired lands for the two alternatives are shown in table S-5.

Table S-5. Summary of changes in agricultural productivity of project lands relative to the No-Action Alternative [1] ($/year)

	In-Valley/Water Needs Land Retirement Alternative	In-Valley/ Drainage-Impaired Land Retirement Alternative
Northerly Area Annual Equivalent Benefit[2] ($)	**$8,002,000**	**$8,002,000**
Westlands Annual Equivalent Benefit[2] ($)	**$7,125,000**	**$0**
Total Annual Equivalent Benefit ($)	**$15,127,000**	**$8,002,000**

[1] Values represent additional costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

[2] Discounted values converted to an annual equivalent value for comparison with project costs at 4.875 percent over 50 years

NED Costs

NED costs are the opportunity or economic costs of resources used in a project alternative. Financial or accounting costs are a measure of the actual cash outlays made to acquire the resources necessary to implement the project. In cases where financial costs reflect the full economic value of a particular resource to society, they can and should be used to determine NED costs. However, financial costs are often different from, and unrelated to, economic costs. Many financial costs do not reflect the true opportunity cost of a resource.

The NED costs of implementation outlays include the costs incurred by the responsible Federal entity and, where appropriate, contributed by other Federal or non-Federal entities to construct, operate, and maintain a project in accordance with sound engineering and environmental principles and place it in operation. These costs include remaining post-authorization planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; relocation costs; historical and archaeological salvage costs; land, water, and mineral rights costs; and operation, maintenance, and replacement costs.

Summary of Net NED Costs

NED costs estimated for each alternative are listed in table S-6. All cost estimates shown are based on comparing the costs incurred under each of the action alternatives to those estimated under the No-Action Alternative.

Table S-6. Summary of changes in NED costs relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/ Drainage-Impaired Land Retirement
Westlands		
Irrigation Mgt Cost, Ag Losses, Land Retirement Administrative Costs	$9,135,000	$17,712,000
Northerly Area		
Irrigation Management Cost, Agriculture Losses, Land Retirement Administration Costs	$1,384,000	$1,384,000
Northerly Area and Westlands Combined		
Treatment and Disposal Costs and Supplemental Water Purchases/Sales	$135,754,000	$40,430,000
TOTAL COSTS	**$146,273,000**	**$59,526,000**

[1] Values represent NED costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Net NED Benefits

Table S-7 identifies the In-Valley/ Drainage-Impaired Land Retirement Alternative as the action alternative that maximizes the net NED benefits. This alternative is the NED plan in accordance with the Principles and Guidelines. It should be noted that neither alternative generates a positive net NED benefit. Under typical water resource project planning procedures, such results indicate that neither of the alternatives is economically justifiable and do not justify warrant the expenditure of Federal funds.

Table S-7. Summary of changes in net NED benefit/cost summary relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/ Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
Total NED Benefit	$15,127,000	$8,002,000
Total NED Cost	146,273,000	59,526,000
NET NED BENEFIT	**($131,146,000)**	**($51,524,000)**

[1] Values represent net NED benefits relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Financial Feasibility

The financial feasibility of a project entails the examination and evaluation of the project beneficiaries' ability to repay the Federal Government's investment in the project over a period of time consistent with applicable law. For the San Luis Drainage Feature Re-evaluation Project, all project costs are allocable to irrigation and would be repayable without interest by the Westlands, Pacheco, Panoche, and San Luis Water Districts. The following briefly describes the analysis required to determine financial feasibility.

Cost Allocation

Reclamation law and policy require an allocation of costs to components or purposes of projects to: (1) test financial feasibility of reimbursable components or purposes by a comparison of estimated project costs with anticipated revenues and (2) establish and measure compliance with project financial requirements after construction.

Since the project costs are fully attributable to irrigation, the cost allocation process can be streamlined to focus on each district's ability to repay its share of the project costs in addition to existing financial obligations.

Payment Capacity

Payment capacity is an irrigator's estimated residual net farm income available for payment of both federally and non-federally assessed water costs after subtracting for on-farm production and investment expenses and appropriate allowances for management, equity, and labor. Payment capacity is a "farm-level" analysis that determines the estimated on-farm economic and financial conditions expected to occur in the following 5 years with the Federal project in place.

Ability to Pay

An ability-to-pay study assesses the financial capability of an irrigation district (or contracting entity) to pay for existing or increased Reclamation water charges and services. An ability-to-pay study is a "district-level" analysis completed

subsequent to a payment capacity study. Ability to pay is the farm-level payment capacity aggregated to the entire district, minus district existing obligations, operation and maintenance (O&M) costs, power costs, and reserve fund requirements. If the annual district income exceeds the annual district obligations, the district has ability to pay.

Determining financial feasibility requires an evaluation of the individual district's ability to pay the estimated water rates attributed to the annual O&M, project's capital repayment costs, Restoration Fund[2] charges, and other charges, coupled with any existing obligations currently being paid.

Contracts

To protect the interests of the United States, Reclamation's water-related contracts must ensure that repayment of the reimbursable capital cost is made in accordance with Reclamation law. Subsections 9(c), (d), and (e) of the Reclamation Project Act of 1939 (1939 Act) require repayment of all reimbursable costs. Both 9(d) and 9(e) contracts are executed with water districts within the San Luis Unit.

Contract terms and repayment periods will be for the maximum duration provided by law, typically 40 years. Contracts will ensure that the Federal investment and Reclamation's O&M costs are recovered pursuant to law and policy. Full payment of annual O&M costs is required by section 5 of the Reclamation Extension Act of 1914 (Public Law 63-208; 43 U.S.C. Sections 471 and 472). Full payment in advance of water delivery is mandated by section 46 of the Omnibus Adjustment Act of 1926 (Public Law 69-284; 43 U.S.C. Section 423e), and section 6 of the 1939 Act (Public Law 76-260; 43 U.S.C. Section 485e).

Aid to Irrigation

Also commonly known as "ability-to-pay relief," aid to irrigation typically allows for the assignment to CVP power that amount of capital costs and Restoration Fund charges which are beyond the ability of irrigators to repay pursuant to Reclamation law. However, through section 101(e) of the Continuing Appropriations Act of October 18, 1986 (Public Law 99-500), section 8 of the San Luis Act of June 3, 1960 (74 Stat. 156; Public Law 86-488) was amended with the addition of section 8(b). This amendment prohibits the assignment of any costs from implementation of either action alternatives to CVP power customers. Therefore, if either action alternative is implemented, this will require separate accounting of the OMR&E and capital repayment costs associated with the drainage service. If either action alternative is implemented, the Restoration

[2] The Restoration Fund was established by Section 3406(a) of the Central Valley Project Improvement Act (Public Law 102-575). Section 3407 (d) requires CVP water and power contractors to make annual mitigation and restoration payments for each acre-foot of water sold and delivered by the CVP.

Fund may be adversely affected because it is unclear if the charges that the San Luis Unit contractors are unable to pay can be assigned to power contractors.

Project Repayment Analysis

The farm budget method of analysis was used to estimate the payment capacity of San Luis Unit lands. Enterprise budgets for crops commonly produced within the study area were generated. Criteria for using preparing the enterprise budget approach followed the *Technical Guidelines for Irrigation Ability to Pay and Irrigation Payment Capacity*, May 2004. Payment capacity value has been computed for all lands in the San Luis Unit using the prevailing cropping pattern projected to occur under each action alternative for each district within the San Luis Unit and is shown in table S-8.

District O&M and Cost of Water

The cost of water needed for comparison is the combination of the district cost of O&M and their cost of water. The district cost of O&M includes all costs associated with district operations, except water costs, as reported on the financial reports of each district. Likewise, the district's cost of water is the cost reported on each district's financial reports for water. Included in the district's cost of water are any payments to Reclamation for O&M, existing capital repayment, and Restoration Fund charges, in addition to the costs of any additional water supplied to the district from alternate sources. Both the district cost of O&M and cost of water reflect 5-year averages to minimize the impacts of one time expenditures.

Table S-8. Estimated payment capacity for each district in the San Luis Drainage Area

	Payment Capacity by District				
	Pacheco	Panoche	San Luis	Westlands	Weighted Total
Weighted Payment Capacity – In-Valley Water Needs Land Retirement					
$/acre (includes negative payment capacity)	232.40	192.23	228.76	269.18	257.79
$/acre-ft	96.87	73.93	78.88	99.7	95.34
Weighted Payment Capacity – In-Valley/Drainage-Impaired Land Retirement					
$/acre (includes negative payment capacity)	232.40	192.23	228.76	274.93	257.49
$/acre-ft	96.87	73.93	78.88	101.83	95.23

Repayment of Drainage Service

For a project to be considered financially feasible, Reclamation policy requires that irrigated lands generate, as a minimum, at least enough revenue to pay annual operation, maintenance, replacement, and energy (OMR&E) costs. Current expenses estimated for each district are compared to district payment capacity in

tables S-10 and S-11 to determine the remaining payment capacity available to repay annual OMR&E and capital repayment costs of each alternative.

Based on the values estimated in table S-9, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing district O&M and assigned annual OMR&E costs of drainage service under the In-Valley/Water Needs Land Retirement Alternative. In addition, none of the water districts have the ability to fully repay its assigned capital costs of drainage service facilities under this alternative after paying for water.

Figure S-2 illustrates the four water districts' payment capacity relative to their existing obligations and the implementation of the In-Valley/Water Needs Land Retirement Alternative at a cost per acre. While all four districts currently have some remaining payment capacity, implementing this alternative far exceeds their ability to repay the associated costs of the project when coupled with their existing obligations.

Of the total annual capital repayment obligation of $67 million, only Westlands has the ability to pay a portion of the amount, approximately 42 percent. Under Reclamation law, this alternative is financially infeasible due to Pacheco's, Panoche's, and possibly San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, this alternative is still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation. None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if this alternative is implemented.

Table S-9. In-Valley/Water Needs Land Retirement Alternative Repayment capacity analysis ($/year)

	Pacheco	Panoche	San Luis	Westlands	Total San Luis Unit
Acres	5,071	37,050	37,927	321,367	401,414
Estimated Payment Capacity ($/acre)	$232.40	$192.23	$228.76	$269.18	$257.79
District Payment Capacity	$1,178,500	$7,122,122	$8,676,181	$86,505,569	$103,480,515
District O&M Cost	$665,000	$3,114,000	$2,161,000	$21,081,000	$27,021,000
OMR&E Cost of Drainage Facilities	$820,000	$5,989,000	$6,131,000	$8,915,000	$21,855,000
Remaining Payment Capacity	($306,500)	($1,980,879)	$384,181	$56,509,569	$54,604,515
Cost of Water	$370,000	$2,751,000	$3,337,000	$28,156,000	$34,614,000
Remaining Payment Capacity	($676,500)	($4,731,879)	($2,952,819)	$28,353,569	$19,990,515
Capital Repayment of Drainage Service	$520,000	$3,797,000	$3,887,000	$58,974,000	$67,178,000
Difference ($)	($1,196,500)	($8,528,879)	($6,839,819)	($30,620,431)	($47,187,485)

Table S-10. In-Valley/Drainage-Impaired Land Retirement Alternative Repayment capacity analysis ($/year)

	Pacheco	Panoche	San Luis	Westlands	Total San Luis Unit
Acres	5,071	37,050	37,927	208,367	288,415
Estimated Payment Capacity ($/acre)	$232.40	$192.23	$228.76	$274.93	$257.49
District Payment Capacity	$1,178,500	$7,122,122	$8,676,181	$57,286,339	$74,263,978
District O&M Costs	$665,000	$3,114,000	$2,161,000	$21,081,000	$27,021,000
OMR&E Cost of Drainage Facilities	$827,000	$6,039,000	$6,182,000	$0	$13,048,000
Remaining Payment Capacity	($313,500)	($2,030,879)	$333,181	$36,205,339	$34,194,978
Cost of Water	$370,000	$2,751,000	$3,337,000	$18,255,000	$24,713,000
Remaining Payment Capacity	($683,500)	($4,781,879)	($3,003,819)	$17,950,339	$9,481,978
Capital Repayment of Drainage Service	$1,565,000	$11,434,000	$11,705,000	$31,250,000	$55,954,000
Difference ($)	($2,248,500)	($16,215,879)	($14,708,819)	($13,299,661)	($46,472,022)

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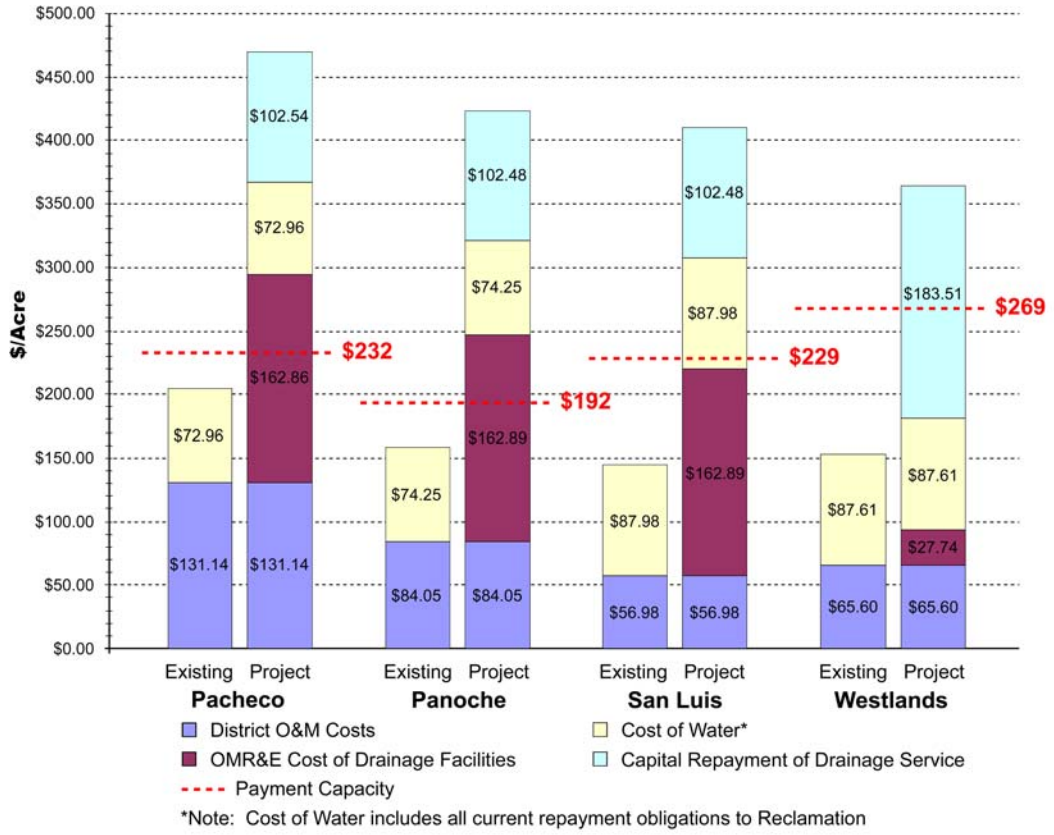

Figure S-2. In-Valley/Water Needs Land Retirement Alternative district payment capacity ($/acre), with and without project

Based on the values estimated in table S-10, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing district O&M and assigned annual OMR&E costs of drainage service under the In-Valley/Drainage-Impaired Land Retirement Alternative. After paying for water, only Westlands has some ability to repay their assigned capital investment costs of drainage service facilities under this alternative.

Figure S-3 illustrates the four water districts' payment capacity relative to their existing obligations and implementation of the In-Valley/Drainage-Impaired Land Retirement Alternative. As with the preceding alternative, all four districts currently have some remaining payment capacity. However, the implementation of this alternative far exceeds their ability to repay the associated costs of the project when coupled with their existing obligations. None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if this alternative is implemented.

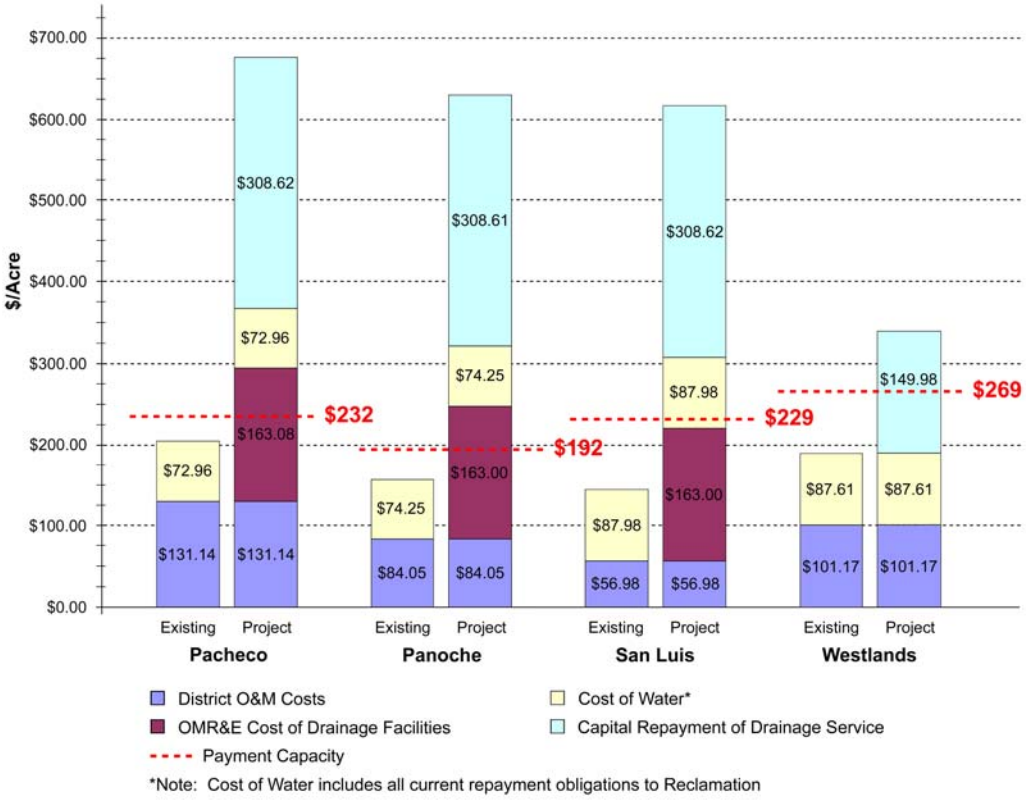

Figure S-3. In-Valley/Drainage-Impaired Land Retirement Alternative district payment capacity, with and without project.

Of the total annual capital repayment obligation of $56 million, only Westlands Water District has the ability to pay a portion of the amount, approximately 32 percent. Under Reclamation law, this alternative is financially infeasible due to Pacheco's, Panoche's, and possibly San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, this alternative is still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation.

Findings

Of the four feasibility tests a project must meet, both action alternatives satisfy only two—technical and environmental feasibility. The following briefly summarizes the results of the four tests.

Technical Feasibility

Both action alternatives are technically feasible, constructible, and can be operated and maintained. Though the RO treatment plants are not at a

feasibility level design, this does not affect the finding of technical feasibility. RO technology is continually evolving and improving over time. This report anticipates these improvements will be incorporated as they become available over the 50-year life of the project.

Environmental Feasibility

Both action alternatives are environmentally feasible. Both action alternatives, as well as the No-Action Alternative, were included in a final EIS, which was filed in May 2006. The environmental impacts were evaluated and a mitigation plan was included in the final EIS. The In-Valley/Drainage-Impaired Land Retirement Alternative was identified as the environmentally preferred alternative. In a March 16, 2006, biological opinion, the U.S. Fish and Wildlife Service concurred with Reclamation that the In-Valley/Water Needs Land Retirement Alternative is not likely to adversely affect federally listed endangered species within the project area.

Economic Feasibility

Neither action alternative is economically feasible. The two action alternatives have negative net NED benefits as follows:

- In-Valley/Drainage-Impaired Land Retirement Alternative – ($51,524,000)
- In-Valley/Water Needs Land Retirement Alternative – ($131,146,000)

Because both of the action alternatives would result in net negative NED benefits, neither action alternative is economically justified for implementation.

The In-Valley/Drainage-Impaired Land Retirement Alternative is the alternative that reasonably maximizes net NED benefits (although the benefits are negative) and is designated the national economic development plan (NED Plan) in accordance with the *Principles and Guidelines*.

The In-Valley/Water Needs Land Retirement Alternative is considered the locally preferred plan because it mostly closely parallels the locally developed Westside Regional Drainage Plan.

Financial Feasibility

Neither action alternative is financially feasible for implementation (see figure S-4).

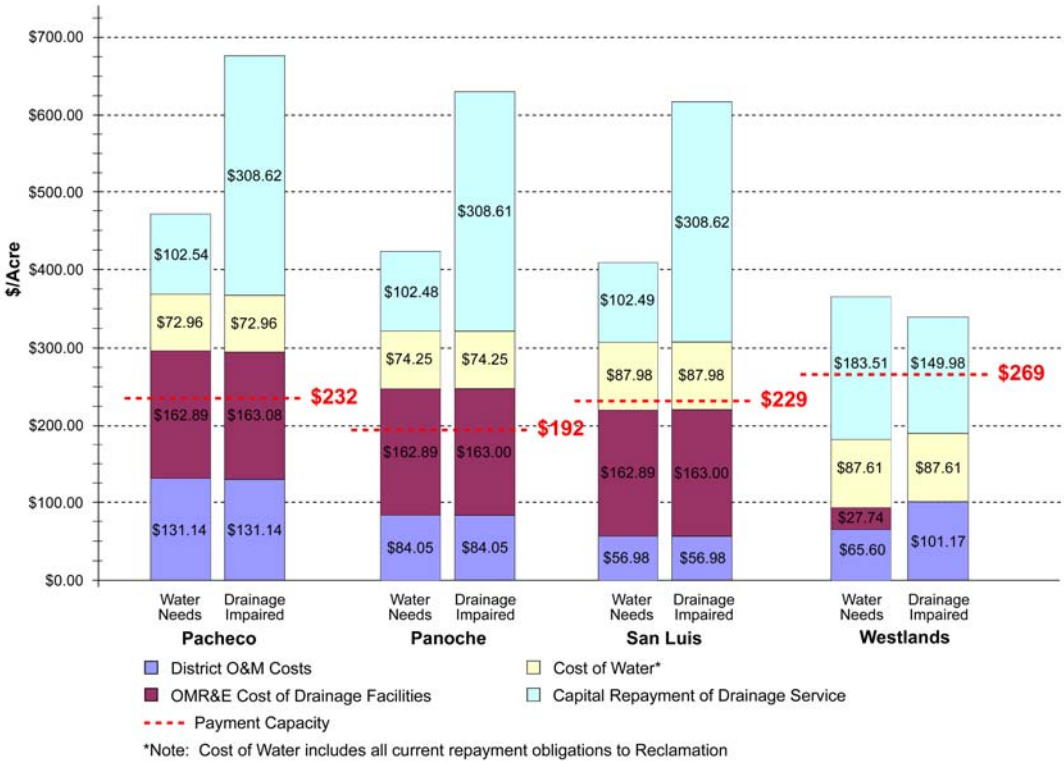

Figure S-4. Comparison of two action alternatives district payment capacity ($/acre).

Under both action alternatives, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing district O&M and assigned annual OMR&E costs of drainage service. None of the four water districts have the ability to fully repay its assigned capital costs of drainage service facilities. The implementation of either action alternative would far exceed their ability to repay the associated costs of the project when coupled with their existing obligations.

Full payment of annual O&M costs is required by section 5 of the Reclamation Extension Act of 1914 (Public Law 63-208; 43 U.S.C. Sections 471 and 472). Full payment in advance of water delivery is mandated by section 46 of the Omnibus Adjustment Act of 1926 (Public Law 69-284; 43 U.S.C. Section 423e) and section 6 of the 1939 Act (Public Law 76-260; 43 U.S.C. Section 485e). Under Reclamation law, both action alternatives are financially infeasible due to Pacheco's, Panoche's, and San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, these alternatives are still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation. None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if either action alternative is implemented.

Section 101(e) of the Continuing Appropriations Act of October 18, 1986 (Public Law 99-500) amended section 8 of the San Luis Unit Act of June 3, 1960 (74 Statute 156; Public Law 86-488) with the addition of section 8(b). Section 8(b) prohibits the Secretary from directly or indirectly recovering from CVP power contractors the costs of drainage service. This amendment to the Act of 1960 prohibits the assignment of any costs from implementation of either action alternative to CVP power customers. Therefore, if either action alternative is implemented, this will require separate accounting of the OMR&E and capital repayment costs associated with the drainage service. If either action alternative is implemented, the Restoration Fund will be adversely affected because the charges that the San Luis Unit contractors are unable to pay cannot be assigned to power contractors.

Recommendations

The recommendation is to implement the In-Valley/Water Needs Land Retirement Alternative. In order to implement this alternative, it would require Congress to:

- Amend Public Law 96-488, the San Luis Unit, Central Valley Project Act of 1960 designating the In-Valley/Water Needs Land Retirement Alternative as a distribution systems and drains component of the San Luis Unit, increase the construction cost ceiling for distribution systems and drains by $2.69 billion (2006 dollars), and authorize indexing.

- Provide relief from Section 5 of the Reclamation Extension Act of 1914 that requires full payment of the operation and maintenance (O&M) charges related to delivery of water. Authorize Federal appropriations to pay the O&M charges related to implementation of the In-Valley Water Needs Land Retirement Alternative that the Panoche Water District, Pacheco Water District, and San Luis Water District are unable to pay.

- Authorize the Secretary to defer without interest each San Luis Unit contractor's obligation to repay reimbursable capital and/or reimbursable O&M costs incurred to implement the In-Valley Water Needs Land Retirement Alternative, and if necessary, the repayment of some or all of the remaining reimbursable capital costs incurred to construct the pre-existing CVP facilities until the Secretary determines that such contractor has the independent ability to repay its share of such costs without unduly burdening its water users, provided such determinations are made at not more than 5-year intervals.

- Direct the Secretary that the repayment of the reimbursable capital costs and reimbursable O&M costs incurred to implement the In-Valley Water Needs Land Retirement Alternative are to be accounted for separately from the repayment of the reimbursable capital costs and the reimbursable O&M costs incurred to construct and operate the pre-existing CVP facilities.

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Abbreviations and Acronyms

acre-ft	acre-feet
acre-ft/yr	acre-feet per year
AFT	American Farmland Trust
APE	area of potential effect
Bay	San Francisco Bay
Bay-Delta	San Francisco Bay-Sacramento-San Joaquin River Delta
CAR	Coordination Act Report
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act Control Board
DEC	Policy, Independent Oversight of Design, Cost Estimating, and Construction
Delta	Sacramento-San Joaquin River Delta
Drain	San Luis Interceptor Drain
DWR	California Department of Water Resources
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EQ	environmental quality
ET	evapotranspiration
FSI	Farmland of Statewide Importance
FY	fiscal year
GDA	Grassland Drainage Area
GIS	geographic information system
Interior	U.S. Department of the Interior
mg/kg	milligram per kilogram
M&I	municipal and industrial
NASS	National Agricultural Statistics Service
NED	national economic development
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
O&M	operation and maintenance
OM&R	operation, maintenance, and replacement
OMR&E	operation, maintenance, replacement, and energy
OSE	other social effects
PAR	Preliminary Alternatives Report

PFR	Plan Formulation Report
ppb	parts per billion
Principles and Guidelines	*Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*
Reclamation	Bureau of Reclamation
RED	regional economic development
RO	reverse osmosis
RRR	Red Rock Ranch
SCADA	supervisory control and data acquisition
Se	selenium
Service	U.S. Fish and Wildlife Service
SHPO	State Historic Preservation Officer
SJRECWA	San Joaquin River Exchange Contractors Water Authority
SJVDIP	San Joaquin Valley Drainage Implementation Project
SJVDP	San Joaquin Valley Drainage Program
SLDFR	San Luis Drainage Feature Re-evaluation
SLWD	San Luis Water District
State Board	State Water Resources Control Board
TMDL	total maximum daily load
Unit	San Luis Unit
U.S.C.	United States Code
URS	URS Corporation
Westlands	Westlands Water District

Chapter 1
Purpose and Need for Action

The purpose of the San Luis Drainage Feature Re-evaluation Project is to provide agricultural drainage service to the Central Valley Project's (CVP) San Luis Unit (Unit). Drainage service is defined as managing the regional shallow groundwater table by collecting and disposing of shallow groundwater from the root zone of drainage-impacted lands and/or reducing contributions of water to the shallow groundwater table through land retirement.

This chapter locates the potential project, describes the purpose and need for the action, summarizes the background of the study, provides the authority, summarizes the public involvement and scoping for the project, and lists other studies previously conducted in the project area.

Location of Project

The project area consists of the drainage study area in the San Joaquin Valley and other areas affected by disposal alternative features, such as conveyance, treatment facilities, and discharge locations. The entire project area extends beyond the San Joaquin Valley west to the Pacific Ocean as far south as Point Estero and northwest to the Sacramento-San Joaquin River Delta (Delta) in northern and central California. Features of the action alternatives are located in three counties—Fresno, Kings, and Merced.

The drainage study area—where the drainage is produced—is located in the western San Joaquin Valley and consists primarily of the lands lying within the boundary of the Unit, as shown on figure 1. The Unit, as defined by the authorized service area, encompasses the entire Westlands, Broadview, Panoche, and Pacheco Water Districts and the southern portion of the San Luis Water District. Lands immediately adjacent to the Unit, in the Grassland Drainage Area, have also been included. For this study, the drainage study area has been subdivided into the Westlands Water District (Westlands) (north, central, and south sections) and the Northerly Area.

The drainage study area (including 40,400 acres of lands to the north and outside of the Unit) totals approximately 730,000 acres, as shown in table 1.

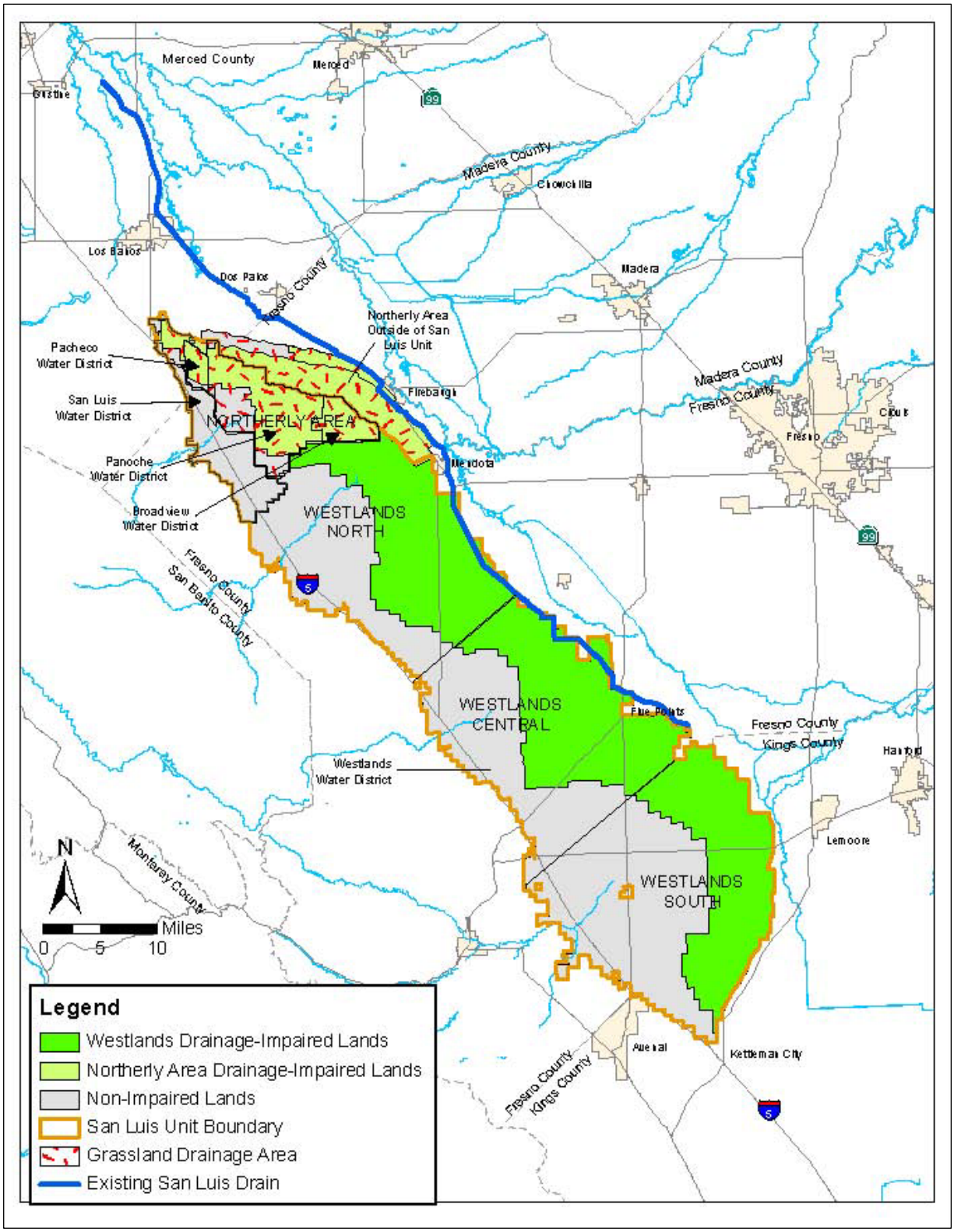

Figure 1. Westlands Water District and Northerly Area lands in the drainage study area.

Table 1. Drainage study area[1]

District	Area (acres)
Westlands Water District	604,000
Northern San Luis Unit Districts	85,600
Northerly Area Outside of San Luis Unit	40,400
Total	**730,000**

[1] All areas are based on acreage reported by the water districts except the San Luis Water District, which was calculated using Arc Geographic Information System.

Federal Interest

Federal interest is established either by legislation or through an evaluation of a proposed action relative to the agency's mission. For an action to be federally implementable, it must be feasible as defined by the *Economic and Environmental Principles and Guidelines* (*Principles and Guidelines*). The *Principles and Guidelines* require Federal actions contribute to the national economic development (NED). The San Luis Act of 1960 as amended establishes the Bureau of Reclamation's (Reclamation's) Federal interest in the proposed action. This interest was reaffirmed by the Federal District Court Order dated November 29, 2000.

However, the requirement for a net positive contribution to the Nation's economy cannot be met by either of the two action alternatives. This report details the analysis surrounding that conclusion.

Purpose and Need

The project purpose is to provide agricultural drainage service to the San Luis Unit to achieve a long-term, sustainable salt and water balance in the root zone of irrigated lands in the Unit and adjacent areas. Drainage service is defined as managing the regional shallow groundwater table by collecting and disposing of shallow groundwater from the root zone and/or reducing contributions of water to the shallow groundwater table through land retirement. A long-term sustainable salt and water balance is needed to ensure sustainable agriculture in the Unit and the region.

A Ninth Circuit Court of Appeals ruling upheld a district court finding that Reclamation has a statutory duty to provide drainage service to the Unit, and the district court subsequently issued an order stating that the *". . . Department of the Interior. . . shall without delay, provide drainage to the San Luis Unit, pursuant to the statutory duty imposed by section 1(a) of the San Luis Act."* To meet the overall purpose and need, Reclamation used four related project objectives to develop the alternatives evaluated.

- Drainage service will consist of measures and facilities to provide a complete drainage solution, from production through disposal, and avoid a partial solution or a solution with undefined components.

- Drainage service must be technically proven and cost effective.

- Drainage service must be provided in a timely manner.

- Drainage service should minimize adverse environmental effects and risks.

The potential Federal action evaluated in this feasibility study is the provision of drainage service to the San Luis Unit to fulfill the requirements of the February 2000 Court Order.

Areas Needing Drainage

To adequately design the facilities required to provide drainage service, Reclamation developed an estimate of the quantity and quality of the drainwater requiring disposal based on the answers to the following questions:

- Which lands will ultimately need drainage to maintain arability of the soil?

- How much subsurface water will need to be drained from the fields to maintain arability of the soil?

- What reasonable on-farm and in-district drainwater reduction actions could be implemented to reduce the rate at which shallow groundwater would reach the root zone?

Panoche Water District has a gross 38,000-acre service area, of which 22,000 acres are improved with subsurface drainage systems. The district has had drainage service since the 1950s, when it began receiving CVP water from the Delta-Mendota Canal. Panoche Water District coordinates policies and activities with Panoche Drainage District, including participation in the Grassland Bypass Project and San Joaquin River Improvement Project.

Panoche Drainage District consists of a gross 44,000 acres, which include the 38,000 acres of Panoche Water District (in the San Luis Unit), along with approximately 6,000 acres in Mercy Springs, Oro Loma, and Eagle Field Water District (outside of the San Luis Unit). Panoche Drainage District has no water supply function and no CVP water service contract. The district is the largest participant of the Grassland Bypass Project and actually operates the project on behalf of the group. Panoche Drainage District also owns and is the primary operator of the San Joaquin River Improvement Project, composed of

approximately 4,000 acres, the reuse project that serves Panoche Water District and the other participants in the Grassland Bypass Project.

Pacheco Water District consists of approximately 4,410 acres, of which about 2,750 acres have tile drainage systems. In addition, about 830 tiled acres in the San Luis Water District receive drainage service based upon a historical Pacheco Water District contract and share drainage facilities. Drainage from these acres is managed together with Pacheco Water District drainage (i.e., through participation in the Grassland Bypass Project). The balance of the organized drainage area in San Luis Water District is within Charleston Drainage District (4,300 acres).

Of the gross 604,000 acres in Westlands service area approximately 570,000 acres are classified as irrigable of which landowners farm on about 559,500 (minus any lands fallowed annually). Water is delivered throughout Westlands via underground pipelines, and all water is metered at the point of delivery. Westlands delivers both municipal and industrial (M&I) and irrigation water. Average total demand for Westlands is approximately 1,394,000 acre-feet per year (acre-ft/yr). The annual safe yield available from groundwater pumping is approximately 148,000 acre-ft/yr leaving Westlands with a potential annual water supply shortfall of 96,000 acre-feet (acre-ft).

Broadview is located on the west side of the San Joaquin Valley just north of Westlands Water District. Following the expiration of their long-term contract in 1995, Broadview entered into a series of interim contracts to provide for 27,000 acre-ft/yr of CVP water. In March 2007, Broadview was annexed by Westlands Water District. Lands within Broadview have shallow water tables, with groundwater averaging 5-10 feet below ground surface (1987 data). The shallow groundwater adversely affects crop productivity. Broadview landowners had struggled to maintain economic viability due to drainage impacts and changing farm economy. As a result, the acreage is currently fallowed.

The San Luis Water District (SLWD) is located on the western side of the San Joaquin Valley near Los Banos and within both Merced and Fresno Counties. After a series of inclusions and exclusions of land, the district's current size is approximately 66,458 acres. Interstate 5 is the approximate dividing line between the hilly terrain to the west and the relatively level land to the east. SLWD's current distribution system consists of pipelines and lined and unlined canals. The district has a long-term contract with Reclamation for a maximum of 125,080 acre-ft of CVP supply from the Delta-Mendota and San Luis Canals. The district's long-term contract will expire on December 31, 2008. Only the southern portion of the SLWD within the Charleston Drainage District, approximately 4,300 acres, is included in the project study area.

The non-San Luis Unit portions of the Northerly Area considered in the study are outside of the San Luis Unit and include a portion of Central California Irrigation

District and Firebaugh Canal Water District, both exchange contractors. All of these areas have participated in the Grassland Bypass Project and are covered by the Westside Regional Drainage Plan.

Of the 730,000 acres in the drainage study area, about 379,000 acres are drainage impaired and constitute the drainage service area. The areas needing drainage service were estimated from previous projections and information collected as part of the Plan Formulation Report (PFR). Table 2 summarizes the areas needing drainage service for both Westlands and the Northerly Area, resulting in a total drainage service area of 379,000 acres.

Table 2. Area needing drainage service[1]

District	Area (acres)
Westlands North	102,000
Westlands Central	104,000
Westlands South	92,000
Subtotal (Westlands Water District)[2]	298,000
Northern San Luis Unit Districts[3]	45,000
Northerly Area Outside of San Luis Unit	36,000
Subtotal (Northerly Area)	81,000
Total	**379,000**

[1] Source of table: San Luis Drainage Feature Re-evaluation Environmental Impact Statement, Reclamation, May 2006.

[2] The areas needing drainage service include the 44,106 acres already permanently retired.

[3] Based on projections in the environmental impact statement (EIS), appendix C, table C1-3.

The alternative disposal designs are based on estimates of the drainage flows emanating from subsurface tile drain systems installed by farmers within the drainage-impaired lands. It is reasonable to expect that some of the farmers within the drainage-impaired areas would not elect to install tile drain systems based on economic or other considerations. Therefore, Reclamation estimates that only two-thirds of the drainage service area (254,000 acres) would actually have tile drains installed during the 50-year planning life of the project. Analysis of the drainwater flows and water table elevations indicates that arability of the entire 379,000-acre drainage service area is maintained with this condition (URS Corporation 2002).[3]

[3] Control Memorandum, San Luis Drainage Feature Re-evaluation, URS Corporation, June 2002.

Drainwater Quantity and Quality

The details of the modeling assumptions and results to determine the quantity and quality of drainwater for the alternatives are located in appendix C of the EIS (Reclamation 2006).

Based on modeling of the groundwater conditions and agricultural productivity, Reclamation identified the lands that would require drainage service, the rate at which farmers would install tile drains to collect drainwater, and the rate at which the water would need to be drained from the fields to maintain arability. Reclamation then evaluated the potential drainwater reduction actions that could be implemented on-farm, in-district, or with regional facilities. Reclamation determined that regional drainwater reuse facilities would be a cost-effective measure for reducing the volume of drainwater for treatment and disposal and should be included in all alternatives. Reuse facilities irrigate salt-tolerant crops with unblended drainwater.

To determine the quantity and quality of drainwater that the collection and reuse systems would receive from farms and water districts (and, therefore, the size of the facilities), Reclamation identified additional drainwater reduction actions that would be more cost effective than drainwater collection, reuse, treatment, and disposal. That is, Reclamation identified the drainwater reduction measures where the cost of reducing an acre-foot of drainwater would be less than the cost of collecting, reusing, treating, managing, and disposing of that acre-foot of drainwater. To size the drainwater collection, reuse, treatment, and disposal facilities, Reclamation assumed that farmers and/or water districts would implement those actions that would be cost effective. Farmers and water districts would have flexibility to select other measures to reduce drainwater.

Reclamation found four drainwater reduction measures to be cost effective—drainwater recycling, shallow groundwater management, seepage reduction, and irrigation system improvements (Reclamation 2006). In addition, Reclamation determined that the storage capacity of the groundwater aquifer beneath the reuse facilities could be used to regulate the seasonal variations in drainwater flows.

Based on this analysis, Reclamation developed drainage quantities and flow rates (Reclamation 2002). The total area needing drainage service is reduced by land retirement programs and actions. Land retirement is defined as the removal of lands from irrigated agricultural production by purchase or lease for other purposes or land uses through non-irrigation covenants and/or deed restrictions. In this scenario, land retirement also involves the purchase of land for treatment facilities. Land retirement assumptions are described in the EIS (Reclamation 2006). The maximum estimated flow of drainwater produced is about 97,000 acre-ft per year. Different alternatives contain features that reduce this amount. Final drainwater flows for treatment and disposal range from 8,100 to 21,000 acre-ft/yr, depending on the amount of land retirement in the alternatives.

Background

Planning for drainage facilities to serve the San Joaquin Valley has occurred since the mid-1950s. Drainage facilities were discussed when Reclamation studied the feasibility of water supply development for the Unit. In the 1957 California Water Plan, the California Department of Water Resources (DWR) also planned for drainage facilities from near the Buena Vista lakebed in Tulare Basin to the Delta. Figure 2 provides an overview of historical and future events for San Joaquin Valley drainage planning.

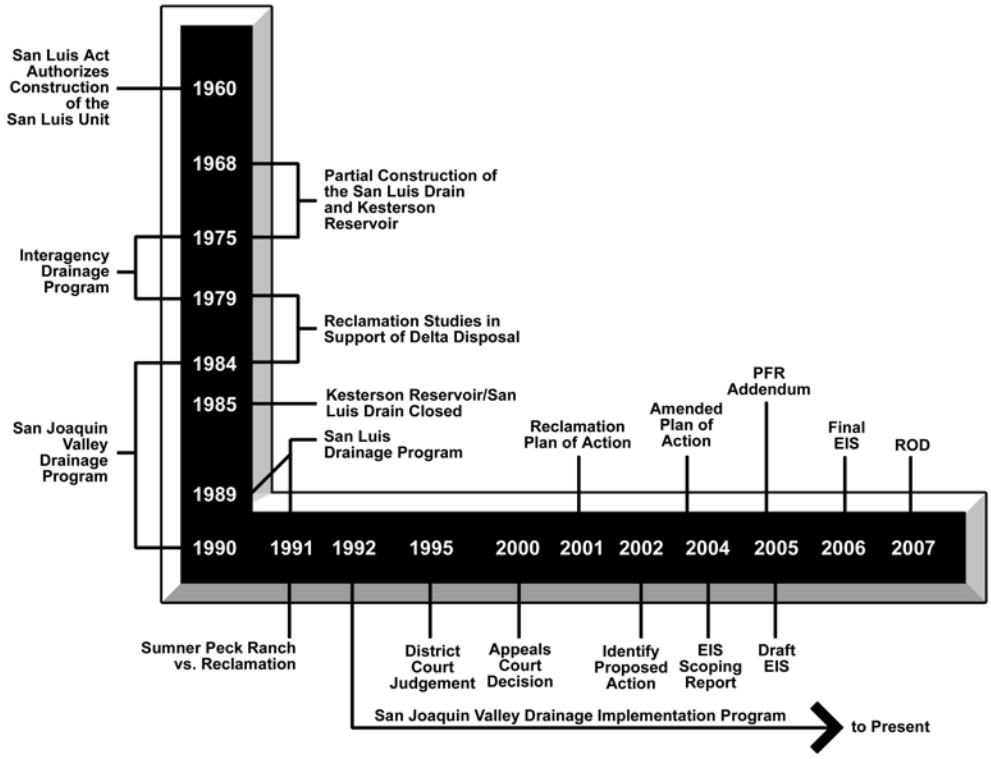

Figure 2. San Luis Unit drainage timeline.

In 1960, the Congress enacted Public Law 86-488 (San Luis Act) authorizing construction of the San Luis Unit of the Central Valley Project. Also in 1960, California voters approved the Burns-Porter Act authorizing the State Water Project. Both acts included facilities to remove drainwater from the San Joaquin Valley.

In the early 1960s, the plan for constructing the San Luis Interceptor Drain (the Drain) changed from an unlined ditch to a concrete-lined canal. In 1968, Reclamation began construction of the Drain and the first stage of Kesterson Reservoir. Kesterson Reservoir became part of a wildlife refuge through a joint

agreement between Reclamation and the U.S. Fish and Wildlife Service (Service). The primary purpose of the reservoir was to regulate flow to support completion of the Drain to the Delta. By 1975, an 82-mile segment of the Drain (ending at Kesterson Reservoir) was completed; and, subsequently, 120 miles of collector drains were constructed in a 42,000-acre area of the northeast portion of Westlands Water District.

Between 1975 and 1979, the San Joaquin Valley Interagency Drainage Program—a joint effort between Reclamation, DWR, and the State Water Resources Control Board (State Board)—was formed to find an economically, environmentally, and politically acceptable solution to San Joaquin Valley drainage problems. This group recommended that a drain be completed to the Delta, terminating near Chipps Island. The State of California declined to participate in a master drain and, based on the San Joaquin Valley Interagency Drainage Program's recommendation, Reclamation initiated a special study to fulfill the requirements for a discharge permit from the State Board for a Federal-only drain.

In 1983, discovery of embryonic deformities of aquatic birds at Kesterson Reservoir significantly changed the approach to drainage solutions in the San Joaquin Valley. Because of the high selenium (Se) levels found in the drainwater and its effects at Kesterson Reservoir, the San Luis Unit Special Study was suspended. In 1985, following a Nuisance and Abatement Order issued by the State Board, discharges to Kesterson Reservoir were halted; and feeder drains leading to the Drain were plugged.

In response to the Kesterson problems, the San Joaquin Valley Drainage Program (SJVDP) was formed by the governor of California and the Secretary of the Interior. This joint Federal/State effort was established to develop solutions to drainage and drainage-related problems. While the initial efforts looked at all possible solutions, a policy decision in 1987 limited studies, to in-valley drainage management measures based on a recommendation from a citizen's advisory committee consisting of water users, environmental advocates, and public interests. The SJVDP's final report (SJVDP 1990) recommended an in-valley solution that included source reduction, drainage reuse, land retirement, evaporation basins, groundwater management, San Joaquin River discharge, and institutional changes. This plan provided a strategy for managing salts through 2040 and stated that, eventually, salts may need to be removed from the San Joaquin Valley.

While the SJVDP was preparing its recommendations, a 1986 Federal court order settled a lawsuit among Westlands, Reclamation, and various classes of landowners and water users in Westlands. Named after one of the parties to the lawsuit, the Barcellos Judgment addressed, among other things, the supply of water to Westlands and the provision of drainage service to Westlands. It directed Reclamation to develop, adopt, and submit to Westlands a plan for drainage

service facilities by the end of 1991, leading to preparation of the *San Luis Unit Drainage Program Plan Formulation Report* and the related draft EIS.

Several landowners subsequently sued the U.S. Department of the Interior (Interior), seeking completion of the master drain to the Delta. These lawsuits were partially consolidated in 1992 to address the common allegation that Interior was required by law to construct drainage service facilities from certain lands in the Unit. In 1995, the district court issued a partial judgment stating that the San Luis Act established a mandatory duty to provide drainage. The judgment ordered Interior to promptly prepare, file, and pursue an application for a discharge permit with the State Board to complete the San Luis Drain to the Delta. Interior appealed this judgment.

In February 2000, the U.S. Court of Appeals concluded that Interior must provide drainage service but held that Interior had the discretion to meet the court order with a plan other than the interceptor drain solution. In accordance with the court order, Reclamation developed a Plan of Action (April 2001; Reclamation 2001a) outlining its proposed efforts to provide prompt drainage service considering a variety of options.

- The first phase of the re-evaluation, consistent with the Plan of Action, was the process of identifying a list of preliminary alternatives that met the court's order to provide prompt drainage service to the Unit. The result of the first phase was the *Preliminary Alternatives Report (PAR), San Luis Unit Drainage Feature Re-evaluation*, which was published in December 2001 (Reclamation 2001b). The alternatives described in the PAR meet the court order and use proven technology.

- The second phase of the re-evaluation was the preparation of the PFR, which included the determination of the lands that require drainage service; the anticipated quantity and quality of drainwater for which Reclamation will need to provide service; the formulation, evaluation, and screening of the preliminary alternatives; the description of the final set of alternative plans; and the selection of the proposed action. The PFR was published in December 2002 (Reclamation 2002).

- The third phase of the re-evaluation refined the components of the proposed action, provided additional engineering detail, and completed the environmental review of the proposed action and alternatives. The product of this phase is an EIS and a record of decision.

The 2002 PFR identified the In-Valley Disposal Alternative as the preferred alternative to provide drainage service. The In-Valley Disposal Alternative was

compared to No Action and the three Out-of-Valley Alternatives and was selected in 2002 based on cost, implementation, and other available environmental information.

Land retirement was considered in the 2002 PFR but was excluded as a primary drainage reduction component of the Federal drainage service alternatives under consideration at that time because it did not meet the project purpose of "providing drainage service." Land retirement is a measure that removes land from irrigated agricultural production, reducing the need for drainage service on remaining lands. However, as a result of public and stakeholder input, Reclamation determined that it would broaden the scope of analysis to include large-scale land retirement as a component of some of the action alternatives.

On February 5, 2004, Reclamation submitted to the Court an *Amended Plan of Action for Drainage to the San Luis Unit*. The Amended Plan of Action states that Reclamation will continue to refine and evaluate all five alternatives described in the PFR for inclusion in the EIS. Additionally, Reclamation formulated alternative(s) that use land retirement as a method to control drainage need, by comparing costs, benefits, and impacts for alternatives with different amounts of land retirement.

Authority

The reevaluation is completed under the authority of Public Law 86-488 as amended, which authorized the Unit.

Public Involvement and Scoping

Reclamation published a Notice of Intent to prepare an environmental impact statement in the *Federal Register* in October 2001 and held a series of public scoping meetings in Fresno and Concord in November 2001. At these meetings, Reclamation provided information on the court decision prompting the EIS, as well as study plans, options to be re-evaluated, and other important components of the project.

In January 2003, Reclamation held a second series of scoping meetings to receive comments from the public on issues that should be included in the EIS in Morro Bay, Fresno, Concord, and Sacramento. At this series of meetings, Reclamation presented a brief history of the project, a review of the alternatives, and other information. Reclamation conducted additional public scoping on land retirement alternatives in early March 2004.

According to a scoping report, public concerns and comments received at the public scoping meetings reflected regional preferences for drainage disposal and a desire among stakeholders to reduce or eliminate potential environmental impacts

drainage service may generate, as well as a preference to reduce or eliminate the need for drainage service altogether.

In addition to public scoping meetings discussed above and interagency workshops held throughout 2002, Reclamation conducted briefings for a number of local agencies, cooperating agencies, environmental groups, and congressional staff (EIS). The public draft EIS was available for review and comment following filing of the Notice of Availability of the EIS with the U.S. Environmental Protection Agency. This review was to allow comments from interested parties on the draft EIS completeness and adequacy in disclosing the environmental effects of the alternatives under consideration and to allow input into Reclamation's determination of a preferred alternative. This report presents the evaluation of the feasibility of the two most promising alternatives.

Previous Studies and Activities in Project Area

Related projects are those that would directly affect drainwater quality and quantity or are programs attempting to address drainage needs. Related projects identified in the study area are the Grassland Bypass Project; the San Joaquin Valley Drainage Implementation Project, including ongoing studies and pilot projects by Reclamation, DWR, and others; the San Luis Unit long-term water service contract renewal; two land retirement programs; the Westside Regional Drainage Plan, and the Water Supply, Reliability, and Environmental Improvement Act.

Grassland Bypass Project

The Grassland Area farmers established the Grassland Drainage Area and a regional drainage entity to collect subsurface drainwater from 97,400 acres and use a portion of Reclamation's San Luis Drain to convey the water to its current terminus at Mud Slough, through September 2009. Constructed and funded portions of the project are included in the No-Action Alternative for this re-evaluation. Future components of the Grassland Bypass Project have been incorporated into the action alternatives evaluated in this feasibility study, specifically expanded reuse, treatment, and disposal components.

San Joaquin Valley Drainage Program and Ongoing Studies

The SJVDP produced its Rainbow Report in September 1990. Since then, several of the recommendations for action have been implemented but not on a scale large enough to address the drainage management and disposal needs in the San Luis Unit. Recommendations in the plan are consistent with features included in the In-Valley Disposal Alternative.

Reclamation, DWR, and other SJVDP agencies are pursuing new technologies through pilot projects involving selenium treatment, enhanced solar evaporation, and marketing of salts.

San Luis Unit Long-Term Contract Renewal

Reclamation proposed to renew the long-term water service contracts for the CVP San Luis Unit Contractors—which include the cities of Avenal, Coalinga, and Huron; Pacheco, Panoche, San Luis, and Westlands Water Districts; and the California Department of Fish and Game. Reclamation initially released a draft EIS in November 2004 (Reclamation 2004). Upon review of the comments received, Reclamation decided to prepare a new draft EIS which was released in October 2005 (Reclamation 2005). During the comment period of the 2005 draft EIS Reclamation also prepared additional supplemental information to the draft EIS. The proposed contracts are for the delivery of up to 1,436,358 acre-ft of CVP water per year. Reclamation proposes to renew M&I water service contracts for a period of 40 years and agricultural only or agriculture and M&I water service contracts for a period of 25 years. The purpose of this Federal action is to renew the Unit long-term water service contracts consistent with Reclamation authority and all applicable State and Federal laws, including the Central Valley Project Improvement Act (CVPIA). Project alternatives evaluated in the EIS include the terms and conditions of the long-term contracts and tiered water pricing (Reclamation 2005).

Land Retirement Programs

The objective of Reclamation's CVPIA Land Retirement Program is to reduce the volume of subsurface drainwater through a voluntary program of purchases of land, water, and other property interests from willing sellers who receive CVP water allocations. Land retirement eliminates the application of irrigation water, which reduces the amount of subsurface drainage resulting on the affected property.

In addition, Westlands is engaged in land retirement due to litigation and water supply constraints. Drainage-impacted land is being retired on a voluntary basis under three settlement agreements (EIS section 2.2.1.2). Acreage acquired by Westlands includes both temporary and permanent retirement. Approximately 100,000 acres may be purchased from individual landowners, and irrigated agriculture would cease. The affected lands would be put to other beneficial uses such as wildlife habitat, dryland farming, or related economic development activities (San Joaquin River Exchange Contractors Water Authority [SJRECWA] et al. 2003).

Westside Regional Drainage Plan

The Westside Regional Drainage Plan, to provide drainage relief in portions of the San Luis Unit, represents a collaborative effort among the following

stakeholders: San Joaquin River Exchange Contractors Water Authority, Panoche Water District, Westlands Water District, and Broadview Water District. Key elements of the plan include adaptive management to perfect the final drainage management strategy, land retirement of up to 200,000 acres, groundwater management, source control, regional reuse, treatment, and salt disposal. The Westside Regional Drainage Plan calls for identification of sound and effective projects to manage drainage and an accelerated implementation schedule to comply with impending regulatory constraints. The plan establishes a phased approach to establishing drainage service, including a list of specific actions to occur under Phase I from 2003 to 2009 (SJRECWA et al. 2003). Future components of the Westside Regional Drainage Plan have been incorporated into the action alternatives evaluated in the feasibility report, specifically expanded reuse, treatment, and disposal components.

Water Supply, Reliability, and Environmental Improvement Act

This act (Public Law 108-361) directs the Secretary of the Interior to

> *". . .provide greater flexibility in meeting the existing water quality standards and objectives for which the Central Valley Project has responsibility to reduce the demand on water from New Melones Reservoir used for that purpose and to assist the Secretary in meeting any obligations to Central Valley Project contractors from the New Melones Project."*

Organization of this Report

This feasibility report uses information from the *San Luis Drainage Feature Re-evaluation Environmental Impact Statement* (SLDFR EIS) for most of the information provided in chapters 1 through 3 and 6 and 7. The alternatives presented in chapter 3 are appraisal-level descriptions. The proposed facilities at feasibility level analysis appear in chapters 4.

Chapter 1 provides an overview of the study—its location, purpose and need, background, and other information.

Chapter 2 discusses resources necessary to formulate viable alternative plans for a drainage and disposal system.

Chapter 3 presents the alternatives evaluated at the appraisal level in *San Luis Drainage Feature Re-evaluation Environmental Impact Statement* and explains how the two action alternatives were selected to be studied at the feasibility level.

Chapter 4 presents an overview of the proposed facilities analyzed at the feasibility level for the two action alternatives.

Chapter 5 presents the economic and financial analyses for the two selected alternatives at the feasibility level.

Chapter 6 summarizes the potential environmental effects of the two action alternatives studied at the feasibility level.

Chapter 7 summarizes the consultation and coordination during the course of the EIS preparation.

Chapter 8 presents the findings and conclusions that resulted from the feasibility analyses.

Chapter 9 presents the recommendations that resulted from the feasibility study.

Chapter 2
Resources, Opportunities, and Constraints

This chapter discusses resources necessary to formulate viable alternative plans for a drainage and disposal system to remove selenium laden waters from the San Luis Unit. Improvement of the quality in the existing water resources and the required agricultural drainage service to the Unit, within the constraints of water rights laws, other State and Federal laws, and environmental constraints, constitute the statutory underpinning of this re-evaluation.

Surface Water Resources

Major surface water resources in the San Joaquin Valley include the San Joaquin River and its tributaries, water supply reservoirs and canals, and wetlands maintained for wildlife habitat. Portions of the Northerly Area currently discharge to the San Joaquin River through Mud Slough as part of the Grassland Bypass Project. The San Joaquin River provides the major drainage outlet from the San Joaquin Valley. The San Joaquin River flows north along the valley trough and converges with the southerly flowing Sacramento River in the San Francisco Bay-Sacramento-San Joaquin River Delta (Bay-Delta). From there, the water flows through Suisun Bay and Carquinez Strait into San Francisco Bay (the Bay) and out to the Pacific Ocean.

In the drainage study area, water supply for other than drinking water is mainly derived from runoff from the mountains and foothills of the Coast Ranges and the Sierra Nevada foothills. The primary use of surface water in the study area is for agriculture. Surface water supplies have been developed by local irrigation districts, county agencies, private companies, and State and Federal agencies. The San Joaquin River is the main natural drainage for surface water, but it has been augmented by various manmade drainage systems.

Water Quality in the San Joaquin River Reaches and Tributaries

Selenium, salinity, and boron are the principal parameters of concern from the drainage study area. Selenium is a semimetallic trace element that is widely distributed in the earth's crust at levels less than 1 milligram per kilogram (mg/kg) and with chemical properties similar to sulfur. The natural source of Selenium in the San Joaquin Valley is erosion of marine shales in the mountain

soils of the eastern side of the Coast Range, followed by deposition of sediment in the valley, which forms the parent material for valley soils. Accelerated transfer of selenium into the valley aquatic ecosystem occurs when selenium-bearing materials are subject to floods or disturbed by road building, mining, overgrazing, and agricultural irrigation.

Irrigation water applied to agricultural lands in the western San Joaquin Valley can leach selenium from the soil to the shallow groundwater. Tile drains have been installed on some farms to reduce the harmful effects of salts reaching the root zone. However, these drains have unintentionally accelerated the leaching of selenium into the valley's surface waters. Consequently, portions of the San Joaquin River contain elevated levels of selenium and salts, which have exceeded levels considered safe for fish and wildlife species. These levels will continue to increase unless a drainage and disposal system to collect the waters with high selenium, salinity, and boron levels is developed.

Agricultural Production and Economics

The San Luis Unit is predominantly an agricultural region, comprising five water districts that hold contracts for CVP water. Westlands, Broadview, Panoche, and Pacheco Water Districts, and the southern portion of San Luis Water District cover about 713,000 acres, though not all of this acreage is irrigated. This area is one of the most productive farming regions in the United States and can continue to be with adequate water supply and drainage.

Recent data compiled from district reports, Reclamation crop reports, and the DWR crop surveys indicate that irrigated crop acreage can range up to about 550,000 acres in Westlands, depending on water supply and market conditions. In the four Northerly Area districts (Broadview, Panoche, Pacheco, and the southern portion of San Luis Water District), irrigated acreage has averaged about 80,000 acres in recent years. Not all of this land is in the potentially drainage-impaired area defined for this study.

More than 30,000 acres of land in the Northerly Area districts have subsurface drains installed and operating. These lands discharge drainwater to the Grassland Bypass (which connects to the San Luis Drain). An additional 18,000 acres of drained land outside the Unit also discharge drainwater to the Grassland Bypass. Drains have also been installed on approximately 5,000 acres within the northern portion of Westlands, and these operated until 1986. Since that time, no drainage service has been provided to the Westlands drainage-impaired area.

Land and Soil Resources

According to the American Farmland Trust (AFT), California's Great Central Valley is the most threatened major land resource area in the United States. This is based on the market value of agricultural production, development pressure, and land quality issues (AFT 1995). The San Luis Unit contains some of the most productive lands in California. However, increasingly severe soil drainage problems and associated soil salinity and sodicity problems are putting this valuable natural resource at risk.

The San Luis Drainage Feature Re-evaluation lands consist of various landforms from west to east: hills (residual soils from sedimentary rocks), fan remnants (alluvium), alluvial fans (upper and mid), lower alluvial fans or fan skirts, and basin floors. Three interfan areas are also present in the study area. These areas are particularly vulnerable to drainage problems because they receive subsurface inflows from both of the two adjoining fans, as well as converging canal seepage from two directions. The high groundwater recharge potential in interfan areas is often complicated by fine textured soils that restrict lateral flow and cause the water tables to rise in these areas. These interfan areas are susceptible to salt sink development. The Red Rock Ranch reuse area is a good example of an interfan land type. The interfan areas generally are the highest elevation lands affected by shallow groundwater. The drainage problem involves the shallow-water table and its detrimental effects on soil salinity and land productivity. The fan skirts, interfan areas, and basin floor lands (46 percent of the Unit) are generally affected by shallow groundwater tables, while the middle and upper alluvial fans and the fan terrace lands (54 percent of the Unit) are generally not affected by shallow groundwater (Reclamation 1991). The area affected by shallow groundwater is expected to increase to about 52 percent of the Unit over the 50-year planning period of the re-evaluation.

Westlands currently contains more than 350,000 acres suitable for growing any crop and about 250,000 acres suitable for only salt-tolerant crops. Based on the Westlands 2002 crop report (www.westlandswater.org), it appears that about 100,000 acres of land are now idle or fallowed. Many of these lands appear to be idle because of salinity and drainage problems. However, water supply limitations also limit the number of irrigated acres. Some of these lands were classified as non-arable by Reclamation and have not been irrigated with CVP water. A large number of arable areas in Westlands are idle in dry years because of inadequate water supply. About 1,000 acres of basin floor and fan skirt lands are not suited to grow any crop and were never completely reclaimed from native conditions. The Northerly Area also has lands suitable for growing all crops and some lands suitable for only salt-tolerant crops.

Technology and Environmental Constraints and Conflicts

A long-term sustainable salt and water balance is needed to ensure sustainable agriculture in the Unit and the region. Drainage service of this project must be technically proven and cost effective. Generally, industrial use of saline water or salts has not proven cost effective at present and has been eliminated from consideration. Constraints that would limit the project include the physical, statutory, and institutional limitations, as well as environmental factors discussed in chapter 6.

Implementation of new or revised total maximum daily loads (TMDLs) for selenium, salt, and boron in the San Joaquin River Basin must be taken into consideration in development of the alternatives. The Central Valley Project Improvement Act amends previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation, domestic uses, fish and wildlife enhancement, and power generation (Reclamation and Service 1999). The alternatives considered must contain measures to minimize effects to significant biological resources and to compensate, if necessary, for unavoidable losses or damage to protected species, important habitats, and sensitive natural communities.

The two action alternatives under feasibility level study would entail the use of evaporation basins that could possibly contribute to selenium bioaccumulation in birds within the San Joaquin Valley. Designs of these evaporation basins include measures to significantly limit the environmental impacts to birds based upon lessons learned at other evaporation basins that have been operating in the San Joaquin Valley for the past 20 years. Although several potential environmental problems are associated with salinity and selenium reduction proposals in the San Luis Unit, the greatest concern centers on the potential loss of irrigation-supported agricultural lands that produce high quality crops.

The recovery of drainage service costs (incremental effects in the drainage service area) would likely affect agricultural production and economics in the Central Valley or State of California. Feasibility level cost estimates of drainage service are quite substantial. If recovered solely through water, land, or drainage assessments on growers using the drainage facilities, the costs would likely affect their ability to operate profitably over the long term. Under the worst circumstances, costs of project operation and maintenance and repayment could be so burdensome that growers would simply not participate in the drainage service provided. Some lands could be taken out of production to avoid the need to drain them. However, loss of prime farmland due to land retirement in irrigated areas such as California is somewhat less detrimental to the Nation's food security than irreversible losses in more humid regions of the country. Many Western States currently have more good lands than water; therefore, lack of irrigation water is the most limiting factor on food production.

Chapter 3
Alternatives Formulation – Appraisal Level Analysis

This chapter describes the alternatives formulation process at the appraisal level that was presented in the SLDFR EIS, the elements common to all action alternatives, and the two action alternatives selected for feasibility study—the In-Valley/Drainage-Impaired Land Retirement Alternative and the In-Valley/Water Needs Land Retirement Alternative. Descriptions of the other viable alternatives studied in the EIS but not carried forward for feasibility level analyses, as well as the No-Action Alternative, are also briefly described. The chapter ends with an appraisal-level four-account analysis and a summary describing how the two action alternatives were selected for feasibility level study.

Alternatives Formulation

Reclamation identified 21 preliminary alternatives that were presented in the Preliminary Alternatives Report (Reclamation 2001b). The PAR identified a wide range of alternatives for providing drainage service based on two broad initial screening criteria that an alternative must: (1) meet the February 2000 court order and (2) utilize proven technology. The 21 alternatives in the PAR were grouped among three broad concepts: In-Valley Disposal; Out-of-Valley Disposal, including Ocean Disposal and Delta Disposal; and Beneficial Use.

Site visits and additional public scoping enabled more specific evaluation criteria to be developed and applied to determine reasonable alternatives that required further evaluation. Using a multiple iterative evaluation process, Reclamation considered many factors in developing the alternatives considered in the EIS. Alternatives including land retirement were refined and optimized by considering several factors before deciding the amount of land retirement in each alternative:

- **Improved irrigation efficiency** balanced with deep percolation rates to maintain salt balance in the root zone
- The **amount of drainage** to be expected under the different land retirement scenarios using the regional groundwater model
- Estimated **costs of drainage service** for the land retirement scenarios using engineering cost curves, which calculated the cost for each component of drainage service (e.g., collector system, treatment system, and disposal) for a corresponding drainage rate

- The **economic benefits** of each scenario to provide another measure to select a final set of alternatives for analysis

- **Indicators of environmental effect** (such as acres of reuse and evaporation basins needed, or amount of drainwater reclaimed for irrigation) for each scenario

Reclamation developed and analyzed potential alternatives that include combinations of land retirement, source reduction (including reduced percolation losses from irrigation, and drainwater recycling and reuse), and treatment and disposal. Scenarios mix different levels of land retirement, source reduction, and treatment/disposal. Many years of study (Reclamation 2005) have led to the appraisal analysis of seven alternatives in the EIS, along with the No-Action Alternative, which serves as the basis for determining the effects of all viable alternatives.

The alternatives studied at the appraisal level are listed below.

- In-Valley Disposal Alternative
- In-Valley/Groundwater Quality Land Retirement Alternative
- In-Valley/Water Needs Land Retirement Alternative
- In-Valley/Drainage-Impaired Land Retirement Alternative
- Ocean Disposal Alternative
- Delta-Chipps Island Disposal Alternative
- Delta-Carquinez Strait Disposal Alternative

Elements Considered in the Appraisal Level Analysis

Except for the No-Action Alternative, all alternatives under consideration include on-farm/in-district actions to reduce drainwater and Federal facilities including drainwater collection and regional reuse facilities as illustrated in figure 3.

On-Farm, In-District Activities

On-farm, in-district drainwater reduction activities are components of the drainage service alternatives that the farmers and water districts would implement. They represent the assumptions Reclamation has made regarding the conditions of the area to be served and the reasonable actions that districts could implement in the future once drainage service is provided. Potentially, other drainwater reduction measures could be implemented, but it was assumed that they would not be implemented due to the uncertainty of the measure's effectiveness.

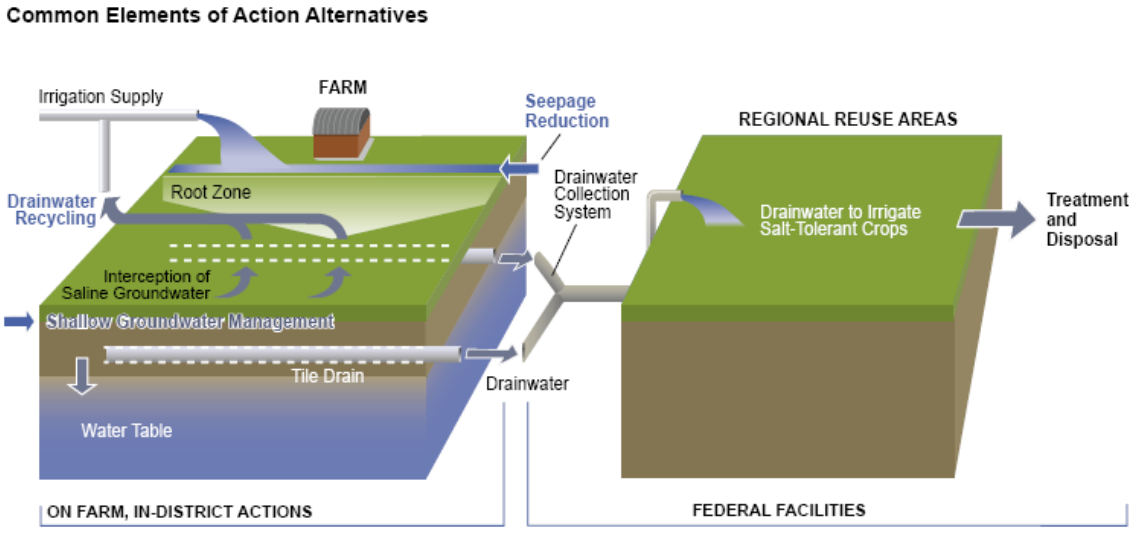

Figure 3. Common elements to all disposal alternatives.

Federal Facilities

Federal facilities included in all of the Federal action alternatives consist of a series of components designed to comply with all applicable Federal and State regulations. Principle components include:

- The collection system is intended to be a closed collection system including drain sumps and pipelines. Drain sumps would be placed at the lowest corner of the quarter sections of land or at some other low point on the quarter section lines.

- The proposed Delta-Mendota Canal sump intercept system is designed to intercept this groundwater at the existing Firebaugh sumps and convey it to the Northerly Area reuse, treatment, and disposal facilities (approximately 1,100 acre-ft/yr).

- At the reuse facilities, drainwater would irrigate salt-tolerant crops on lands near or surrounding regional reuse facilities. Each reuse facility would also be an underground regulating reservoir to control the flow of reused drainwater to downstream features. The reused drainwater would be conveyed by pipeline or canal to treatment and/or disposal facilities. The water quality of the water table under the reuse areas is expected to gradually decline during long-term use, as do all aquifers underlying irrigated farmlands.

- Each alternative would retire a minimum amount of land (44,106 acres). Additional land retirement (of 48,486 to 263,894 acres) was included for three of the In-Valley Alternatives. Retired lands are assumed to be managed as dryland farming, grazed, or fallowed.

Appraisal-Level Cost Estimates

Cost estimates for each alternative were prepared in accordance with Reclamation instructions for appraisal studies. Appraisal-level cost estimates are based mostly on existing information with a very limited amount of new data but are adequate to support a preliminary assessment of alternatives. The level of data and sophistication of the analyses are adequate to support a decision as to whether the alternatives should be carried forward for more detailed analyses and cost estimates (i.e., feasibility level) or eliminated from further studies. This decision is necessarily subjective, based on existing data, input from various specialists, and the judgment of Reclamation personnel.

For purposes of developing cost information for the EIS, retired lands not acquired for project facilities were assumed to be managed in three ways: (1) one-third of the purchased land would be used for dry land farming, (2) one-third would be used for grazing, and (3) one-third would remain fallow.

Capital costs of acquiring land for both land retirement purposes and to locate project facilities were estimated at $2,600 per acre, based on available data obtained from Fresno County land sale records, as well as land purchases by Westlands.

Alternatives Studied at the Appraisal Level

In-Valley/Drainage-Impaired Land Retirement Alternative

This alternative is one of the two alternatives from the EIS that was selected for further study in the feasibility study. This description is at the appraisal level. In addition to the common elements described previously, reverse osmosis, selenium biotreatment, conveyance systems, and evaporation basins are part of the alternative.

Description

The In-Valley/Drainage-Impaired Land Retirement Alternative would retire 308,000 acres (44,106 plus 263,894 acres), including all of the drainage-impaired lands in Westlands—approximately 298,000 acres. The Northerly Area (non-Westlands) is excluded from land retirement, except for 10,000 acres in Broadview Water District. Drainage collection, treatment, and disposal facilities would not be needed in the Westlands drainage-impaired areas. The alternative would include irrigation system improvements to reduce deep percolation to shallow groundwater. The irrigation system improvement program would occur only in the Northerly Area.

Lands remaining in production within the Northerly drainage-impaired area would be eligible for drainage service. The collection, treatment, and disposal of drainwater collected from drained lands would be only those needed to serve the

Northerly Area. Figure 4 shows relevant features for the In-Valley/Drainage-Impaired Land Retirement Area Alternative. Lands that could be retired are outside of the areas with drainwater collection but inside the drainage-impaired area.

In-Valley/Water Needs Land Retirement Alternative

Description

The In-Valley/Water Needs Land Retirement Alternative would retire lands such that the water needs of the lands remaining in production could be met by the Unit's foreseeable water supply from its CVP contracts and groundwater resources. This results in an estimated 194,000 acres retired (44,106 plus 149,850 additional acres). This estimate of land retirement is a planning-level approximation and should not be viewed as a firm prediction of future water supply or water needs. For purposes of SLDFR analyses for plan formulation, the Unit's available water supply is based on the five districts receiving an average of 70 percent of their existing CVP contract amounts totaling 1,399,100 acre-ft/yr (or about 979,400 acre-ft/yr) plus local groundwater supplies (about 185,000 acre-ft/yr) for a total available water supply of 1,164,400 acre-ft/yr.[4]

The quantity of retired acres would include lands with selenium concentrations greater than 20 parts per billion (ppb) in Westlands, lands acquired by Westlands (that could be brought into production with drainage service) and 10,000 acres in Broadview Water District. The alternative would include irrigation system improvements to reduce deep percolation to shallow groundwater.

Lands remaining in production within the drainage-impaired area would be eligible for drainage service as under the previous alternative. Figure 5 shows relevant features for the In-Valley/Water Needs Land Retirement Alternative. Lands that could be retired are outside of the areas with drainwater collection but inside the drainage-impaired areas.

In-Valley Disposal Alternative

The In-Valley Disposal Alternative lies within the San Joaquin Valley and entirely within the boundaries of the drainage study area. This alternative would include the common elements of all alternatives: on-farm and in-district actions, drainwater collection systems, Delta-Mendota Canal Drain, regional reuse facilities, and land retirement (44,106 acres). In addition to the common elements, reuse facility drainwater would be treated with reverse osmosis (RO) and selenium biotreatment before disposal in evaporation basins.

[4] This 70 percent is not an explicit assumption nor is it to be confused with the 59 percent of CVP contract supply assumption used for calculating drainage quantity for the other action alternatives.

In-Valley/Groundwater Quality Land Retirement Alternative

The In-Valley/Groundwater Quality Land Retirement Alternative consists of retiring the 44,106 acres common to all alternatives, plus all the lands in Westlands with selenium concentration greater than 50 ppb in the shallow groundwater and lands recently acquired by Westlands (approximately 38,486 acres), and 10,000 acres in Broadview Water District in the Northerly Area. Total land retirement is 92,592 acres (44,106 acres plus an additional 48,486 acres). This alternative includes irrigation system improvements to reduce deep percolation to shallow groundwater.

Lands remaining in production within the drainage-impaired area would be eligible for drainage service. The collection, treatment, and disposal of drainwater collected from drained lands would be similar to that described for the In-Valley Disposal Alternative. Lands that could be retired are outside of the areas with drainwater collection but inside the drainage-impaired areas.

Ocean Disposal Alternative

The Ocean Disposal Alternative would include the common elements of all alternatives: on-farm and in-district actions, drainwater collection systems, Delta-Mendota Canal Drain, regional reuse facilities, and land retirement (44,106 acres). Reused drainwater would be collected from the regional reuse facilities and transported by pipeline to the Pacific Ocean for disposal. The pipeline conveyance system would lie within the San Joaquin Valley from near Los Banos southeast to just south of Kettleman City and then extend southwesterly to the Pacific Ocean at Point Estero. The ocean diffuser would be approximately 1.4 miles offshore, at a depth of 200 feet, approximately 10 miles south of the southern boundary of the Monterey Bay National Marine Sanctuary. Figure 6 shows the key components of this alternative.

Delta-Chipps Island Disposal Alternative

The Delta-Chipps Island Disposal Alternative would include the common elements of all alternatives: on-farm and in-district actions, drainwater collection systems, Delta-Mendota Canal Drain to intercept Firebaugh sumps, regional reuse facilities, and land retirement. Reuse drainwater would be treated with biological selenium treatment before conveyance by canal and pipeline to the Delta for disposal. RO treatment is not included in the Delta-Chipps Island Disposal Alternative; however, reused drainwater would be treated with biological selenium treatment. The canal and pipeline conveyance system would extend the existing San Luis Drain from its current terminus at Mud Slough to the north-northwest through Merced, Stanislaus, San Joaquin, and Contra Costa Counties

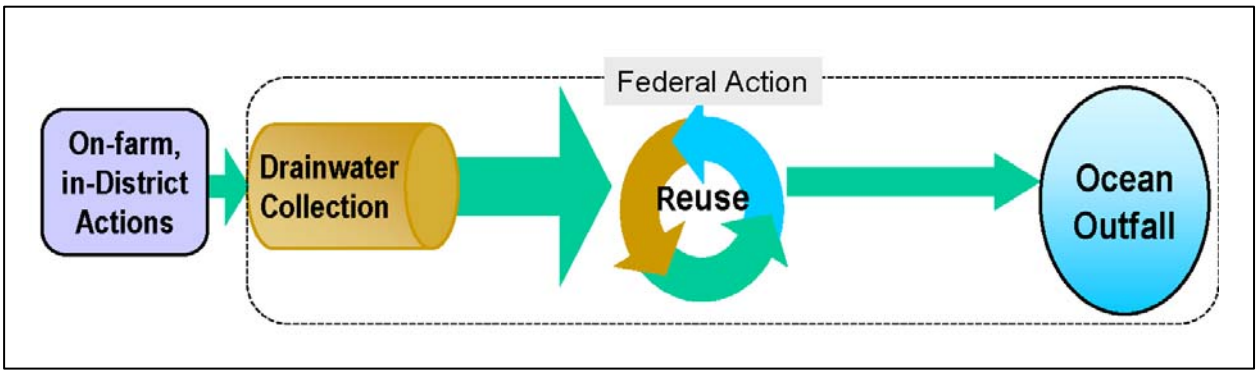

Figure 6. Components of the Ocean Disposal Alternative.

for disposal at the western end of the Delta at Chipps Island. The diffuser would be approximately 1 mile from the shoreline at Mallard Slough at a depth of 18 feet. Figure 7 shows the key components of this alternative.

Delta-Carquinez Straight Disposal Alternative

This alternative has the same route and design elements as the Delta-Chipps Island Disposal Alternative, except that it continues west past Martinez to Carquinez Strait for disposal immediately upstream of Carquinez Bridge. Tidal flows heavily influence the mixing of the water in this area. Figure 7 shows the key components of this alternative.

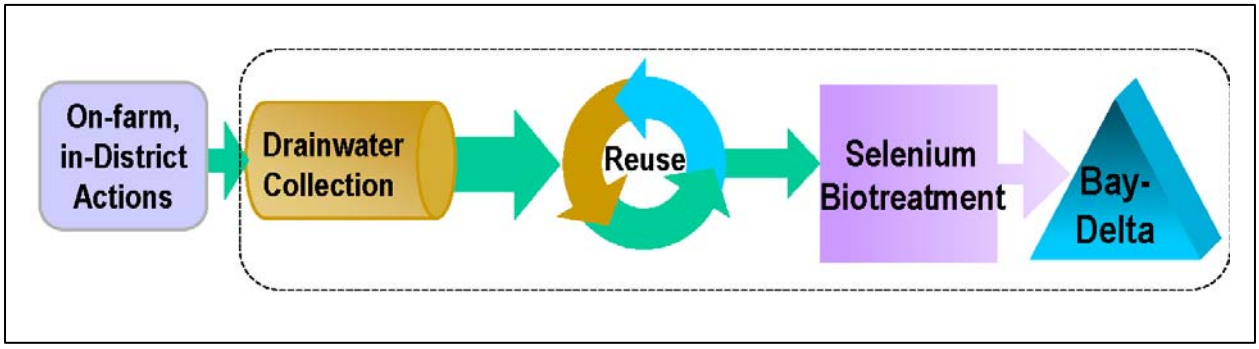

Figure 7. Components of the Delta-Chips Island Disposal Alternatives.

A total of about 177 miles of pipeline and canal would be installed, including 1 mile of pipe buried underwater. In addition, about 83 miles of the existing San Luis Drain would be used, for a total conveyance length of 260 miles. The Delta-Carquinez Strait route follows the Delta-Chipps Island route but continues west along the railroad tracks past Martinez to Carquinez Strait Regional Shoreline to the city of Crockett, where it goes offshore to the diffuser. This disposal location has greater tidal action and is further removed from drinking water intakes than the Delta-Chipps Island Disposal Alternative.

Summary of Federal Project Costs

Table 3 shows the summary of the estimated appraisal level Federal project costs for all action alternatives. The costs do not include costs for mitigation of environmental effects, which were not included in the comparison of alternatives and economic analyses in the EIS. Estimated mitigation costs, however, are presented in appendix O in the EIS.

Table 3. All alternatives examined in the environmental impact statement – summary of present worth of Federal project costs[1] ($ millions, 2002 dollars)

Alternatives	Federal Cost[2]			
	Construction	Annual OM&R[3]	Present Worth	Annual Equivalent
In-Valley	$607	$19.8	$562	$33.8
In-Valley/Groundwater Quality	$676	$18.1	$626	$37.6
In-Valley/Water Needs	$828	$15.1	$773	$46.5
In-Valley/Drainage-Impaired	$918	$10.9	$857	$51.6
Delta-Chipps	$630	$12.5	$562	$33.8
Delta-Carquinez	$673	$12.5	$598	$36.0
Ocean	$589	$11.6	$563	$33.8

[1] **Federal Cost** – Costs for facilities that would be part of the Federal drainage service plan and are federally funded, except mitigation facilities.

Construction – All capital costs for lands, right-of-way, construction, mitigation, and interest during construction, displayed in 2002 dollars.

Annual OM&R – All costs required each year to operate, maintain, and replace project facilities, displayed in 2002 dollars, including energy costs.

Present Worth – The combined construction and annual OM&R costs presented as a one-time cost, displayed in 2002 dollars.

Annual Equivalent – The present worth cost presented as a series of equal annual payments over 50 years.

[2] The Federal costs for each of the action alternatives would exceed the current Federal spending limit authorized under the San Luis Act.

[3] OM&R = operation, maintenance, and replacement.

No-Action Alternative

The No-Action Alternative defines conditions in the project area through the 50-year planning timeframe if drainage service is not provided to the San Luis Unit and related areas. It represents existing conditions for drainage management in 2001, with individual farmers and districts making limited changes in management in the absence of Federal drainage service. These changes would be

"the future without the project." No-Action includes only regional treatment, conveyance, and disposal facilities that existed in 2001 or are authorized, funded projects.

Under the No-Action Alternative, without Federal drainage service, farmers and districts would not be able to discharge drainwater to receiving waters (sloughs, rivers, bays, or ocean) from drainage-impaired lands, except where such discharges are currently permitted (e.g., the Grassland Bypass Project). This restriction means that 379,000 acres that are projected to need drainage service would not have that service available, and farmers would pursue individual actions related to (1) drainage control and reuse and (2) cropping practices. Water districts and landowners would continue to address drainage problems within institutional, regulatory, and financial constraints currently in effect and reasonably foreseeable.

Key characteristics and assumptions for the No-Action Alternative are the following drainage and land management activities.

- **Drainage Production** - Only the Grassland Drainage Area (GDA) would produce drainage for disposal through 2009 (with the Grassland Bypass Project). Under the current use agreement, expiring December 31, 2009, the Grassland Area farmers must meet their selenium load requirements within 20 percent of the annual and monthly targets or pay a fine. If the annual target is exceeded by more than 20 percent, the use agreement can be terminated and allow no further discharges.

  Under the No-Action Alternative, the GDA would be prevented from discharging drainwater after 2009.

  The future expansion of the GDA's existing Northerly Area reuse facilities are not included under No Action because of the uncertainties associated with their design, operation, and funding (additional land acquisition, additional subsurface drainage systems, and additional treatment facility/disposal units).

- **Land Retirement** - Land retirement is defined as the removal of lands from irrigated agricultural production by purchase or lease for other purposes or land uses. Under the No-Action Alternative, Reclamation assumes that 44,106 acres of permanently retired lands would be increased by 65,000 acres if drainage service is not provided to Westlands, for a total of 109,106 acres.

- **Land Fallowing** - On an annual basis, 5 to 10 percent of the total cultivated acreage is often fallowed for soil fertility, normal crop rotation, and economic purposes. This practice would continue

under No Action. This fallowing acreage is in addition to the land retirement described above.

- **On-Farm, In-District Activities** - The following management activities by individual farmers and/or districts for drainage-impaired land are assumed to occur under the No-Action Alternative.

  - A total of 48,000 acres would continue to be drained in the GDA and none in Westlands; no additional drains would be installed.

  - Some on-farm irrigation system improvements would occur within Westlands to continue to manage perched water and crop practices in the absence of drainage service. However, it is assumed that no new on-farm tile systems, collection facilities, or land disposal actions would be implemented. Limited use of existing facilities for on-farm drainwater recycling would occur.

  - Irrigation practices remain similar to current efficiency levels. As the drainage problem expands and farmers adjust irrigation practices to high water table conditions, water use efficiency in these areas may increase, but not substantially, over existing conditions, which are already highly efficient. Overall, irrigation practices would change in response to economic conditions and would be consistent with efficiency assumptions in the California Water Plan (DWR 1993).

  - Any water that fallowing frees up in drainage-impaired areas would be reallocated to unaffected areas. Water conserved because of improved irrigation efficiency, changes in cropping pattern, increased contribution to evapotranspiration (ET) from groundwater, or possible reductions in irrigated acreage would be available within the respective district to meet internal needs. The reallocated water would likely result in less groundwater pumping, as the quantity applied per acre would not increase beyond crop requirements.

  - Other drainwater reduction measures are anticipated to be used at current or increased levels under the No-Action Alternative with no drainage service and include seepage reduction, drainwater recycling, shallow groundwater pumping, and shallow groundwater management.

Appraisal Level Four Account Analysis

As part of the preliminary alternatives formulation process, an economic analysis quantifying the potential net benefits of each alternative was performed. The following briefly describes the results of that analysis. A detailed description of

the four account analysis can be found in appendix N of the final EIS and appendix B of this feasibility report. Chapter 5 contains a feasibility level four account analysis.

Appraisal Level Environmental Quality Account

The environmental quality (EQ) account is used to identify and display the significant non-monetary beneficial and adverse effects each alternative plan has on significant EQ resources when compared to the No-Action Alternative. Significant EQ resources that occur in the planning area include surface and groundwater, biological resources (aquatic and terrestrial species and habitats, including State and Federal special status species), geologic resources, energy, air, land and soil, recreation resources, aesthetics (visual resources), and cultural resources. For each EQ resource, one or more indicators were selected to directly or indirectly measure or otherwise describe changes that would be expected to occur with implementation of each alternative. A detailed appraisal-level assessment of the effects of each alternative on the selected resource indicators is presented in the EIS and its accompanying appendices and referenced studies.

The following summarizes the beneficial and adverse effects of the seven alternatives evaluated in the EIS:

- **Surface and Groundwater Resources:**
    - All of the alternatives would result in beneficial effects to water quality of the irrigation water supply, rate of bare-soil evaporation, and undrained land area affected by shallow water table.
    - The In-Valley/Drainage-Impaired Land Retirement Alternative is expected to improve drinking water sources in the planning area as a result of the substantial reduction in drainwater quantity.
- **Biological Resources:**
    - Aqueduct and outfall construction under the two Delta Disposal Alternatives presumably would have considerable adverse effects that could result in the incidental take of federally listed freshwater aquatic/wetland species and/or loss, degradation, or disturbance of their habitat.
    - Operation of the two Delta Disposal Alternatives could result in the incidental take of State or federally listed threatened and endangered species due to selenium bioaccumulation in either the Bay-Delta (outfalls) or San Joaquin Valley (reuse areas).
    - All of the “in-valley” disposal alternatives, including the No-Action Alternative, could result in the incidental take of foraging State- or

federally listed species due to potential selenium bioaccumulation occurring from operation of the evaporation basins and reuse areas. This potential effect would be expected to increase with increasing size of the basins and reuse areas.

- All of the "in-valley" alternatives using evaporation basins for drainwater disposal potentially could lead to adverse effects to non-listed migratory and wintering waterbirds that use the planning area, including salt toxicosis, salt encrustations on feathers of wintering birds, and disturbances from operation and maintenance (O&M) activities. Though non-listed, the non-listed migratory and wintering waterbirds likely are covered by the Migratory Bird Treaty Act.

- The permanent retirement of large areas of irrigated pasture and small grains that historically have provided valuable forage and cover to a variety of non-listed migratory and wintering waterbirds could result in the loss of high-value habitat.

- **Air Resources:**

  - Beneficial effects are expected to occur under the In-Valley/Water Needs Land Retirement and In-Valley/Drainage-Impaired Land Retirement Alternatives as emissions from agricultural operations are reduced; a result of the reduction in farmed acres remaining in production.

- **Land and Soil Resources:**

  - For the most part, all alternatives, except for the No-Action Alternative, would have beneficial effects on land and soil resources: Acreage of prime farmland would increase, formation of salt sinks would decrease, and more acreage would remain in production. Under the No-Action Alternative, the reverse would occur, resulting in adverse effects.

  - Farmland of Statewide Importance (FSI) would increase under the three "out-of-valley" disposal alternatives and those "in-valley" alternatives having the smallest land retirement component, resulting in a beneficial effect when compared to no action.

  - The permanent conversion of agricultural land to evaporation basins would contribute to the loss of land/soil resources for the "in-valley" alternatives.

  - The large-scale land retirements and decreasing acreage of FSI that would occur under the In-Valley/Water Needs and In-Valley/

Drainage-Impaired Alternatives would be inconsistent with State and local plans and laws and would be an adverse effect.

- **Recreation Resources:**
  - No beneficial or adverse effects to recreation resources are anticipated for any of the in-valley action alternatives.
  - Under the two Delta Disposal Alternatives, potential bioaccumulation of selenium in sportfish and waterfowl in localized areas could result in additional human health advisories to limit consumption, potentially resulting in adverse effects to the recreational fishing and hunting industry.
- **Geological, Energy, Aesthetics (Visual Resources), and Cultural Resources:**
  - None of the alternatives are expected to result in beneficial or residual adverse effects.

Appraisal Level Other Social Effects Account

All of the alternatives would provide small increases in employment when compared to the No-Action Alternative except the In-Valley/Water Needs Land Retirement Alternative and the In-Valley/Drainage-Impaired Land Retirement Alternative. For these two alternatives, while there would be a temporary small increase in employment during construction, there would be a long-term small loss of jobs associated with operation, maintenance, and replacement (OM&R) and crop production.

Appraisal Level Regional Economic Development Account

No-Action Alternative

The difference between the No-Action Alternative and existing conditions is very small from a regional perspective. The greatest annual effects (measured as a percent of existing condition values) occur in farm employment, agricultural output, and agricultural income. The projected difference in economic indicators between the No-Action Alternative and existing conditions is less than 0.25 percent.

Action Alternatives

All of the action alternatives, except the In-Valley/Water Needs Land Retirement Alternative and the In-Valley/Drainage-Impaired Land Retirement Alternative, have a slightly positive effect on the regional economy when compared to the No-Action Alternative. However, none of the effects would be significant because

total projected employment and labor income effects generated by any action alternative are less than 0.2 percent of the affected region's total for those indicators.

The two Delta Disposal Alternatives generate the greatest amount of economic activity in the agricultural sector, while the In-Valley/Drainage-Impaired Land Retirement Alternative has the largest negative impact to agriculture in the region (based on the impacts estimated to occur at the end of the 50-year analysis period).

All of the action alternatives generate a large amount of economic activity during the relatively short-term construction phase (first 10 years) of the project, primarily as a result of the intensive construction efforts required to build the drainage collection and conveyance systems. In addition, a significant amount of economic activity is generated by money spent to purchase land for those alternatives that include land retirement.

National Economic Development Account

The objective of the national economic development analysis is to determine the change in net value of the Nation's output of goods and services that would result from implementing each project alternative. Beneficial and adverse effects are evaluated in monetary terms and are measured in terms of changes in national income.

NED Benefits

Contributions to NED are measured as increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the project area and the rest of the Nation. Contributions to NED include increases in the net value of goods and services that are marketed, as well as goods and services that may not be marketed.

NED benefits generated from the agricultural production of an alternative are measured as the increased value of agricultural output of the Nation plus any cost savings that occur in maintaining a given level of output. Such benefits include reductions in production costs and associated costs; reduction in damage costs from flooding, erosion, sedimentation, inadequate drainage, or inadequate water supply; and the value of increased production of crops.

The benefits of the action alternatives are estimated relative to the No-Action Alternative and are based on providing drainage service to drainage-impaired lands within the San Luis Unit service area. These benefits fall into three categories:

1) Increased net revenues resulting from continued farming of drainage-impaired lands

2) Increased net revenues resulting from changing to a more revenue intensive crop mix on drainage-impaired lands

3) Reduced costs of irrigation management practices by providing drainage service to drainage-impaired lands

The first category of benefits results from reclaiming drainage-impaired lands that would otherwise be removed from agricultural production without the provision of adequate drainage service. Under all of the action alternatives that do not incorporate land retirement, it is assumed that these 65,000 acres would be part of the land that would receive drainage service. For those action alternatives that include land retirement, an adjustment to the area of land retirement is necessary to avoid double counting the lands retired under the No-Action Alternative. The increased net farm revenue used to estimate the benefit of avoiding land retirement is $147.74 per acre per year for Westlands and $161.17 per acre per year for the Northerly Area.

The second category of benefits results from farmers having the capacity to grow a much broader selection of crops rather than being restricted to only salt-tolerant crops. These lands, which are drainage-impaired under the No-Action Alternative, are estimated to generate an additional $94.67 per acre per year in Westlands and $149.27 per acre per year in the Northerly Area. As indicated above, the benefit estimated for lands changing from a drainage-impaired condition to a drained condition requires an adjustment to account for the 65,000 acres of land retired under the No-Action Alternative to avoid double counting the benefit of those lands.

The first two types of benefits described above are based on strategies used under the No-Action Alternative to keep lands with limited natural drainage and high soil salinities under agricultural production.

The last benefit category results from a reduction in production costs that occurs as farmers are relieved from increasingly restrictive irrigation management practices that are required to continue farming drainage-impaired lands, even as salts continue to accumulate in the root zone of the soil. These values are included in the increased net farm revenue indicated for the two benefit categories described above. Therefore, an estimate of NED benefits was not prepared separately for this category.

Benefit Summary

Table 4 shows the estimated values of benefits projected to occur as a result of providing adequate collection, treatment, and disposal of drainwater for drainage-impaired lands in the San Luis Unit.

NED Costs

Project measures, whether structural or nonstructural, require the use of various resources. NED costs are the opportunity costs of resource use. Opportunity

costs are a measure of the highest valued alternative use that would be foregone as a result of using a particular resource. Both public and private uses of the various resources required in a project alternative were considered when evaluating NED costs. The following briefly describes the NED cost categories.

- **Implementation Costs of Project Features** - The NED costs of implementation outlays include the costs incurred by the responsible Federal entity and, where appropriate, contributed by other Federal or non-Federal entities to construct, operate, and maintain a project in accordance with sound engineering and environmental principles and place it in operation. These costs include remaining post-authorization planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; relocation costs; historical and archeological salvage costs; land, water, and mineral rights costs; and OM&R costs.

Table 4. Summary of changes in agricultural productivity of project lands relative to the No-Action Alternative ($/year in 2050)

Subarea	In-Valley Disposal Alternative	Out-of-Valley Disposal Alternative	In-Valley/ Groundwater Quality Land Retirement Alternative	In-Valley/ Water Needs Land Retirement Alternative	In-Valley/ Drainage-Impaired Land Retirement Alternative
Westlands					
Land Retired Under No-Action Alternative – Drained Under Action Alternatives					
Benefit Subtotal ($)	$9,603,000	$9,603,000	$3,917,000	$0	$0
Land Retired Under No-Action Alternative – Retired Under Action Alternatives					
Benefit Subtotal ($)	$0	$0	$0	$0	$0
Drainage-Impaired Land Under No-Action Alternative – Drained Under Action Alternatives					
Benefit Subtotal ($)	$17,138,000	$17,318,000	$17,316,000	$10,698,000	$0
Net Change in Agricultural Productivity – Westlands					
Drainage Benefit – Westlands	$26,741,000	$26,921,000	$21,233,000	$10,698,000	$0
Northerly Area					
Land Retired Under No-Action Alternative – Drained Under Action Alternatives					
Benefit Subtotal ($)	$0	$0	$0	$0	$0
Land Retired Under No-Action Alternative – Retired Under Action Alternatives					
Benefit Subtotal ($)	$0	$0	$0	$0	$0
Drainage-Impaired Land Under No-Action Alternative – Drained Under Action Alternatives					
Benefit Subtotal ($)	$11,221,000	$11,509,000	$9,931,000	$9,931,000	$9,931,000
Net Change in Agricultural Productivity – Northerly Area					
Drainage Benefit – Northerly Area	$11,221,000	$11,509,000	$9,931,000	$9,931,000	$9,931,000
Benefit Total	**$37,962,000**	**$38,430,000**	**$31,164,000**	**$20,629,000**	**$9,931,000**

[1] Values represent additional costs relative to the No-Action Alternative. Values are rounded to nearest $1,000. Totals may not add due to rounding.

- **Treatment and Disposal Costs** - Treatment and disposal costs include post-authorization planning and design costs, construction costs, construction contingency costs, and administrative service costs, as well as OM&R costs.

  Specific treatment and disposal facilities include facilities funded by the Federal Government, as well as those funded by non-Federal entities. Federally funded facilities consist of the drainage collection system, conveyance system, regional reuse facilities, evaporation basins, RO treatment facilities, biological selenium treatment facilities, and fish and wildlife mitigation facilities. Facilities funded by non-Federal entities include on-farm tile drains, drainwater recycling facilities, seepage reduction measures, shallow groundwater management measures, and on-farm irrigation efficiency improvements. Construction costs, interest during construction costs, and annual OM&R costs are expressed as annual equivalent costs for the preliminary appraisal analyses using the fiscal year (FY) 2005 Federal discount rate of 5.625 percent over a 50-year project life.

- **Fish and Wildlife Mitigation Costs** - There is a high level of uncertainty and insufficient information regarding specific mitigation protocols to allow a reasonable design and cost estimate of mitigation features. Some general information is available for estimating and designing a variety of mitigation facilities, including wetland areas and ponds to mitigate for the construction of evaporation ponds in the in-valley alternatives. However, specific details regarding the type and quantity of mitigation features have not been identified. Additionally, some project features have certain mitigation considerations included in their designs; therefore, some mitigation costs are integrated into the design cost of those particular features.

- **Cost of Reducing Deep Percolation in Non-Drainage-Impaired Lands** - Increased irrigation management could allow full crop production but at a significant cost and within limits. Water use estimates for the drainage-impaired area in Westlands indicate that seasonal application efficiency is already well over 80 percent. Increasing efficiency higher than this level is expensive and may be impractical, especially given the imperative to leach salts from the root zone.

  Lands in Westlands' upslope areas and in the Northerly Area that are not drainage impaired are not currently at a level of irrigation efficiency as high as drainage-impaired lands. For these areas, all of the drainage service alternatives were assumed to implement a moderate reduction in deep percolation on these lands. The costs of the irrigation system improvements were derived by estimating the level of irrigation efficiency and distribution uniformity needed to reduce deep percolation by the target

amount of 0.1 foot per acre on average. Costs associated with higher levels of management are expressed as annual equivalents, including amortized capital costs of irrigation system hardware and operation and maintenance costs. Costs are estimated to be $0.033 million per year in the Northerly Area and $2.081 million per year in Westlands.

- **Land Retirement Costs** - Costs incurred by some of the action alternatives is the removal of lands from agricultural production or land retirement. The NED cost of land retirement is the net farm income foregone as a result of retiring land rather than keeping it in irrigated agricultural production and does not represent the actual cash outlay or financial cost of purchasing land to retire. The financial cost of land retirement is a transfer payment. A transfer payment is essentially a payment from one economic sector of the Nation (Federal Government) to another (current owners of drainage-impaired land) without any corresponding production or expectation of production. The analysis of alternatives formulated to provide the San Luis Unit with drainage service includes two types of land retirement scenarios: (1) retiring land for the purpose of constructing project facilities on it and (2) retiring land to avoid providing drainage service for particular land parcels.

  The change in net farm revenue that occurs when drainage-impaired land is retired is estimated to be $53.07 per acre per year in Westlands and $11.90 per acre per year for land in the Northerly Area (the difference is due to different crop mixes on the affected lands).

- **Administrative and management costs of land retirement** - In addition to the loss of net revenue that occurs as land is taken out of agricultural production, an additional cost of the land retirement program results from management and administrative activities required to manage the alternative uses of retired lands. Specific activities assumed to be part of the land management program are dryland farming, land fallowing, and grazing. One-third of all voluntary retired land is assumed to be in one of these three program activities. Administrative and management costs of the land retirement program are assigned only to those lands retired to avoid having to provide drainage service. Annual administrative and management costs of the land retirement program are estimated to be $42.60 per acre. Lands retired to provide sites for project facilities are not assigned administrative and management costs.

- **Cost of Supplemental Water Purchases** - Under the No-Action Alternative, it is estimated that about 96,000 acre-ft of additional water is necessary to provide a full irrigation supply for the Unit. Providing drainage service to drainage-impaired lands within the Unit increases the amount of water that will be needed to irrigate all land suitable for unrestricted agricultural production. Under all of the action alternatives,

except for the In-Valley/Water Needs Land Retirement Alternative and the In-Valley/Drainage-Impaired Land Retirement Alternative, additional water will need to be acquired to irrigate Unit lands that will have sufficient drainage service. The additional cost of acquiring additional irrigation water each year is a cost that needs to be accounted for in the NED analysis.

The additional water needed to irrigate all Unit lands with sufficient drainage service was limited to 130,000 acre-ft/yr, based on annual water purchases by Westlands from 2002 to 2004. Limiting the amount of water purchased in any 1 year to 130,000 acre-ft means that the action alternatives that do not include land retirement will still not have a full water supply for all of the lands with adequate drainage service; therefore, an additional adjustment was made to estimate the net NED benefits for the In-Valley Disposal Alternative and the Out-of-Valley Disposal Alternatives. NED benefits were adjusted by assuming that some land would need to be retired or fallowed due to an inadequate water supply.

Cost Summary

Table 5 lists the NED costs estimated for each alternative. All cost estimates shown are based on comparing the costs incurred under each of the action alternatives to those estimated under the No-Action Alternative.

Net NED Benefits

Net NED benefits are calculated by subtracting NED costs from NED benefits. As shown in table 6, the action alternative that generates the maximum net NED benefit is the In-Valley/ Drainage-Impaired Land Retirement Alternative. However, the question of whether the In-Valley/Drainage-Impaired Land Retirement Alternative is consistent with the Federal objective is debatable because the Federal objective is to provide drainage service to drainage-impaired lands in the San Luis Unit.

Alternatives Selected for Feasibility Study

As a result of the NED analysis, the two alternatives with the greatest net benefits were selected for feasibility study: the In-Valley/Drainage-Impaired Land Retirement Alternative and the In-Valley/Water Needs Land Retirement Alternative. This section briefly explains the reasons for selecting the two alternatives for the feasibility level evaluation. It also explains the reasons why the other alternatives were not selected for further study at the feasibility level.

Table 5. Summary of NED costs — changes relative to the No-Action Alternative[1] ($/year in 2050)

Subarea	In-Valley Disposal Alternative	Out-of-Valley Disposal Alternative	In-Valley/ Groundwater Quality Land Retirement Alternative	In-Valley/ Water Needs Land Retirement Alternative	In-Valley/ Drainage-Impaired Land Retirement Alternative
Westlands					
Irrigation Management Cost–Unimpaired Lands	$2,081,000	$2,081,000	$2,081,000	$2,081,000	$2,081,000
Agriculture Losses – Facilities	$417,000	$316,000	$318,000	$55,000	$0
Agriculture Losses – Land Retirement	$0	$0	$0	$3,972,000	$10,024,000
Land Retirement Administration Costs	$0	$0	$1,640,000	$5,958,000	$10,816,000
Cost Subtotal	**$2,489,000**	**$2,489,000**	**$4,039,000**	**$12,066,000**	**$22,921,000**
Northerly Area					
Irrigation Management Cost–Unimpaired Lands	$33,000	$33,000	$33,000	$33,000	$33,000
Agriculture Losses – Facilities	$69,000	$46,000	$53,000	$53,000	$53,000
Agriculture Losses – Land Retirement	$0	$0	$119,000	$119,000	$119,000
Land Retirement Administration Costs	$0	$0	$426,000	$426,000	$426,000
Cost Subtotal	**$102,000**	**$79,000**	**$631,000**	**$631,000**	**$631,000**
Northerly Area and Westlands Combined					
Treatment and Disposal Costs	$41,601,000	$41,675,000	$36,843,000	$27,398,000	$10,565,000
Supplemental Water Purchases/Sales	$4,743,000	$4,743,000	$4,743,000	($9,828,000)	($28,340,000)
Upslope Land Retirement	$1,770,000	$1,965,000	$0	$0	$0
Cost Subtotal	**$48,314,000**	**$48,333,000**	**$41,586,000**	**$17,570,000**	**($17,775,000)**
Total Costs	**$50,905,000**	**$50,901,000**	**$46,256,000**	**$30,267,000**	**$5,777,000**

[1] Values represent NED costs relative to the No-Action Alternative. Values are rounded to nearest $1,000. Totals may not add due to rounding.

Table 6. NED benefit/cost summary — changes relative to the No-Action Alternative[1] ($/year in 2050)

Subarea	In-Valley Disposal Alternative	Out-of-Valley Disposal Alternative	In-Valley/ Groundwater Quality Land Retirement Alternative	In-Valley/ Water Needs Land Retirement Alternative	In-Valley/ Drainage-Impaired Land Retirement Alternative
Total NED Benefit	$37,962,000	$38,430,000	$31,164,000	$20,629,000	$9,931,000
Total NED Cost	$50,905,000	$50,901,000	$46,256,000	$30,267,000	$5,777,000
Net NED Benefit	**($12,943,00)0**	**($12,471,000)**	**($15,092,000)**	**($9,638,000)**	**$4,154,000**

[1] Values represent net NED benefits relative to the No-Action Alternative. Values are rounded to nearest $1,000. Totals may not add due to rounding.

Alternatives Selected

In-Valley/Drainage-Impaired Land Retirement Alternative

The In-Valley/Drainage-Impaired Land Retirement Alternative was identified in the EIS as the preferred alternative because it is the most beneficial plan for the economy on a national perspective (the NED plan). Therefore, Reclamation completed feasibility level designs and cost estimates for this alternative.

In-Valley/Water Needs Land Retirement Alternative

Because this alternative is not ranked as the most beneficial plan for the economy on a national perspective, it was not recommended for selection as the preferred alternative. However, this alternative is the second most beneficial plan for the economy according to the NED analysis, does have significant benefits, and is considered the locally preferred alternative because it most closely parallels the locally developed Westside Regional Drainage Plan.

The In-Valley/Water Needs Land Retirement Alternative would retire sufficient lands to balance long-term water needs in the San Luis Unit. Farmers would receive adequate water supplies to meet crop demand of land remaining in production. Some of the merits of this plan include (1) many of the stakeholders involved in this project prefer the In-Valley/Water Needs Land Retirement Alternative because it is the alternative closest to the Westside Regional Drainage Plan, (2) it would retire sufficient land to balance water needs with the lands remaining in production in the San Luis Unit, (3) it would allow for a sustainable amount of agricultural production, (4) it would retain more farm worker jobs in small communities with high unemployment than the NED Plan, and (5) it is more likely that Reclamation could implement this alternative based upon a willing-participant concept. Therefore, Reclamation completed feasibility level designs and cost estimates for this alternative.

Alternatives Not Selected

In-Valley Disposal Alternative

Because this alternative is not ranked as the most beneficial plan in relation to the economy on a national perspective and does not have many of the significant benefits described for the In-Valley/Water Needs Land Retirement Alternative, it was not carried forward for feasibility level analysis.

In-Valley/Groundwater Quality Land Retirement Alternative

Because this alternative is not ranked as the most beneficial plan to the economy on a national perspective and does not have many of the significant benefits described for the In-Valley/Water Needs Land Retirement Alternative, it was not carried forward for feasibility level analysis.

Ocean Disposal Alternative

Because this alternative is not ranked as the most beneficial plan to the economy on a national perspective, it was not identified as the preferred alternative.

Reclamation did not complete feasibility level designs and cost estimates for this alternative because of several disadvantages: (1) it would be difficult to provide sufficient analysis to demonstrate that this alternative is consistent with the California Coastal Management Program and that this alternative is the least environmentally damaging feasible alternative considering long-term effects to the marine environment, (2) it is not one of the top two alternatives with the greatest NED benefit, (3) implementing this alternative would result in significant public concerns, (4) it is doubtful that a consistency determination, acceptable to U.S. Environmental Protection Agency (EPA) and the State of California, could be developed establishing that the Ocean Disposal Alternative is the least environmentally damaging feasible alternative, and (5) this alternative would not be completed until 2014 and, therefore, could not begin providing drainage service within the time required to meet the revised TMDLs for drainage into the San Joaquin River. This alternative was not carried forward for feasibility level analysis.

Delta (Delta-Chipps Island and Delta-Carquinez Strait) Disposal Alternatives

Because these alternatives are not ranked as the most beneficial plans to the economy on a national perspective, neither was selected as the preferred alternative. The Delta disposal alternatives were not evaluated at the feasibility level because (1) they were the second most costly option based on a national perspective, (2) they obtained an EPA rating as *"Environmental Objections-Insufficient Information (EO-2),"* (3) the Delta to which the drainage water would be discharged is listed under the Clean Water Act as an impaired water body for selenium, (4) it is doubtful that permits could be obtained for discharge due to a limited capacity to allocate such discharges, and (5) these alternatives would not be completed until 2013 and, therefore, could not begin providing drainage service within the time required to meet the revised TMDLs for drainage into the San Joaquin River. This alternative was not carried forward for feasibility level analysis.

No-Action Alternative

The U.S. District Court order of November 29, 2000, precludes selection of this alternative for implementation. The court order reaffirmed the Federal Government's responsibility to "*provide drainage to the San Luis Unit pursuant to statutory duty imposed by section 1(a) of the San Luis Act."*

Chapter 4
Drainage Service Alternatives – Feasibility Evaluation

Introduction

Feasibility designs and cost estimates are presented for two drainage service alternatives:

- In-Valley/Drainage-Impaired Land Retirement Alternative
- In-Valley/Water Needs Land Retirement Alternative

The term "in-valley" indicates that drainage service features are constructed entirely within the geographic boundaries of the project area in the San Joaquin Valley. The drainage study area was subdivided into two geographic areas: Westlands Water District (north, central, and south sections) and the Northerly Area. Refer to figure 1 for a map of the study area and table 2 (both in chapter 1 of this document) for a description of the drainage-impaired areas that require drainage service.

The term "drainage-impaired" refers to lands that are not capable of sustaining commercial agricultural production without the installation of tile drains to collect and remove subsurface drainage and shallow groundwater from the root zone. Drainage-impaired lands arise from a combination of subsurface hydrogeologic properties that naturally impede the removal or drainage of shallow groundwater.

The term "land retirement" indicates that both alternatives incorporate retirement of farmland as a significant component of drainage service. The primary difference between the two alternatives is the amount of land that would be retired from irrigation and the amount of land for which drainage service features would be constructed.

In-Valley/Drainage-Impaired Land Retirement Alternative

A geographic depiction of the proposed retired lands and constructed drainage service features in both the Westlands area and the Northerly Area for the In-Valley/Drainage-Impaired Land Retirement Alternative is shown previously in figure 5.

Westlands

The In-Valley/Drainage-Impaired Land Retirement Alternative retires all drainage-impaired lands within Westlands—approximately 298,000 acres. Retired lands in Westlands would include 44,106 acres retired under a previous agreement plus 253,894 acres proposed under this alternative. Drainage service features would not be constructed for farms within Westlands under this alternative.

Northerly Area

The In-Valley/Drainage-Impaired Land Retirement Alternative includes retirement of 10,000 acres in the Broadview Water District in the Northerly Area. Drainage service features would be constructed for the remaining drainage-impaired lands in the Northerly Area—approximately 71,000 acres. This area includes and would incorporate existing infrastructure that currently provides drainage to approximately 48,000 acres in the Northerly Area districts.

In-Valley/Water Needs Land Retirement Alternative

A geographic depiction of the proposed retired lands and constructed drainage service features in both Westlands and the Northerly Area for the In-Valley/Water Needs Land Retirement Alternative is shown previously in figure 5.

Westlands

The In-Valley/Water Needs Land Retirement Alternative was developed because Westlands does not currently receive sufficient water supply to irrigate all of the farmland within its district. This alternative retires about 184,000 acres (44,106 previous acres plus 139,850 additional acres) of drainage-impaired lands within Westlands. Drainage service features would be constructed for the remainder of the drainage-impaired farmland in Westlands—about 114,000 acres—which would then have adequate water to meet irrigation demands based on the projected available water supply within the district.

Northerly Area

The In-Valley/Water Needs Land Retirement Alternative includes retirement of 10,000 acres in the Broadview Water District and construction of drainage service features for approximately 71,000 acres of drainage-impaired lands in the Northerly Area. This area includes and would incorporate existing infrastructure that currently provides drainage to approximately 48,000 acres in the Northerly Area districts. Land retirement and drainage service construction for the Northerly Area portion of the project is identical under both of the feasibility alternatives.

Proposed Facilities

The proposed Federal drainage service features for both alternatives are depicted graphically in figure 8 and described below. Feasibility design drawings are provided in Appendix A, Feasibility Design Appendix, attachment 1.

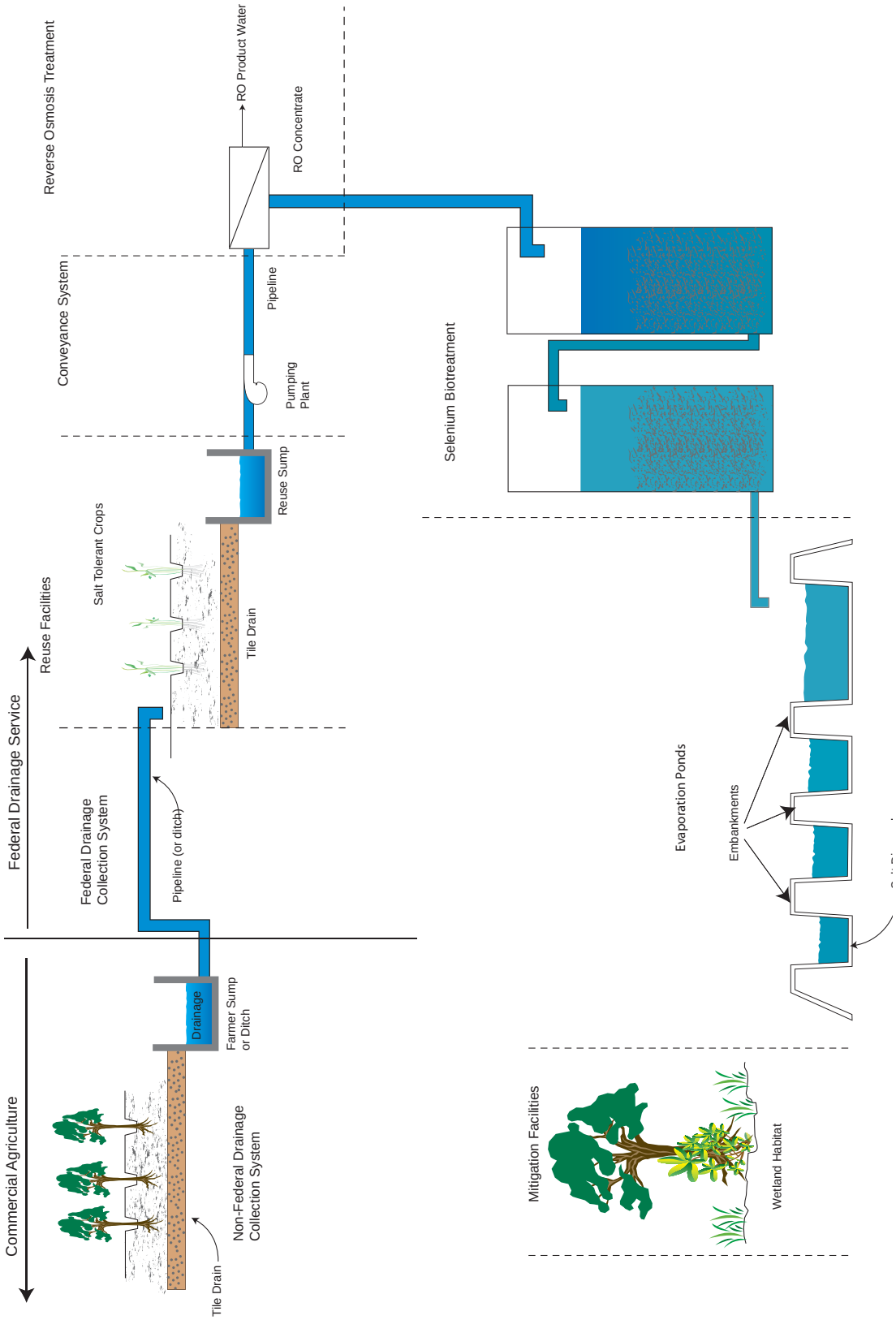

Figure 8. Proposed drainage service features for both feasibility alternatives.

- **Drainage Collection System**: A combination of existing open drainage ditches and proposed closed pressurized pipelines that collect and convey drainage from farmlands to regional reuse facilities.

- **Drainage Reuse Facilities**: Designated agricultural lands that utilize subsurface drainage collected from surrounding farmlands to irrigate salt tolerant crops. The purpose of reuse facilities is to reduce the volume of drainwater that requires further treatment and disposal at downstream facilities. The volume of drainwater is reduced through evapotranspiration of irrigated crops. Reuse facilities would be built and operated similar to commercial farmlands with irrigation, seeding, harvesting, tailwater recovery, and collection of reused drainwater from subsurface tile drains. Reused drainwater would be conveyed to RO treatment plants.

  The Northerly Area reuse irrigation system would require several canal-side pumping plants to convey drainage from the existing open collector drains to the reuse fields. Westlands would have 11 reuse areas scattered across the district, which would receive irrigation supplies from the proposed gravity-flow collector pipelines.

- **Conveyance System**: A network of pumping plants and pipelines that convey drainwater collected from reuse facilities to RO treatment plants.

- **Reverse Osmosis Treatment**: Desalination treatment of drainwater conveyed from the reuse facilities using reverse osmosis membranes to recover approximately 50 percent of drainage as desalted product water. The desalted product water would be available for reuse as an irrigation supply for commercial farmlands. The remaining 50 percent of the drainage would be concentrated wastewater requiring subsequent biotreatment and disposal at evaporation ponds. The Northerly Area would have one large RO treatment plant, and Westlands would have three smaller plants.

- **Selenium Biotreatment**: Enclosed media-filled bioreactor tanks that utilize microbes to remove selenium from the concentrated waste stream from the RO plants. Selenium concentrations are reduced to below 10 micrograms per liter in the treated effluent to reduce potential environmental impacts when discharged to evaporation ponds for final disposal. Selenium is removed from the bioreactor tanks as part of a biological sludge waste stream that would require disposal at a licensed hazardous waste landfill. A biotreatment plant would be co-located with each RO treatment plant.

- **Evaporation Ponds**: A series of interconnected storage cells surrounded by embankments that impound the treated effluent from the biotreatment plants for sequential solar evaporation, leaving dry salts for in-place burial

in the terminal evaporation cell. An evaporation pond facility would be co-located with each RO and biotreatment plant facility. Ponds would be constructed with geomembrane liners to minimize seepage potential and managed to maintain a minimum 4-foot depth.

- **Mitigation Facilities**: Wetland habitats constructed to mitigate potential adverse environmental impacts of the evaporation ponds. Wetlands would serve as both alternative and compensation mitigation and would provide both shallow and deep habitats. Potential environmental impacts were evaluated in the EIS.

- **Land Retirement**: Real estate interest will be acquired through the purchase of non-irrigation covenants that restrict irrigation water use but permit the land to be used for grazing, fallowing, and dryland farming. Land retirement is considered a feature of drainage service because it reduces contributions of water to the shallow groundwater table. Cost data and assumptions for acquisition of lands and rights are provided in attachment 2.

Cost Estimates

A review of Appendix A, Feasibility Design Appendix, was performed in accordance with the Reclamation manual temporary release of Policy, Independent Oversight of Design, Cost Estimating, and Construction (DEC) (FAC TRMR-12). Appendix A, Feasibility Design Appendix, addresses and incorporates the DEC recommendations as agreed to by the Directors of the Mid-Pacific Region and Technical Resources. Feasibility level construction cost estimates for both action alternatives are presented in tables 7 and 8 with the exception of the cost estimates for the RO treatment plants. Cost estimates for the RO treatment plants are appraisal level because they were generated from computer software that uses cost data from other plant construction projects. The RO treatment cost estimates represent less than 3 percent of the total project construction cost. The RO and other technologies employed in the designs for drainage treatment are considered to be established and proven technologies; however, additional pilot studies will be needed during final design to optimize construction and operational details. Consequently, the cost estimates provided herein for the RO treatment plants include higher than normal contingency allowances to address the uncertainties regarding treatment technologies. Project cost estimates and detailed construction cost estimates for both action alternatives are presented in Appendix A, Feasibility Design Appendix, attachment 3.

Implementation Schedules

Detailed Gantt charts for implementation of both alternatives are provided in Appendix A, Feasibility Design Appendix, attachment 4. Summary descriptions and schedules are presented in the following paragraphs.

Table 7. Feasibility level construction cost estimates for the In-Valley/Drainage-Impaired Land Retirement Alternative

Description	Total Field Cost	Non-contract Cost	Total Construction Cost	Percent of Total Cost (%)
Total Project Costs	**$1,975,907,000**	**$262,242,000**	**$2,238,149,000**	**100.00**
Collection System	$14,533,000	$3,941,000	$18,474,000	0.83
Conveyance System	$52,774,000	$14,333,000	$67,107,000	3.00
Reuse Areas	$199,024,000	$56,007,000	$255,031,000	11.39
RO Treatment Plant	$34,419,000	$9,618,000	$44,037,000	1.97
Selenium (Se) Biotreatment Plant	$103,535,000	$26,465,000	$130,000,000	5.81
Evaporation Ponds	$336,022,000	$92,478,000	$428,500,000	19.15
Mitigation	$35,600,000	$9,400,000	$45,000,000	2.01
Retired Land	$1,200,000,000	$50,000,000	$1,250,000,000	55.85

Table 8. Feasibility level construction cost estimates for the In-Valley/Water Needs Land Retirement Alternative

Description	Total Field Cost	Non-contract Cost	Total Construction Cost	Percent of Total Cost (%)
Total Project Cost	**$2,222,852,500**	**$464,262,500**	**$2,687,115,000**	**100.00**
Northerly Area - Project Cost	*$775,907,000*	*$212,242,000*	*$988,149,000*	*36.77*
Collection System	$14,533,000	$3,941,000	$18,474,000	
Conveyance System	$52,774,000	$14,333,000	$67,107,000	
Reuse Areas	$199,024,000	$56,007,000	$255,031,000	
RO Treatment Plant	$34,419,000	$9,618,000	$44,037,000	
Se Biotreatment Plant	$103,535,000	$26,465,000	$130,000,000	
Evaporation Ponds	$336,022,000	$92,478,000	$428,500,000	
Mitigation	$35,600,000	$9,400,000	$45,000,000	
Westlands - Project Cost	*$816,945,500*	*$222,020,500*	*$1,038,966,000*	*38.66*
Collection System	$218,810,000	$59,190,000	$278,000,000	
Conveyance System	$54,748,500	$14,760,500	$69,509,000	
Reuse Areas	$84,490,000	$23,690,000	$108,180,000	
RO Treatment Plant	$25,186,000	$6,891,000	$32,077,000	
Se Biotreatment Plant	$83,545,000	$23,455,000	$107,000,000	
Evaporation Ponds	$325,746,000	$87,254,000	$413,000,000	
Mitigation	$24,420,000	$6,780,000	$31,200,000	
Retired Land	$630,000,000	$30,000,000	$660,000,000	24.56

In-Valley/Drainage-Impaired Land Retirement Alternative

The implementation schedule for the In-Valley/Drainage-Impaired Land Retirement Alternative is shown in figure 9. Most tasks are completed in about 6 years; however, a second construction phase for additional mitigation facilities may be implemented depending on the results of monitoring impacts after the first phase is completed.

In-Valley/Water Needs Land Retirement Alternative

The implementation schedule for the In-Valley/Water Needs Land Retirement Alternative is shown in figure 10. The chart indicates that most tasks for providing drainage to the Northerly Area and the Westlands span approximately 10 years from design data collection through construction of all features, with the second phase of mitigation work, if required, finishing after 11 years have elapsed.

Appropriation Ceiling

The San Luis Unit was authorized with two appropriation ceilings. Section 8(a) of Public Law 86-488, 74 Stat. 156, June 3, 1960, as amended, the authorizing legislation for the San Luis Unit, states *"There is hereby authorized to be appropriated for construction of the works of the San Luis Unit, including joint-use facilities, authorized by this Act, other than distribution systems and drains, the sum of $290,430,000, plus such additional amount, if any, as may be required by reason of changes in costs of construction of the type involved in the San Luis Unit as shown by engineering indexes…."* and *"There are also authorized to be appropriated, in addition thereto, such amounts as are required (a) for construction of such distribution systems and drains as are not constructed by local interests, but not exceeded in total cost the sum of $192,650,000…"*

The construction of project works, except for distribution systems and drains, are covered by an indexable ceiling. The ceiling for the distribution systems and drains is not subject to indexing. As facilities are constructed, the costs of construction are applied to one of the authorized ceilings. Construction of the joint-use and Federal (only) facilities are applied against the indexable ceiling. The appropriation ceiling for the main project facilities is currently $802,316,000.

In 1977, the ceiling for the distribution systems and drains was determined to be insufficient to cover expected future costs. Appropriate congressional committees were notified; and on June 15, 1977, Public Law 95-46 was enacted which provided $31,050,000 *"for continuation of construction of distribution systems and drains on the San Luis Unit. . . .."* The ceiling for the distribution systems and drains was subsequently recomputed to $236,176,311. This figure ($236,176,311) was first presented to the Congress in the San Luis Unit PF-65 for the FY 1979 Budget Justifications.

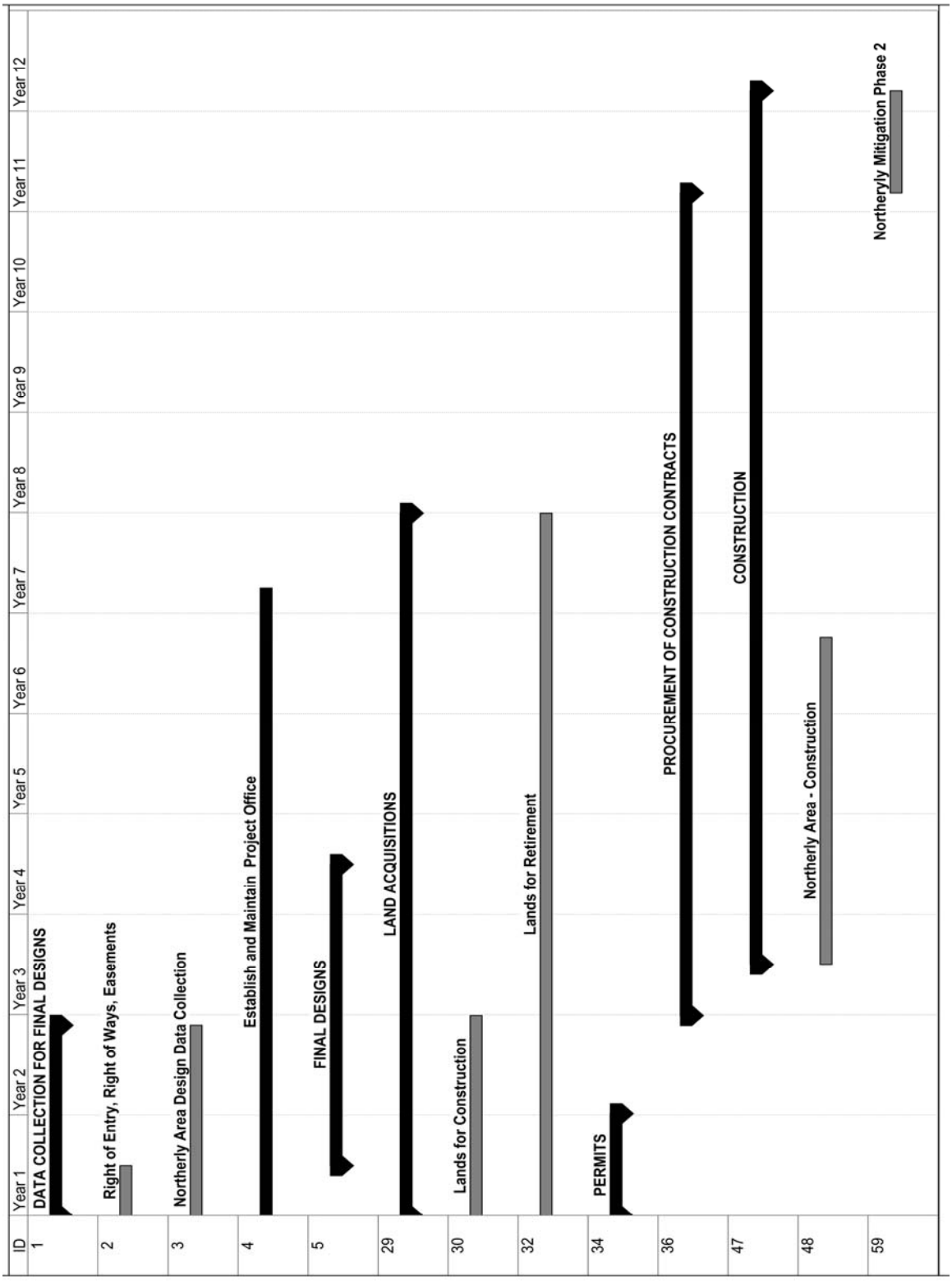

Figure 9. Implementation schedule for the In-Valley/Drainage-Impaired Land Retirement Alternative.

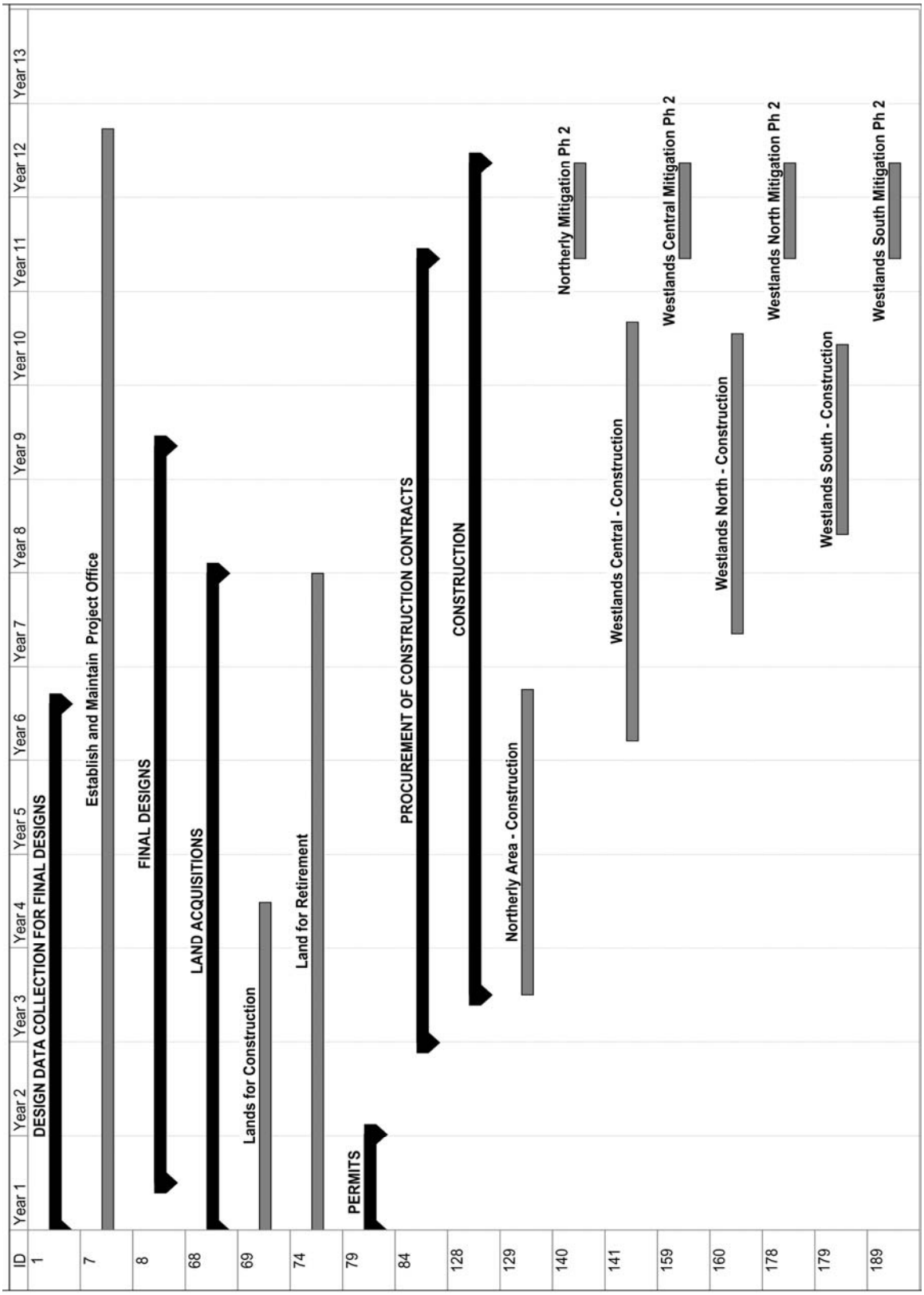

Figure 10. Implementation schedule for the In-Valley/Water Needs Land Retirement Alternative.

In FY 1985, $7 million was added to the ceiling under the authority of the Secretary of the Interior to use available funding for emergency situations (studies at Kesterson).

In FY 1986, $9,794,000 was added to the ceiling for distribution systems and drains, based on provisions in the Joint Conference Report supporting the FY 1986 Energy and Water Development Appropriation which allows that the studies (at Kesterson) continue *"at the present levels of effort."* The appropriation ceiling for distribution systems and drains is now $252,970,311 and has been stated as such in the Budget Justifications documents for a number of years.

Which ceiling was applicable to the San Luis Interceptor Drain has been subject to interpretation over the years since 1986; however, the Department has carried it under the main project features ceiling.

Table 9 summarizes the available funding ceiling for the San Luis Unit.

The combined remaining construction cost ceiling for the San Luis Unit is $428,674,777. The total estimated cost to implement the In-Valley/Drainage-Impaired Land Retirement Alternative is $2.3 billion. The total estimated cost to implement the In-Valley/Water Needs Land Retirement Alternative is $2.7 billion. Thus, implementing either of these action alternatives would exceed the combined remaining construction cost ceilings for the San Luis Unit.

Table 9. Available funding ceiling for the San Luis Unit

	Main Project Facilities *Indexing Authorized*	Distribution System and Drains *No Indexing Authorized*
Authorization:		
Public Law 86-488 (June 3, 1960)	$290,430,000	$192,650,000
Public Law 95-46 (June 15, 1977)		$31,050,000
Indexed ceiling (as of 10-08)	$802,316,000	$223,700,000
Computed ceiling		$236,176,311
Increases: Emergency Authority		$7,000,000
FY 1986 Appropriation		$9,794,000
	$802,316,000	$252,970,311
Obligations through September 30, 2006:		
Distribution Systems and Drains		$185,815,162
Main Facilities and Joint-Use Facilities	$440,796,372	
Available Ceiling:	**$361,519,628**	**$67,155,149**

Chapter 5
Economics and Financial Analysis

The feasibility level four account analyses of the two alternatives are presented in this chapter. It also describes the project repayment analysis.

Four Account Feasibility Level Analysis

Four accounts are established to facilitate evaluation and display of the effects of alternative plans. These accounts are: national economic development, environmental quality), regional economic development (RED), and other social effects (OSE). These four accounts encompass all significant effects of a plan on the human environment as required by the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [U.S.C.] 4321 *et seq.*). The NED account is the only required account under the *Principles and Guidelines*. The other accounts are only required if by law or will have a material bearing on the decisionmaking process.

Environmental Quality and Other Social Effects Accounts

The "environmental quality" account is a means of displaying and integrating into water resources planning that information on the effects of alternative plans on significant EQ resources and attributes of NEPA human environment, as defined in 40 Code of Federal Regulations 1507.14, that is essential to a reasoned choice among alternative plans. Significant means likely to have a material bearing on the decisionmaking process.

The "other social effects" account is a means of displaying and integrating into water resource planning information on alternative plan effects from perspectives that are not reflected in the other three accounts. The categories of effects in the OSE account include the following: urban and community impacts; life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation.

A thorough evaluation of the EQ and OSE accounts was performed as part of the study's environmental documentation process, and no significant effects were identified that would have a material bearing on the decisionmaking process. The analysis is documented in the *San Luis Drainage Feature Re-evaluation Final Environmental Impact Statement,* May 2006, and accompanying appendices. Feasibility level evaluation of these two accounts was considered unnecessary.

Regional Economic Development Account

Evaluation Criteria

The purpose of this section is to assess and compare how each of the alternatives affects economic activity within Fresno and Kings Counties. The following evaluation criteria are addressed:

- Industry output, or the value of an industry's total production
- Employment, or the number of jobs created in each industry
- Personal income, or the change in employee compensation and proprietor income

Environmental Effects Summary

No-Action Alternative

The difference between the No-Action Alternative and existing conditions is very small from a regional perspective. The only changes that can be measured between existing conditions and the No-Action Alternative are changes in agricultural production that occur as a result of land removed from irrigated agriculture due to inadequate drainage conditions.

The projected difference in economic indicators between the No-Action Alternative and existing conditions is less than 1 percent. The greatest annual economic changes between existing conditions and the No-Action Alternative (measured as a percent of existing condition values) occur in agricultural employment, agricultural income, and agricultural output, at 0.38, 0.24, and 0.48 percent, respectively. These are summarized as shown later in table 11.

Values in the second and third columns of table 10 provide a comparison of economic indicators under existing conditions to those projected to occur under the No-Action Alternative. In addition, values in the last two columns show the projected changes of each economic indicator for the two action alternatives compared to the No-Action Alternative. Comparisons in this table are based on combined data for Fresno and Kings Counties.

Action Alternatives

Both the In-Valley/Water Needs Land Retirement Alternative and the In-Valley/Drainage-Impaired Land Retirement Alternative have a slightly negative effect on the regional economy when compared to the No-Action Alternative. However, none of the effects would be significant, because total projected employment and labor income effects generated by any action alternative are less than 1.0 percent of the affected region's total for those indicators.

Table 10. Summary of regional economic effects[1]

Economic Indicator	Existing Conditions	Projected No Action (Year 50)	In-Valley/Water Needs Land Retirement Alternative	In-Valley/ Drainage-Impaired Land Retirement Alternative
Summary of Annual Effects from Recurring OM&R Expenditures (Years 1 through 50)				
Total Output	$46,909,000	Not Applicable	$27,705	$16,244
Agricultural Output	$5,223,000	Not Applicable	$122	$66
Total Labor Income	$24,996,000	Not Applicable	$11,506	$5,712
Agricultural Income	$2,970,000	Not Applicable	$26	$17
Total Employment	505,400	Not Applicable	220	120
Agricultural Employment	75,700	Not Applicable	2	1
Summary of Annual Effects from Changes in Agricultural Expenditures (Year 50)				
Total Output	$46,909,000	$46,875,000	($43,955)	($69,677)
Agricultural Output	$5,223,000	$5,198,000	($32,070)	($50,834)
Total Labor Income	$24,996,000	$24,986,000	($12,612)	($19,996)
Agricultural Income	$2,970,000	$2,963,000	($8,870)	($14,063)
Total Employment	505,400	505,030	(510)	(820)
Agricultural Employment	75,700	75,415	(400)	(640)
Summary of Construction Activities During Project Construction Period (10 Years)				
Total Output	$46,909,000	Not Applicable	$2,687,115	$2,238,149
Construction	$403,000	Not Applicable	$1,368	$672,754
Total Labor Income	$24,996,000	Not Applicable	$1,065,152	$661,041
Construction	$41,000	Not Applicable	$609,928	$290,266
Total Employment	505,400	Not Applicable	26,540	17,600
Construction	460	Not Applicable	12,850	6,100

[1] All values are shown in thousands of 2006 dollars, except jobs.

The In-Valley/Drainage-Impaired Land Retirement Alternative has the largest negative impact to agriculture in the region based on the impacts estimated to occur as a result of retiring more than 260,000 acres (compared to the No-Action Alternative).

Both alternatives generate a large amount of economic activity during the relatively short-term construction phase (first 10 years) of the project, as a result of the intensive construction efforts required to build the drainage collection and conveyance systems. In addition, a significant amount of economic activity is generated by purchasing drainage-impaired land for retirement from irrigated agriculture.

Tables 11 through 13 summarize the effects that the No-Action Alternative and action alternatives have on regional economics. Changes to agricultural employment, agricultural income, and agricultural output are compared to the No-Action Alternative as well as to existing conditions. These indicators are also shown as a percentage change from the No-Action Alternative and existing conditions.

Mitigation Recommendations

No mitigation measures are identified for minimal effects to agricultural production and economics. Both alternatives are projected to cause a reduction in the value of crop production and decreased regional economic activity over the life of the project.

Table 11. Summary comparison of effects of No-Action Alternative[1]

Affected Resource and Area of Potential Effect	No-Action Alternative Compared to Existing Conditions
Regional Agricultural Economics	Agricultural Employment: -285 compared to 75,700 (-0.38 percent) Agricultural Income: -$6,889 compared to $2,970,000 (-0.24 percent) Agricultural Output: -$24,715 compared to $5,223,000 (-0.48 percent)

[1] All values are shown in thousands of 2006 dollars, except jobs.

Table 12. Summary comparison of effects of In-Valley/Water Needs Land Retirement Alternative[1]

Affected Resource and Area of Potential Effect	In-Valley/Water Needs Land Alternative Compared to No Action	In-Valley/Water Needs Land Retirement Compared to Existing Conditions
Regional Agricultural Economics	Agricultural Employment: -400 compared to 75,415 (-0.53 percent) Agricultural Income: $-8,870 compared to $2,963,000 (-0.30 percent) Agricultural Output:: $-32,070 compared to $5,198,000 (-0.62 percent) No significant effect	Agricultural Employment: -685 compared to 75,700 (-0.90 percent) Agricultural Income: $-15,870 compared to $2,970,000 (-0.53 percent) Agricultural Output:: $-57,070 compared to $5,223,000 -(1.09 percent) Minimal effect

[1] All values are shown in thousands of 2006 dollars, except jobs.

Table 13. Summary comparison of effects of In-Valley/Drainage-Impaired Area Land Retirement Alternative[1]

Affected Resource and Area of Potential Effect	In-Valley/Drainage-Impaired Land Retirement Compared to No Action	In-Valley/Drainage-Impaired Land Retirement Compared to Existing Conditions
Regional Agricultural Economics	Agricultural Employment: -640 compared to75,415 (-0.85 percent) Agricultural Income: $-14,063 compared to $2,963,000 (-0.47 percent) Agricultural Output:: $-50,834 compared to $5,198,000 (-0.98 percent) No significant effect	Agricultural Employment: -925 compared to 75,700 (-1.22 percent) Agricultural Income: $-21,063 compared to $2,970,000 (-0.71 percent) Agricultural Output:: $-75,834 compared to $5,223,000 (-1.45 percent) Minimal effect

[1] All values are shown in thousands of 2006 dollars, except jobs.

National Economic Development Account

The objective of the NED analysis is to determine the change in net value of the Nation's output of goods and services which would result from implementing each project alternative. Beneficial and adverse effects are evaluated in monetary terms and are measured in terms of changes in national income. The NED account describes the NEPA human environment and identifies beneficial and adverse effects on the economy. Beneficial effects in the NED account are (1) increases in the economic value of the national output of goods and services from a plan, (2) the value of output resulting from external economies caused by a plan, and (3) the value associated with the use of otherwise unemployed or under-employed labor resources. Adverse effects in the NED account are the opportunity costs of resources used in implementing a plan. These adverse effects include (1) implementation outlays, (2) associated costs, and (3) other direct costs. Specific guidelines, standards, and procedures used in the NED analysis are provided in the *Principles and Guideline*.

Effects to the NED account resulting from the two action alternative features are discussed below.

NED Benefits

Contributions to national economic development are measured as increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the project area and the rest of the Nation. Contributions to NED include increases in the net value of goods and services that are marketed, as well as those that may not be marketed.

NED benefits generated from the agricultural production of an alternative are measured as the increased value of agricultural output of the Nation plus any cost savings which occur in maintaining a given level of output. Such benefits include reductions in production costs and associated costs; reduction in damage costs from flooding, erosion, sedimentation, inadequate drainage, or inadequate water supply; and the value of increased production of crops.

Provision of Drainage Service

The benefits of the action alternatives are estimated relative to the No-Action Alternative and are based on providing drainage service to drainage-impaired lands within the San Luis Unit service area. These benefits fall into three categories:

- Increased net revenues that are a result of continuing to farm those drainage-impaired lands that would otherwise have to be removed from agricultural production due to inadequate drainage

- Increased net revenues resulting from changing from a salinity- and water-restricted crop mix to a more revenue intensive crop mix on drainage-impaired lands

- Reduced costs of irrigation management practices by providing drainage service to drainage-impaired lands

The first category of benefits is the result of reclaiming drainage-impaired lands that would otherwise be removed from agricultural production without the provision of adequate drainage service. It is estimated that under the No-Action Alternative, the drainage capacity of 65,000 acres would be impaired to the point that the land could no longer sustain irrigated agriculture. For the two action alternatives, it was assumed that these 65,000 acres would be included in the drainage-impaired land removed from agricultural production. The amount of drainage-impaired land removed from agricultural production is shown in table 14. An adjustment to the area of land retirement is necessary to avoid double counting the lands retired under the No-Action Alternative. This adjustment is shown in table 14. The increased net farm revenue used to estimate the benefit of avoiding land retirement is $158.39 per acre per year for Westlands and $172.79 per acre per year for the Northerly Area. The data on crop mix, yields, prices, and costs were developed according to Reclamation guidelines for estimating project costs and benefits and are described in the PFR Addendum (Reclamation 2004b). Agricultural benefits values used in this study have been indexed from 2003 to 2006 using indices from *Agricultural Prices 2006 Summary* (U.S. Department of Agriculture 2006).

The second category of benefits is the result of farmers being able to grow a much broader selection of crops rather than being restricted to raising only salt-tolerant crops. These lands, which are drainage-impaired under the No-Action

Table 14. Changes in acres of land identified as drainage-impaired, drained, or retired relative to the No-Action Alternative[1] (acres)

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
WESTLANDS		
DRAINAGE-IMPAIRED AREA (acres)	298,000	298,000
Existing Retired - Drainage Impairment	44,106	44,106
Remaining Drainage-Impaired Land	253,894	253,894
DRAINAGE-IMPAIRED LAND REMOVED FROM AGRICULTURAL PRODUCTION (acres)		
Land Retirement	139,850	253,894
Additional Land Retired for New Facilities	1,044	0
Total Land Retired for Action Alternatives	140,894	253,894
ADJUSTMENT TO LANDS RETIRED UNDER NO ACTION - DRAINED UNDER ACTION ALTERNATIVES (acres)		
Lands Retired Under No Action	65,000	65,000
Land Retirement	139,850	253,894
Benefited Area (retired to drained)	0	0
DRAINAGE-IMPAIRED LAND UNDER NO ACTION CONVERTED TO DRAINED LAND (acres)		
Remaining Drainage-Impaired Land	253,894	253,894
Total Land Retired for Action Alternatives	140,894	253,894
Retired to Drained Land Adjustment	0	0
Benefited Area (impaired to drained)	113,000	0
NORTHERLY AREA		
DRAINAGE-IMPAIRED AREA (acres)	81,000	81,000
Existing Retired - Drainage Impairment	0	0
Remaining Drainage-Impaired Land	81,000	81,000
DRAINAGE-IMPAIRED LAND REMOVED FROM AGRICULTURAL PRODUCTION (acres)		
Land Retirement	10,000	10,000
Additional Land Retired - New Facilities	4,467	4,467
Total Land Retired for Action Alternatives	14,467	14,467
LANDS RETIRED UNDER NO ACTION - DRAINED UNDER ACTION ALTERNATIVES (acres)		
Lands Retired Under No Action	0	0
Benefited Area (retired to drained)	0	0
DRAINAGE-IMPAIRED LAND UNDER NO ACTION CONVERTED TO DRAINED LAND (acres)		
Remaining Drainage-Impaired Land	81,000	81,000
Total Land Retired for Action Alternatives	14,467	14,467
Retired to Drained Land Adjustment	0	0
Benefited Area (impaired to drained)	66,533	66,533

[1] Values represent the number of acres in each category, relative to No Action.

Alternative, are estimated to generate an additional $101.49 per acre per year in Westlands and $160.03 per acre per year in the Northerly Area. As indicated above, the benefit estimated for lands changing from a drainage-impaired to a drained condition requires an adjustment to account for the 65,000 acres of the land retired under the No-Action Alternative to avoid double counting the benefit of those lands. The land area converted from drainage-impaired to drained land for this second category of benefit is also shown in table 14.

The first two types of benefits described above are based on strategies used under the No-Action Alternative to keep lands with limited natural drainage and high soil salinities under agricultural production. The last benefit category is the result of a reduction in production costs that occurs as farmers are relieved from increasingly restrictive irrigation management practices required to keep farming drainage-impaired lands even as salts continue to accumulate in the root zone of the soil. This reduced cost is estimated to be $8.01 per acre per year in Westlands and $8.45 per acre per year in the Northerly Area. However, these values are included in the increased net farm revenue indicated for the two benefit categories described above. Therefore, an estimate of NED benefits was not prepared or shown separately in table 14. Analysis and results of the action alternatives are described later in this section.

Avoided Cost of Involuntary Land Retirement

The first category of benefits provided by drainage service alternatives is the increase in net farm revenues as a result of sustaining agricultural production on lands that would otherwise be retired because of inadequate drainage. Westlands has implemented a plan to retire 65,000 acres of drainage-impaired land. Under the No-Action Alternative, this land is assumed to remain out of production for the 50-year planning horizon. The annual benefit per acre is estimated as the avoided loss of net farm revenue from lands removed from agricultural production. Based on prices, yields, and production costs developed for the PFR Addendum (Reclamation 2004), the net revenue loss would average $172.79 per acre per year in the Northerly Area and $158.39 per acre per year in Westlands (the difference is due to different crop mixes on the affected lands).

Land retirement has two effects on regional drainage conditions. First, it removes drainage-impaired land from production and, therefore, eliminates the need to provide artificial drainage on those lands. Second, the reduction in irrigation and deep percolation of irrigation water may provide some regional benefit to the shallow groundwater: lands remaining in production may benefit, because the regional water table may be lowered to some degree due to retirement.

Since the two alternatives analyzed in this report retire more land than the 65,000 acres estimated to go out of production (retired) under no action, no benefits are estimated under this category of benefits for either the In-Valley/Water Needs Land Retirement Alternative or the In-Valley/Drainage-Impaired Land Retirement Alternative.

Cropping Pattern Changes

The second category of benefits projected to occur as a result of the provision of drainage service is the increase in net revenues associated with changes in cropping patterns. With adequate drainage conditions, crops are projected to shift toward a more revenue intensive crop mix. The gain in net revenue depends on how the mix of crops changes. For this analysis, an estimate is made of the average crop ET and applied water that would most likely occur under adequate drainage conditions. In Westlands, the weighted increase in net revenue expected from the crop mix change is $101.49 per acre. For the Northerly Area, with slightly lower estimated natural drainage on its most impaired lands, the projected change in crop mix results in a weighted increase in net revenue of $160.03 per acre. These estimates are used to assess the potential net revenue gained as a result of improving drainage conditions by providing drainage service on drainage-impaired lands. This analysis only represents a typical or average situation, wherein individual growers would make their decisions based on specific site and market conditions.

Table 15 displays estimates of the aggregate gain in net revenue from farming, using the crop shifts described above. The expected crop mix with drainage service provided is assumed to be similar to overall crop mix in the Unit, with the exception that the most sensitive crops (orchards and vineyards) would not be planted in areas affected by shallow groundwater. The crops for the No-Action Alternative (no drainage service provided) are assumed to be a mix of cotton, grains, and rotational fallow.

Table 15. Benefits of crop mix change relative to the No-Action Alternative ($/year)

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
NORTHERLY AREA		
Drained Area (acres)	66,533	66,533
Increased Net Revenue ($/acre)	$160.03	$160.03
Benefit Subtotal ($)	$10,647,000	$10,647,000
WESTLANDS		
Drained Area (acres)	113,000	—
Increased Net Revenue ($/acre)	$101.49	$101.49
Benefit Subtotal ($)	$11,468,000	—
Benefit Total	**$22,115,000**	**$10,647,000**

[1] Values used for "Change in Net Revenue" were indexed from 2003 to 2006 using the index for "Prices Received by Farmers for All Crops" from the *Agricultural Prices 2005 Summary*: Released July 2007, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture. ($149.27 per acre * 119/111 = $160.03 per acre for Northerly Area; $94.67 per acre * 119/111 = $101.49 per acre for Westlands). Values represent avoided costs relative to No Action.

Prices and yields are based on Fresno County Agricultural Commissioner annual reports. Production costs were derived from the most recent crop budgets prepared by the University of California Cooperative Extension (various years). These assumptions are developed according to Reclamation guidelines for estimating costs and benefits of water projects.

Avoided Irrigation Management Costs

As indicated in the appraisal-level analysis described in chapter 3, a high level of irrigation management is required to maintain agricultural production on drainage-impaired lands without artificial drainage. The required level of management depends on the estimated rate of natural drainage. Poorly drained lands with a low rate of natural drainage require higher levels of irrigation management to remain in production.

Providing drainage service to (or retiring) drainage-impaired lands eliminates the requirement for such a high level of irrigation management, as well as the associated costs. Irrigation management costs avoided as a result of providing drainage service (or retiring lands) are included as a project benefit. Avoided irrigation management costs are estimated to be $8.01 per acre for Westlands and $8.45 per acre for the Northerly Area districts. Increased irrigation management costs were based on estimates in an update to the irrigation cost and performance study prepared for Reclamation under the San Joaquin Valley Drainage Program and the San Luis Unit Drainage Program (CH2M Hill 1994). As indicated earlier, these avoided irrigation management costs are incorporated in the net change in agricultural productivity values shown in table 16.

Benefit Summary

The estimated values of benefits projected to occur as a result of providing adequate collection, treatment, and disposal of drainwater for drainage-impaired lands in the San Luis Unit are shown in table 16.

NED Costs

Project measures, whether structural or nonstructural, require the use of various resources. NED costs are the opportunity costs of resource use. Opportunity costs are a measure of the highest valued alternative use that would be foregone as a result of using a particular resource. Both public and private uses of the various resources required in a project alternative should be considered when evaluating NED costs.

Economic Costs versus Financial or Accounting Costs

As indicated above, NED costs are the opportunity, or economic, costs of resources used in a project alternative. Financial or accounting costs are a measure of the actual cash outlays made to acquire the resources necessary to implement the project. In cases where financial costs reflect the full economic value of a particular resource to society, they can and should be used to determine

Table 16. Summary of changes in agricultural productivity of project lands relative to the No-Action Alternative[1] ($/year)

	In-Valley/Water Needs Land Retirement Alternative	In-Valley/ Drainage-Impaired Land Retirement Alternative
Northerly Area		
Acres	66,533	66,533
Increased Net Revenue ($/ac/yr)	$160.03	$160.03
Benefit Subtotal ($)	**$10,647,000**	**$10,647,000**
Present Value[2] ($)	$198,186,000	$198,186,000
Discount Period (years)	6	6
Discounted Value[3] ($)	$148,950,000	$148,950,000
Annual Equivalent Benefit [4] ($)	**$8,002,000**	**$8,002,000**
Westlands		
Acres	113,000	0
Increased Net Revenue ($/ac/yr)	$101.49	$101.49
Benefit Subtotal ($)	**$11,468,000**	**$0**
Present Value[2] ($)	$213,468,000	$0
Discount Period (years)	10	10
Discounted Value[3] ($)	$132,621,000	$0
Annual Equivalent Benefit[4] ($)	**$7,125,000**	**$0**
Total		
Total Acres	179,533	66,533
Total Annual Equivalent Benefit ($)	**$15,127,000**	**$8,002,000**

[1] Values represent additional costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

[2] Annual benefits converted to present value at end-of-construction period based on 4.875 percent for 50 years.

[3] Present values discounted to beginning-of-construction period at 4.875 percent.

[4] Discounted values converted to an annual equivalent value for comparison with project costs at 4.875 percent over 50 years.

NED costs. However, financial costs are often different from, and unrelated to, economic costs. Many financial costs do not reflect the true opportunity cost of a resource.

Market prices (i.e., the price that a particular commodity will fetch in the marketplace) are used to quantify the financial cost of a particular commodity or resource. When market prices do not accurately reflect the true opportunity cost of a resource to society, it is necessary to use other or additional means to estimate NED costs. In some cases, financial costs don't include all of the opportunity costs of a resource. Other times, actual cash outlays made to acquire a resource have no relationship to the opportunity costs of the resource. Economic costs may exceed financial costs when uncompensated or unmitigated losses occur as a result of the installation, operation, maintenance, and replacement of project measures. An example of such losses might be the

degradation of water or air quality resulting from the construction and operation of a coal-fired electrical powerplant. The true opportunity cost to society of using these resources is not captured in the accounting or financial costs of the powerplant.

In some instances, the financial costs paid by an entity may exceed the actual increased value of production (especially when measured for the entire Nation). For example, assume that one company buys another company. Unless one of the companies possesses a technological or management process that either increases the total output (or decreases the total production cost) of the new combined company, the actual financial transaction is very likely to exceed the actual increase in net revenue. When this transaction is viewed from a national perspective, the financial transaction is irrelevant to the total output minus the net change in total production costs of the combined company compared to the net revenues of the two separate companies before they were combined (assuming that the output of the rest of the Nation remains the same).

The *Principles and Guidelines* (U.S. Water Resources Council 1983) identifies three separate categories to use in measuring and analyzing NED costs: implementation outlays, associated costs, and other direct costs. These cost categories are discussed and estimated in the sections below.

Implementation Costs of Project Features
The NED costs of implementation outlays include the costs incurred by the responsible Federal entity and, where appropriate, contributed by other Federal or non-Federal entities to construct, operate, and maintain a project in accordance with sound engineering and environmental principles and place it in operation. These costs include remaining post-authorization planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; relocation costs; historical and archaeological salvage costs; land, water, and mineral rights costs; and operation, maintenance, and replacement costs.

Treatment and Disposal Costs
Treatment and disposal costs include post-authorization planning and design costs, construction costs, construction contingency costs, administrative service costs, as well as operation, maintenance, and replacement costs.

Specific treatment and disposal facilities include facilities funded by the Federal Government, as well as those funded by non-Federal entities. Federally funded facilities consist of the drainage collection system, conveyance system, regional reuse facilities, evaporation basins, RO treatment facilities, biological selenium treatment facilities, and fish and wildlife mitigation facilities. Facilities funded by non-Federal entities include on-farm tile drains, drainwater recycling facilities, seepage reduction measures, shallow groundwater management measures, and on-farm irrigation efficiency improvements. Construction costs, interest during

construction costs, and annual operation, maintenance, and replacement costs are expressed as annual equivalent costs using the FY 2007 Federal discount rate of 4.875 percent over a 50-year project life. Annual treatment and disposal costs are shown in table 17.

Table 17. Construction (field and non-contract) costs of drainage service (treatment, disposal, and mitigation)[1]

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
Northerly Area and Westlands Combined		
Federal Project Construction Costs		
Conveyance System	$136,616,000	$67,107,000
Evaporation Basins and Mitigation	$917,700,000	$473,500,000
RO Facilities	$76,294,000	$44,037,000
Selenium Treatment	$237,000,000	$130,000,000
Drainage Collection System	$296,474,000	$18,474,000
Regional Reuse Facilities	$363,031,000	$255,031,000
Total Federal Treatment and Disposal Cost	**$2,027,115,000**	**$988,149,000**
Interest During Construction (IDC) Cost	$197,555,000	$93,826,000
Total Federal Construction and IDC Costs	**$2,224,670,000**	**$1,081,975,000**
Annual Equivalent Federal Construction and IDC	$119,514,000	$58,126,000
Replacement Costs (Annual Equivalent)	$770,000	$333,000
O&M Cost	$19,800,000	$11,800,000
Energy Cost	$1,285,000	$914,000
Total Annual Equivalent of Federal Treatment and Disposal Costs	**$141,369,000**	**$71,173,000**
Annual Equivalent of Non-Federal Treatment and Disposal Project Costs		
Drainage Reduction Costs		
Drainwater Recycling	$1,920,000	$832,000
Seepage Reduction	$517,000	$517,000
Shallow Groundwater Management	$311,000	$9,000
Irrigation Improvements	$768,000	$768,000
Subtotal ($)	$3,516,000	$2,126,000
On-Farm Tile Drains	$2,442,000	$498,000
Non-Federal Cost Subtotal ($)	$5,958,000	$2,624,000
Total Annual Equivalent Treatment and Disposal Costs	$147,327,000	$73,797,000

[1] Values represent additional costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Operation and Maintenance Costs—Basis and Justification

Pumping Plants.—The annual O&M costs for the pumping plants were based on the annualized costs of replacing the pumps and motors within certain time periods, combined with an allowance for labor. All of the vertical turbine pumps and the motors associated with them must be replaced every 25 years, while the submersible pumps and their motors must be replaced every 17 years. A capital

recovery factor using the appropriate number of years (17 or 25) and a rate of 4.875 percent was multiplied by the initial cost of the pumps and motors to obtain the annualized replacement costs.

In addition to the replacement costs, labor costs were added to account for the numerous tasks that were outlined in the *Operation and Maintenance of Drainage Service Features* report. The Northerly Area was assumed to require two full-time mechanics, while the other three areas were all assumed to require one each. The cost of this position was estimated to be $120,000 per year. Therefore, the annual labor costs for the Northerly Area were calculated to be $240,000 per year shared by 14 pumping plants. The Westlands North and South areas were each calculated to require $120,000 per year for the three pumping plants in both of their respective areas, and the Westlands Central area was calculated to require $120,000 per year for the labor associated with maintaining its five pumping plants.

To arrive at the total estimated annual O&M costs for the pumping plants, the annualized replacement costs and the estimated labor costs were added together.

Irrigation Systems, Collection Systems, Conveyance Systems, and the Delta-Mendota Canal Drainage Pipeline

All of these features were treated as if they were pipelines in order to estimate the annual O&M costs. For pipelines, the "annual costs are about 0.5 percent of the construction costs" according to the *Operation and Maintenance of Drainage Service Features* report. This effectively means that 1/200 of the construction cost is required for O&M each year for these features.

Reuse Areas

The reuse areas were considered to have site management costs associated with them similar to wildlife refuges and mitigation sites. Based on the actual annual costs of existing sites, a graph was produced to show the relationship between the unit costs per acre and the total area of the site being managed. Using the graph, a unit cost per acre was estimated based on the total acreage of each site. The unit costs were multiplied by the number of acres at each site, and that resulting value was decreased by 25 percent to estimate the annual O&M costs associated with the reuse areas. These costs include the services of individuals experienced in agriculture to manage the facilities by growing appropriate crops on the sites. It is predicted that the value of these crops will help to offset the annual O&M costs to a degree, but the primary purpose of the crops is to facilitate drainage, not to produce profit. The reuse areas may lay fallow in some years, or be used to grow crops of very low value in other years, which is why the estimated costs were only reduced by 25 percent. It is expected that the reuse areas will become more efficient over time as those who manage them gain experience and the crops with the best combination of drainage capabilities, yields, and value are discovered.

RO Treatment Plants
The annual O&M costs for the RO treatment plants were taken directly from the *Operation and Maintenance of Drainage Service Features* report and were not altered or adjusted in any way.

Selenium Biotreatment Plants
The annual O&M costs for these facilities located in the Northerly Area and the Westlands Central and North areas were taken from the *Operation and Maintenance of Drainage Service Features* report. The annual O&M costs for the selenium biotreatment plant in the Westlands South area were not reported; therefore, the costs were estimated by averaging the costs of the Westlands Central and North plants. The estimated capacity of the Westlands South plant is predicted to be somewhere between the capacities of the Westlands Central and North plants, so this method was thought to be reasonable. The plant in the Northerly Area is expected to handle much more volume compared to the others, so it was not considered when estimating the annual O&M costs of the Westlands South plant.

Evaporation Ponds
The annual O&M costs for the evaporation ponds were estimated by annualizing the costs of closing a basin every 12½ years. It is assumed that personnel from the RO treatment plants and selenium biotreatment plants can handle the activities that are periodically required onsite, since the features are all adjacent to each other. The total cost of closing one of the evaporation pond basins was given in the *Operation and Maintenance of Drainage Service Features* report. A capital recovery factor using 12½ (12.5) years and a rate of 4.875 percent was multiplied by the cost of closing a basin to obtain the annualized O&M costs.

Mitigation
Mitigation associated with the San Luis Drain project consists of land set aside for wetlands to provide habitat for various species. These mitigation sites will require water, site management, and routine monitoring. Based on a draft report on the mitigation requirements, the estimated annual O&M costs, when all 1,040 acres are in operation, was shown to be $1,082,200. The 1,040 acres represents the total area of the mitigation sites, with 640 acres included in the Northerly Area and the remaining 400 acres included in the Westlands areas. For cost estimating purposes, the Westlands mitigation sites were included with the Westlands Central area. To obtain the annual O&M costs for the different areas, the total estimated annual O&M costs were multiplied by a factor based on the proportion of land in each area. A factor of 640/1,040 was used for the Northerly Area, and a factor of 400/1,040 was used for the Westlands Central area. The result of each area's factor multiplied by the total estimated annual O&M costs of $1,082,200 was used as the annual O&M cost for each respective mitigation area.

Transmission Lines
It was assumed that there will be no annual O&M costs associated with the transmission lines, because it is expected that the local utility companies will take ownership and responsibility for them.

Electrical and Control Equipment
The annual O&M costs for the supervisory control and data acquisition (SCADA) systems were estimated to be 8.5 percent of their construction costs, because it was assumed that about 8.5 percent of the system will need to be replaced each year. This assumption was based on the information provided in an estimate guide for the replacement of various features.

Fish and Wildlife Mitigation Costs
The cost of mitigating for the loss of fish and wildlife habitat is included in the cost estimate of evaporation ponds. Some design features of the evaporation ponds included certain mitigation considerations in their designs; and, therefore, a portion of the total mitigation costs have been integrated into the design cost of those particular features. For example, design specifications for evaporation ponds require that the shape of containment berms have a specific slope and that the depth of the ponds be such that they are less likely to attract waterfowl. Therefore, the costs of all project mitigation measures have been combined with evaporation ponds in table 17 above.

Cost of Reducing Deep Percolation in Non-Drainage-impaired Area Lands
Lands in Westlands' upslope areas and in the Northerly Area that are not drainage impaired are not currently at as high a level of irrigation efficiency as drainage-impaired lands. For these areas, the costs and benefits of two levels of improvements were assessed as part of *SLDFR Plan Formulation* (see PFR Addendum [Reclamation 2004b]). Based on that assessment, all of the drainage service alternatives were assumed to implement a moderate reduction in deep percolation on these lands. The costs of the irrigation system improvements were based on estimates in an update to the irrigation cost and performance study prepared for Reclamation under the San Joaquin Valley Drainage Program and the San Luis Unit Drainage Program (CH2M Hill 1994). Irrigation system performance estimates were compiled from studies performed at California State Polytechnic University, San Luis Obispo. The costs were derived by estimating the level of irrigation efficiency and distribution uniformity needed to reduce deep percolation by the target amount of 0.1 foot per acre, on average. Costs associated with higher levels of management are expressed as annual equivalents, including amortized capital costs of irrigation system hardware and O&M costs. These increased irrigation management costs are the same as those discussed above in the "Avoided Irrigation Management Costs" section under "NED Benefits." Changes in additional irrigation management costs to reduce deep percolation in these lands are shown in table 18.

Table 18. Changes in additional irrigation management costs to reduce deep percolation relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/ Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
Northerly Area		
Upslope Unimpaired Area (acres)	253,000	253,000
Irrigation Management Costs ($/acre)	$8.45	$8.45
Subtotal ($)	$2,138,000	$2,138,000
Westlands		
Upslope Unimpaired Area (acres)	126,000	126,000
Irrigation Management Costs ($/acre)	$8.01	$8.01
Subtotal ($)	$1,009,000	$1,009,000
Total Cost	**$3,147,000**	**$3,147,000**

[1] Values used for "change in net revenue" were indexed from 2003 to 2006 using the index for "Prices Received by Farmers for All Crops" from the *Agricultural Prices 2005 Summary*: Released July 2007, by the NASS, Agricultural Statistics Board, U.S. Department of Agriculture. ($149.27 per acre * 119/111 = $160.03 per acre for Northerly Area; $94.67 per acre * 119/111 = $101.49 per acre for Westlands). Values represent avoided costs relative to No Action.

Land Retirement Costs

Another category of costs incurred by some of the action alternatives is the removal of lands from agricultural production, or land retirement. As mentioned above, the NED cost of land retirement is the net farm income forgone as a result of retiring land rather than keeping it in irrigated agricultural production—not the actual cash outlay or financial cost of purchasing land to retire. The financial cost of land retirement is a transfer payment. A transfer payment is essentially a payment from one economic sector of the Nation (Federal Government) to another (current owners of drainage-impaired land) without any corresponding production or expectation of production. The analysis of alternatives formulated to provide the San Luis Unit with drainage service includes two types of land retirement scenarios: (1) retiring land for the purpose of constructing project facilities on it and (2) retiring land to avoid providing drainage service for particular land parcels.

Project Facilities

The first example of land retirement, which occurs in all of the action alternatives, is the purchase of lands required for project facilities, such as reuse areas, evaporation basins, and water storage, treatment, or conveyance facilities. The net revenue from these lands is lost as they are removed from agricultural production and used as sites for project facilities. The change in net farm revenue that occurs when drainage-impaired land is retired is estimated to be $56.90 ($158.39-$101.49) per acre per year in Westlands and $12.76 ($172.79-$160.03) per acre per year for land in the Northerly Area (the difference is due to different crop mixes on the affected lands). The values used in this analysis are indexed to FY 2006 values using prices, yields, and

production costs developed for the PFR Addendum (Reclamation 2004a). The estimated NED cost of lands retired for project facilities is provided in table 19.

Table 19. Changes in cost of agricultural production losses from land purchased for project facilities relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
Northerly Area		
Purchased for Project Facilities (acres)	4,467	4,467
Change in Net Revenue ($/acre/year)	$12.76	$12.76
Subtotal ($)	$57,000	$57,000
Westlands		
Purchased for Project Facilities (acres)	1,044	0
Change in Net Revenue ($/acre/year)	$56.90	$56.90
Subtotal ($)	$59,000	$0
Total Cost	**$116,000**	**$57,000**

[1] Estimates shown are annual figures as of the end of the 50-year planning horizon.

Values used for "Change in Net Revenue" are the difference between the loss of net farm income from land retirement and the change in net farm income with drainage service vs. without drainage service. ($172.79 - $160.03 = $12.60/acre for Northerly Area; $158.39 - $101.49 = $56.90/acre for Westlands).

Values represent additional costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Land Retirement

Another reason to retire land is to avoid the cost of providing drainage service to specific drainage-impaired lands. The NED cost per acre of retiring land to avoid providing drainage service to that same land is the same as the cost estimated for project facilities. Table 20 summarizes the changes in net farm income resulting from land retirement activities.

In addition to the loss of net revenue that occurs as land is taken out of agricultural production, an additional cost of the land retirement program is the result of management and administrative activities required to manage the alternative uses of retired lands. Specific activities assumed to be part of the land management program are dryland farming, land fallowing, and grazing. One-third of all retired land is assumed to be in one of these three program activities.

Administrative and management costs of the land retirement program are assigned only to those lands retired to avoid having to provide drainage service. Annual administrative and management costs of the land retirement program are estimated to be $19.00 per acre. Lands retired to provide sites for project facilities are not assigned administrative and management costs. Administrative and management costs of the land retirement program are shown in table 21.

Table 20. Changes in cost of agricultural production losses from land retirement relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/ Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
Northerly Area		
Additional Retired Land (acres)	10,000	10,000
Change in Net Revenue ($/acre/year)	$12.76	$12.76
Subtotal ($)	$128,000	$128,000
Westlands		
Retired Land (acres)	139,850	253,894
Minus Land Retirement Under No Action (acres)	(65,000)	(65,000)
Adjusted Net Retired Land (acres)	74,850	188,894
Change in Net Revenue ($/acre/year)	$56.90	$56.90
Subtotal ($)	$4,259,000	$10,748,000
Total Cost	**$4,387,000**	**$10,876,000**

[1] Avoided losses increase over time as drainage is installed. Estimates shown are annual figures as of the end of 50-year planning horizon.

Values used for "change in net revenue" are the difference between the loss of net farm income from land retirement and the change in net farm income with drainage service vs. without drainage service. ($172.79-$160.03 = $12.60/acre for Northerly Area; $158.39-$101.49 = $56.90/acre for Westlands).

Values represent additional costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Table 21. Changes in administrative and management costs of land retirement changes relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/ Drainage-Impaired Land Retirement
Northerly Area		
Retired (acres)	10,000	10,000
Administration and Management Cost ($/acre/year)	$19.00	$19.00
Subtotal ($)	$190,000	$190,000
Westlands		
Retired (acres)	141,000	254,000
Administration and Management Cost ($/acre/year)	$19.00	$19.00
Subtotal ($)	$2,679,000	$4,826,000
Total Cost	**$2,869,000**	**$5,016,000**

[1] Values represent additional costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Cost of Supplemental Water Purchases

There is currently a shortage of water available to irrigate all of the land located within the San Luis Unit. It is estimated that under the No-Action Alternative, about 96,000 acre-feet of water is necessary to provide a full irrigation supply for

the Unit. The result of providing drainage service to drainage-impaired lands within the Unit increases the amount of water that will be needed to irrigate all land suitable for unrestricted agricultural production. It is estimated that under the In-Valley/Water Needs Land Retirement Alternative an additional (albeit smaller) amount of water (about 15,700 acre-feet) still will need to be acquired to irrigate Unit lands that will have sufficient drainage service. However, under the In-Valley/Drainage-Impaired Land Retirement Alternative, enough land will be retired so that the contracted amount of water will exceed the water required to irrigate the land remaining in production. Therefore, this alternative will actually create a surplus of water that can be used to meet other demands. Even though this alternative generates a surplus water supply, the overall change is shown as a decrease in the cost of acquiring a full supply of water needed to irrigate Unit lands that would receive irrigation water.

The reduction in demand for irrigation water translates to a decrease in the cost of acquiring a full water supply for both alternatives. This cost reduction needs to be accounted for in the NED analysis. The differences (compared to no action) in the costs of acquiring a full water supply for each alternative are shown in table 22.

Table 22. Changes in cost of additional water supply for land retired relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/ Water Needs Land Retirement	In-Valley/ Drainage-Impaired Land Retirement
Westlands		
No Action Estimate		
Additional Water Required (acre-ft)	96,200	96,200
Water Price ($/acre-ft/year)	$140.81	$140.81
Value of Acquired Water ($)	**$13,546,000**	**$13,546,000**
Estimates of Action Alternatives		
Additional Water Required (acre-ft)	15,700	(296,900)
Water Price ($/acre-ft/year)	125.65	66.76
Value of Acquired Water ($)	**$1,973,000**	**($19,821,000)**
Cost of Supplemental Water	**($11,573,000)**	**($33,367,000)**

[1] Water price values were estimated from a derived demand curve using price and quantity data obtained from Westlands for 2002-2004. Price with large net sale of 300,000 acre-ft based on avoided cost of Environmental Water Account water purchases from Northern California. Water price values were then indexed from 2003 to 2006 using the index for "Prices Paid by Farmers for Production Items" from the *Agricultural Prices 2006 Summary*: Released July 2007, by the NASS, Agricultural Statistics Board, U.S. Department of Agriculture. ($119.59 per acre-ft per year * 146/124 = $140.81 per acre-ft per year for the quantity required under No Action; $106.72 per acre-ft per year * 146/124 = $125.65 per acre-ft per year for the quantity required under the In-Valley/Water Needs Land Retirement Alternative; $56.70 per acre-ft * 146/124 = $66.76 per acre-ft per year for the quantity available under the In-Valley/Drainage-Impaired Land Retirement Alternative).

Values represent additional costs relative to No Action. Values rounded to nearest $1,000. Totals may not add due to rounding.

Cost Summary

NED costs estimated for each alternative are listed in table 23. All cost estimates shown are based on comparing the costs incurred under each of the action alternatives to those estimated under the No-Action Alternative.

Table 23. Summary of changes in NED costs relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/Water Needs Land Retirement	In-Valley/ Drainage-Impaired Land Retirement
Westlands		
Irrigation Management Cost–Unimpaired Lands	$2,138,000	$2,138,000
Agriculture Losses–Facilities	59,000	0
Agriculture Losses – Land Retirement	4,259,000	10,748,000
Land Retirement Administration Costs	2,679,000	4,826,000
Cost Subtotal	**$9,135,000**	**$17,712,000**
Northerly Area		
Irrigation Management Cost–Unimpaired Lands	$1,009,000	$1,009,000
Agriculture Losses–Facilities	57,000	57,000
Agriculture Losses–Land Retirement	128,000	128,000
Land Retirement Administration Costs	190,000	190,000
Cost Subtotal	**$1,384,000**	**$1,384,000**
Northerly Area and Westlands Combined		
Treatment and Disposal Costs	$147,327,000	$73,797,000
Supplemental Water Purchases/Sales	(11,573,000)	(33,367,000)
Cost Subtotal	**$135,754,000**	**$40,430,000**
TOTAL COSTS	**$146,273,000**	**$59,526,000**

[1] Values represent NED costs relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

Net NED Benefits

The *Principles and Guidelines* (U.S. Water Resources Council 1983) state that the alternative that reasonably maximizes net NED benefits, consistent with the Federal objective, is identified as the NED plan. Net NED benefits are calculated by subtracting NED costs from NED benefits. As shown in table 24, the action alternative that generates the maximum net NED benefit is the In-Valley/ Drainage-Impaired Land Retirement Alternative.

Conclusion of Economic Feasibility

Even though table 24 shows that the net NED benefit estimated for the In-Valley/Drainage-Impaired Land Retirement Alternative is greater than the In-Valley/Water Needs Land Retirement Alternative, it should be noted that

Table 24. Summary of changes in net NED benefit/cost summary relative to the No-Action Alternative[1] ($/year)

Subarea	In-Valley/ Water Needs Land Retirement	In-Valley/Drainage-Impaired Land Retirement
Total NED Benefit	$15,127,000	$8,002,000
Total NED Cost	146,273,000	59,526,000
NET NED BENEFIT	**($131,146,000)**	**($51,524,000)**

[1] Values represent net NED benefits relative to No Action. Values are in 2006 dollars rounded to nearest $1,000. Totals may not add due to rounding.

neither alternative generates a positive net NED benefit. Under typical water resource project planning procedures, such results indicate that neither of the alternatives is economically justifiable and do not warrant the expenditure of Federal funds.

Project Feasibility

Basically, project feasibility consists of four parts—technical, environmental, economic, and financial. Technical feasibility consists of engineering, operations, and constructability analyses verifying that the project can be constructed, operated, and maintained. Environmental feasibility consists of analyses verifying that constructing or operating the project will not result in unacceptable environmental consequences to endangered species, cultural, Indian trust, or other resources. Economic feasibility consists of analyses that verify that constructing the project is an economically sound investment of capital (i.e., that the project would result in positive net benefits or the project's benefits would exceed the costs). The financial feasibility of a project entails the examination and evaluation of the project beneficiaries' ability to repay their appropriate portion of the Federal Government's investment in the project over a period of time consistent with applicable law. This section of the report will discuss the financial feasibility of the two action alternatives.

Financial Feasibility

Financial feasibility consists of (1) an allocation of costs to project purposes, (2) determination of reimbursable and non-reimbursable costs, (3) commitment on the part of project beneficiaries to pay the reimbursable costs, and (4) a determination of project beneficiaries' ability to pay their allocated costs, including capital costs and long-term operation, maintenance, and replacement costs. For the San Luis Drainage Feature Re-evaluation project, all project costs are allocable to irrigation and would be repayable by Westlands, Broadview, Pacheco, Panoche, and San Luis Water Districts. As of March 2007, Broadview has been annexed by Westlands.

The determination of financial feasibility requires an evaluation of the individual district's ability to pay the project's estimated capital repayment costs and annual operations and maintenance coupled with any existing obligations, Restoration Fund[5] charges and other existing charges. The following briefly describes the analysis required to determine financial feasibility.

Cost Allocation

Reclamation law and policy require an allocation of costs to components or purposes of projects to: (1) test financial feasibility of reimbursable components or purposes by a comparison of estimated project costs with anticipated revenues and (2) establish and measure compliance with project financial requirements after construction. Cost allocation is used as a transitional step leading from economic evaluation into repayment analysis. The primary purpose of the final allocation is to determine the assignment of costs to beneficiaries for repayment purposes. Specific laws vary the cost-sharing requirements among the purposes or components served by a project. A systematic and impartial process of allocation is necessary to both determine and assign those costs. Costs must be clearly identifiable with the particular purposes which they serve and must be equitably apportion when jointly serving two or more purposes.

An initial cost allocation is made during plan formulation to provide an estimate of the financial feasibility of individual project elements and the project as a whole. In the project planning stage, project costs are allocated to the various project purposes to test financial feasibility of the reimbursable purposes by a comparison of estimated costs against estimated revenues. The reimbursable cost estimates are then used as the basis for establishing the obligations discussed in repayment or water service contracts. The initial cost allocation provides an estimate of costs for each reimbursable and non-reimbursable function as well as costs for the project as a whole. This estimate informs the decisionmaker of the appropriateness of the Federal investment in individual components and the overall project.

All project costs are fully attributable to irrigation; therefore, the cost allocation process can be streamlined to focus on each district's ability to repay its share of the project costs in addition to existing financial obligations. The ability-to-pay process examines and assesses the district's financial capability based on farming's capacity to meet O&M and repayment obligations while continuing to make a reasonable return on the farmer's labor, management, and equity.

Payment Capacity

Payment capacity is an irrigator's estimated residual net farm income available for payment of both federally and non-federally assessed water costs after

[5] The Restoration Fund was established by Section 3406(a) of the Central Valley Project Improvement Act (Public Law 102-575). Section 3407 (d) requires CVP water and power contractors to make annual mitigation and restoration payments for each acre-foot of water sold and delivered by the CVP

subtracting for on-farm production and investment expenses and appropriate allowances for management, return on equity, and labor. Payment capacity is a "farm-level" analysis that determines the estimated on-farm economic and financial conditions expected to occur in the following 5 years with the Federal project in place.

Ability to Pay

An ability-to-pay study assesses the financial capability of an irrigation district (or contracting entity) to pay for existing or increased Reclamation water charges and services. An ability-to-pay study is a "district-level" analysis completed subsequent to a payment capacity study. Ability to pay is the farm-level payment capacity aggregated to the entire district, minus district existing obligations, O&M costs, power costs, and reserve fund requirements.

An ability-to-pay study determines the district's financial capability for the following 5 years. It is Reclamation's policy to review ability-to-pay determinations every 5 years for repayment and water service contracts entered into after March 25, 1994.

Contracts

To protect the interests of the United States, Reclamation's water-related contracts must ensure that repayment of the reimbursable capital cost is made in accordance with Reclamation law. Subsections 9(c), (d), and (e) of the Reclamation Project Act of 1939 (1939 Act) require repayment of all reimbursable costs. The methods used in recovering these costs can vary. Both 9(d) and 9(e) contracts are executed with water districts within the San Luis Unit.

Contract terms and repayment periods will be for the maximum duration provided by law, typically 40 years. For those authorities that are silent on contract term, as with the San Luis Unit Act of 1960, a 40-year maximum term will be used. Contracts will ensure that the Federal investment and Reclamation's O&M costs are recovered pursuant to law and policy. Full payment of annual O&M costs is required by section 5 of the Reclamation Extension Act of 1914 (Public Law 63-208; 43 U.S.C. Sections 471 and 472). Full payment of annual O&M costs in advance of water delivery is mandated by section 46 of the Omnibus Adjustment Act of 1926 (Public Law 69-284; 43 U.S.C. Section 423e), and section 6 of the 1939 Act (Public Law 76-260; 43 U.S.C. Section 485e). Advance payment of O&M costs are adjusted to actual costs either during the year or at the year's end.

Aid to Irrigation

Also commonly known as "ability-to-pay relief," aid to irrigation typically allows for the assignment to CVP power that amount of capital costs and Restoration Fund charges which are beyond the ability of irrigators to repay pursuant to Reclamation law. However, through section 101(e) of the Continuing Appropriations Act of October 18, 1986 (Public Law 99-500), section 8 of the

San Luis Act of June 3, 1960 (74 Statute 156; Public Law 86-488) was amended with the addition of section 8(b) as herein stated:

> *(b) Notwithstanding any other provision of the law, none of the costs associated with, or resulting from, the following which have been or will be incurred shall be recovered by the Secretary , directly or indirectly, from power customers of the Central Valley project:*
>
> *(1) the construction of such distribution systems and drains as are not constructed by local interests;*
>
> *(2) the construction of the San Luis interceptor drain; or*
>
> *(3) the construction or acquisition of any facilities by the United States or the Westlands Water District as partial or full alternatives to the San Luis interceptor drain.*

This amendment to the Act of 1960 prohibits the assignment of any costs from implementation of either action alternative to CVP power customers. Therefore, if either action alternative is implemented, this will require separate accounting of the OMR&E and capital repayment costs associated with drainage service. If either action alternative is implemented, the Restoration Fund may be adversely affected because it is unclear if the charges that the San Luis Unit contractors are unable to pay can be assigned to power contractors.

Project Repayment

A payment capacity study was prepared to determine the financial capacity of irrigators within the San Luis Unit for the two action alternatives. Districts in the northerly drainage service area outside of the San Luis Unit are not included in the analysis. Results of the payment capacity study are based on current water supply conditions and do not include adjustments for possible changes in the water supply.

Payment Capacity Analysis

The farm budget method of analysis was used to estimate the payment capacity of San Luis Unit lands. Enterprise budgets for crops commonly produced within the study area were generated. Criteria for preparing the enterprise budget approach followed the *Technical Guidelines for Irrigation Ability to Pay and Irrigation Payment Capacity*, May 2004.

Estimated payment capacity values for each crop budget prepared for the farm budget analysis are presented in table 25. Payment capacity is determined by subtracting the return to farm family from net farm income. Payment capacity

represents the amount available to pay all district costs associated with providing project irrigation water to project land.

Payment capacity value has been computed for all lands in the San Luis Unit using the prevailing cropping pattern projected to occur under each action alternative for each district within the San Luis Unit and is shown in table 26.

Table 25. Estimated payment capacity by crop

Crops Represented	Payment Capacity ($/acre)
Alfalfa Hay	$0.01
Alfalfa Seed	$94.62
Almonds	$335.61
Cantaloupe	$317.74
Cotton	$115.04
Wine Grapes	$93.25
Sugar Beets	($65.23)
Tomatoes, Processed	$443.82
Wheat	($148.91)

Table 26. Estimated payment capacity for each district in the San Luis Drainage Area

	Payment Capacity by District				
	Pacheco	Panoche	San Luis	Westlands	Weighted Total
Weighted Payment Capacity – In-Valley Water Needs Land Retirement					
$/acre (includes negative payment capacity)	232.40	192.23	228.76	269.18	257.79
$/acre-ft	96.87	73.93	78.88	99.7	95.34
Weighted Payment Capacity – In-Valley/Drainage-Impaired Land Retirement					
$/acre (includes negative payment capacity)	232.40	192.23	228.76	274.93	257.49
$/acre-ft	96.87	73.93	78.88	101.83	95.23

District O&M and Cost of Water

The contractors in this study all have the ability to deliver irrigation water throughout their service area. The cost of providing this service is the combination of the district cost of O&M and their cost of water. The district cost of O&M includes all costs associated with district operations, except water costs, as reported on the financial reports of each district. The district's cost of water likewise is the cost, reported on each district's financial reports for water.

Included in the district's cost of water are any payments to Reclamation for O&M, existing capital repayment, and Restoration Fund charges, in addition to the costs of any additional water supplied to the district from alternate sources. Both the district cost of O&M and cost of water reflect 5-year averages to minimize the impacts of one time expenditures.

Repayment of Drainage Service

For a project to be considered financially feasible, Reclamation policy requires that irrigated lands generate, as a minimum, at least enough revenue to pay annual operation, maintenance, replacement, and energy (OMR&E) costs.[6] Current expenses estimated for each district are compared to district payment capacity in tables 27 and 28 to determine the remaining payment capacity available to repay annual OMR&E and capital costs for each alternative.

Table 27. Repayment Capacity Analysis ($/year)

In-Valley/Water Needs Land Retirement Alternative					
	Pacheco	Panoche	San Luis	Westlands	Total San Luis Unit
Acres	5,071	37,050	37,927	321,367	401,414
Estimated Payment Capacity ($/acre)	$232.40	$192.23	$228.76	$269.18	$257.79
District Payment Capacity	$1,178,500	$7,122,122	$8,676,181	$86,505,569	$103,480,515
District O&M Cost	$665,000	$3,114,000	$2,161,000	$21,081,000	$27,021,000
OMR&E Cost of Drainage Facilities	$820,000	$5,989,000	$6,131,000	$8,915,000	$21,855,000
Remaining Payment Capacity	($306,500)	($1,980,879)	$384,181	$56,509,569	$54,604,515
Cost of Water	$370,000	$2,751,000	$3,337,000	$28,156,000	$34,614,000
Remaining Payment Capacity	($676,500)	($4,731,879)	($2,952,819)	$28,353,569	$19,990,515
Capital Repayment of Drainage Service	$520,000	$3,797,000	$3,887,000	$58,974,000	$67,178,000
Difference ($)	($1,196,500)	($8,528,879)	($6,839,819)	($30,620,431)	($47,187,485)

[6] Reclamation Project Act of 1939, section 9(e).

Table 28. Repayment Capacity Analysis ($/year)

In-Valley/Drainage-Impaired Land Retirement Alternative					
	Pacheco	Panoche	San Luis	Westlands	Total San Luis Unit
Acres	5,071	37,050	37,927	208,367	288,415
Estimated Payment Capacity ($/acre)	$232.40	$192.23	$228.76	$274.93	$257.49
District Payment Capacity	$1,178,500	$7,122,122	$8,676,181	$57,286,339	$74,263,978
District O&M Costs	$665,000	$3,114,000	$2,161,000	$21,081,000	$27,021,000
OMR&E Cost of Drainage Facilities	$827,000	$6,039,000	$6,182,000	$0	$13,048,000
Remaining Payment Capacity	($313,500)	($2,030,879)	$333,181	$36,205,339	$34,194,978
Cost of Water	$370,000	$2,751,000	$3,337,000	$18,255,000	$24,713,000
Remaining Payment Capacity	($683,500)	($4,781,879)	($3,003,819)	$17,950,339	$9,481,978
Capital Repayment of Drainage Service	$1,565,000	$11,434,000	$11,705,000	$31,250,000	$55,954,000
Difference ($)	($2,248,500)	($16,215,879)	($14,708,819)	($13,299,661)	($46,472,022)

Based on the values estimated in table 27, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing district O&M and assigned annual OMR&E costs of drainage service under the In-Valley/Water Needs Land Retirement Alternative. In addition, none of the water districts have the ability to fully repay its assigned capital costs of drainage service facilities under this alternative after paying for water.

Figure 11 illustrates the four water districts' payment capacity relative to their existing obligations and the implementation of the In-Valley/Water Needs Land Retirement Alternative. While all four districts currently have some remaining payment capacity, the implementation of this alternative far exceeds their ability to pay the associated costs of the project when coupled with their existing obligations. None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if this alternative is implemented.

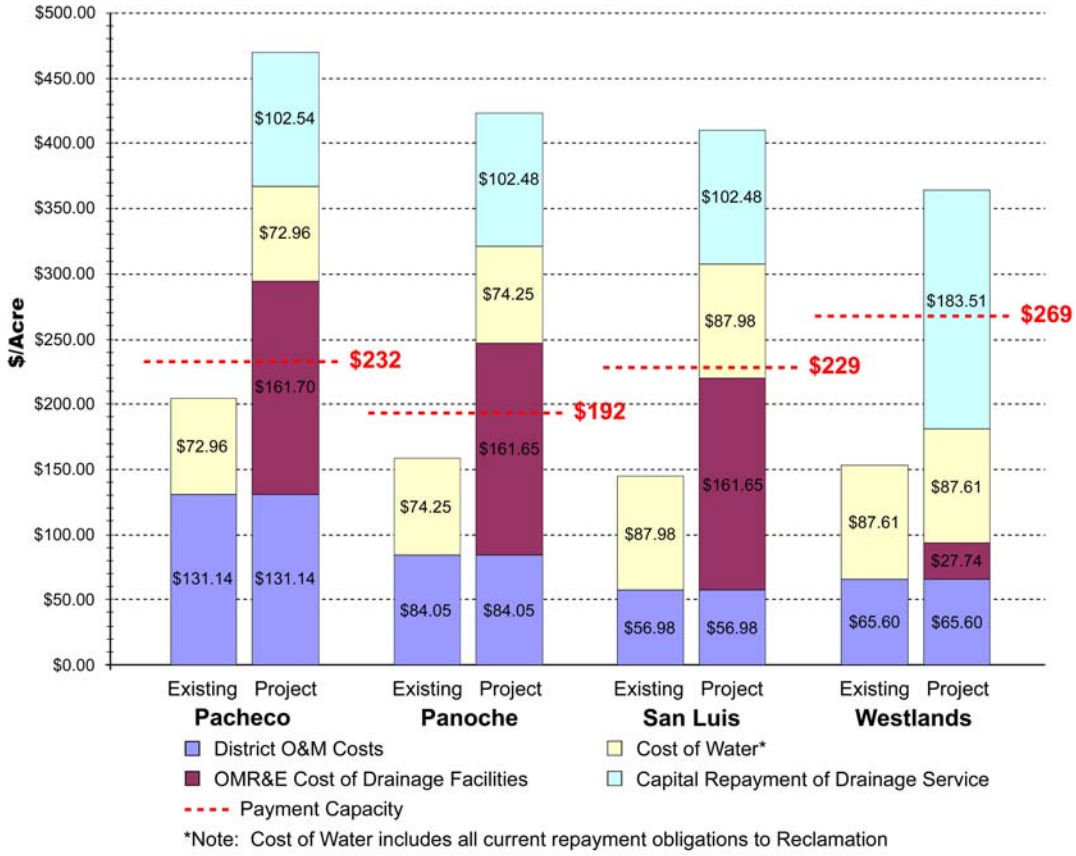

Figure 11. In-Valley/Water Needs Land Retirement Alternative district payment capacity ($/acre), with and without project.

Of the total annual capital repayment obligation of $67 million, only Westlands has the ability to pay a portion of the amount, approximately 42 percent. Under Reclamation law, this alternative is financially infeasible due to Pacheco's, Panoche's, and San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, this alternative is still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation.

Based on the values estimated in table 28, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing District O&M and assigned annual OMR&E costs of drainage service under the In-Valley/Drainage-Impaired Land Retirement Alternative. After paying for water, only Westlands has some ability to repay its assigned capital costs of drainage service facilities under this alternative.

Figure 12 illustrates the four water districts' payment capacity relative to their existing obligations and implementation of the In-Valley/Drainage-Impaired Land Retirement Alternative. As with the preceding alternative, all four districts currently have some remaining payment capacity. However, the implementation of this alternative far exceeds their ability to pay the associated costs of the project when coupled with their existing obligations.

Of the total annual capital repayment obligation of $56 million, only Westlands Water District has the ability to pay a portion of the amount, approximately 32 percent. Under Reclamation law, this alternative is financially infeasible due to Pacheco's, Panoche's, and San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, this alternative is still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation. None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if this alternative is implemented.

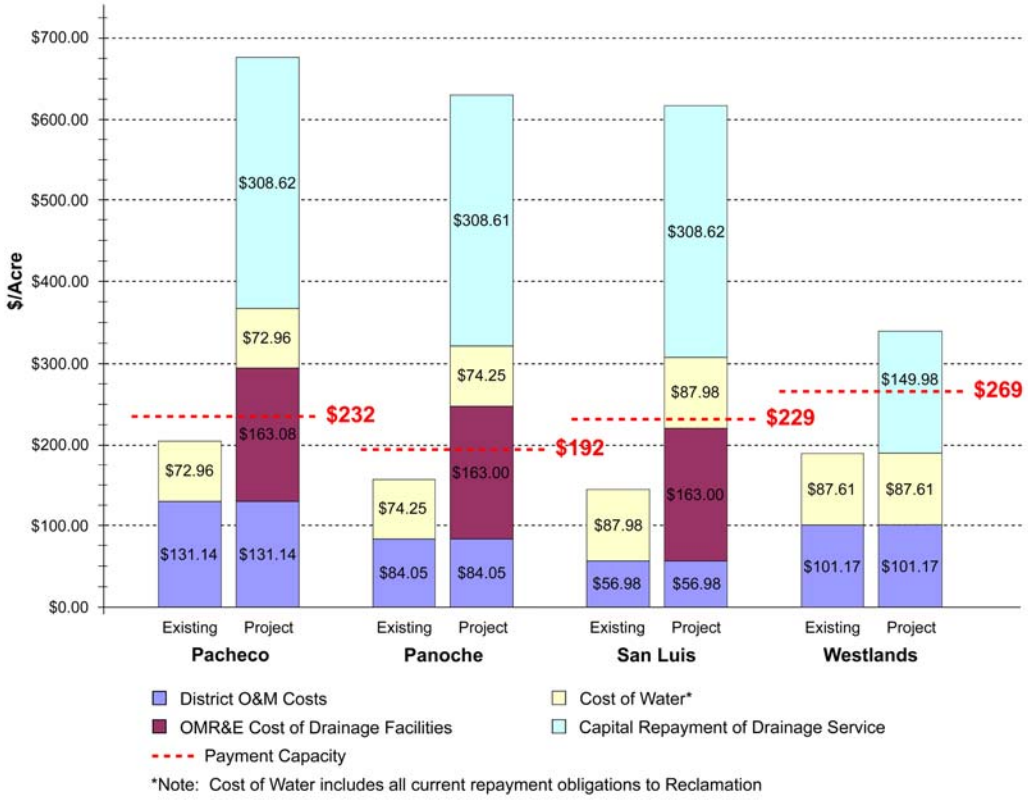

Figure 12. In-Valley/Drainage-Impaired Land Retirement Alternative district payment capacity, with and without project.

Summary

Regional Economic Development Account

Both the In-Valley/Water Needs Land Retirement Alternative and the In-Valley/Drainage-Impaired Land Retirement Alternative have a slightly negative effect on the regional economy when compared to the No-Action Alternative. However, none of the effects would be significant, because total projected employment and labor income effects generated by any action alternative are less than 1.0 percent of the affected region's total for those indicators.

National Economic Development Account

Even though the net NED benefit estimated for the In-Valley/Drainage-Impaired Land Retirement Alternative is greater than the In-Valley/Water Needs Land Retirement Alternative, it should be noted that neither alternative generates a positive net NED benefit. Under typical water resource project planning procedures, such results indicate that neither of the alternatives is economically justifiable and do not warrant the expenditure of Federal funds.

Aid to Irrigation

Section 101(e) of the Continuing Appropriations Act of October 18, 1986 (Public Law 99-500) amended section 8 of the San Luis Unit Act of June 3, 1960 (74 Statute 156; Public Law 86-488) with the addition of section 8(b). Section 8(b) prohibits the Secretary of the Interior from directly or indirectly recovering from CVP power contractors the costs of drainage service. This amendment to the Act of 1960 prohibits the assignment of any costs from implementation of either action alternative to CVP power customers. Therefore, if either action alternative is implemented, this will require separate accounting of the OMR&E and capital repayment costs associated with drainage service. If either action alternative is implemented, the Restoration Fund may be adversely affected because it is unclear if the charges that the San Luis Unit contractors are unable to pay can be assigned to power contractors.

Repayment

Under both action alternatives, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing District O&M and assigned annual OMR&E costs of drainage service. In addition, none of the four water districts have the ability to fully repay its assigned capital costs of drainage service facilities. The implementation of this alternative far exceeds their ability to repay the associated costs of the project when coupled with their existing obligations (figure 13).

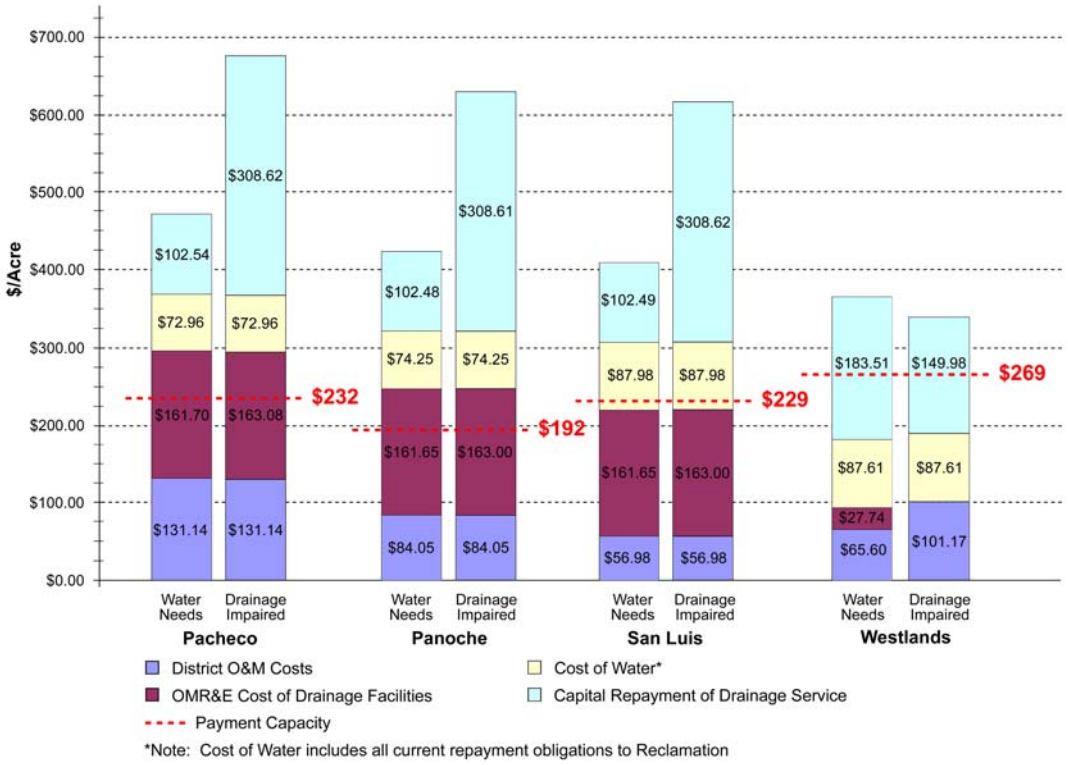

Figure 13. Comparison of two action alternatives relative to payment capacity.

Under Reclamation law, both action alternatives are financially infeasible due to Pacheco's, Panoche's, and San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, these alternatives are still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation.

None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if either action alternative is implemented.

Chapter 6
Potential Environmental Effects of the Alternatives

Potential environmental effects of the alternatives considered in this feasibility study are presented in table 29. Table 29 is a summary of resource issues with any significant adverse effect. Most of these significant adverse effects can be mitigated to not significant. The In-Valley/Drainage-Impaired Land Retirement Alternative was identified as the environmentally preferred alternative. In a March 16, 2006, biological opinion, the Service concluded that the In-Valley/Water Needs Land Retirement Alternative would cause adverse effects to San Joaquin kit fox, giant garter snake, and California least tern and authorized incidental take of those three species. Mitigation measures are described in the mitigation section of chapter 3.

Table 29. Summary of potential adverse environmental effects [1]

Affected resource and area of potential effect	In-Valley/Drainage-Impaired Area Land Retirement	In-Valley/Water Needs Land Retirement
BIOLOGICAL RESOURCES		
Terrestrial Resources		
Permanent changes in agricultural and ruderal habitats affecting terrestrial habitat value	308,000 acres retired; unavoidable impact	194,000 acres retired; unavoidable impact
Population-level effects to terrestrial resources due to Se bioaccumulation in the San Joaquin Valley	7,500 acres of reuse area; mitigable	12,500 acres of reuse area; mitigable
Aquatic and Wetland Resources		
Adverse effects to aquatic or wetland-dependent species	1,270 acres of evaporation facilities; unavoidable impact	2,150 acres of evaporation facilities; unavoidable impact
Filling, draining, or net loss of existing wetlands	Extent unknown but limited; mitigable	Extent unknown but limited; mitigable
Alteration of historic stream channel characteristics	Extent unknown but limited; mitigable	Extent unknown but limited; mitigable
Population-level effects to aquatic resources (including waterbirds) due to Se bioaccumulation in the San Joaquin Valley	1,270 acres of evaporation facilities; unavoidable impact	2,150 acres of evaporation facilities; unavoidable impact

Table 29. Summary of potential adverse environmental effects (continued)

Federally Listed Special-Status Species		
Adverse effects resulting in take of a listed terrestrial species or loss, degradation, fragmentation, or disturbance of its habitat(s)	Significant adverse effects to San Joaquin kit fox and California least tern from construction and operation of project facilities; unavoidable impacts	Significant adverse effects to San Joaquin kit fox and California least tern from construction and operation of project facilities; unavoidable impacts
Adverse effects resulting in take of a listed freshwater aquatic/wetland species or loss, degradation, fragmentation, or disturbance of its habitat(s)	Giant garter snake could experience adverse effects due to construction activities; unavoidable impact	Giant garter snake could experience adverse effects due to construction activities; unavoidable impact
Individual-level effects to listed special-status species due to Se bioaccumulation in the San Joaquin Valley	Adverse effects to San Joaquin kit fox and California least tern. Potentially unavoidable.	Adverse effects to San Joaquin kit fox and California least tern. Potentially unavoidable.
State-listed Special-Status Species		
Adverse effects resulting in take of a listed terrestrial species or loss, degradation, fragmentation, or disturbance of its habitat(s)	Habitat potentially affected by construction and operation; potentially unavoidable	Habitat potentially affected by construction and operation; potentially unavoidable
Adverse effects resulting in take of a listed freshwater aquatic/wetland species or loss, degradation, fragmentation, or disturbance of its habitat(s)	Habitat potentially affected by construction and operation; potentially unavoidable	Habitat potentially affected by construction and operation; potentially unavoidable
Individual-level effects to listed special-status species due to Se bioaccumulation in the San Joaquin Valley	7,500 acres of reuse area; potentially unavoidable	12,500 acres of reuse area; potentially unavoidable
GEOLOGY		
Subsidence/Uplift	Mitigable	Mitigable
Expansive Soils	Mitigable	Mitigable
Erosion	Mitigable	Mitigable
AIR RESOURCES		
Air Quality - Construction Phase Fugitive PM_{10} Emissions and Equipment Exhaust Emissions	Mitigable	Mitigable
LAND AND SOIL RESOURCES		
Farmland of Statewide Importance	Loss of 211,000 acres; unavoidable	Loss of 91,000 acres; unavoidable
Evaporation Basins	Increase of up to 1,270 acres of evaporation basins; unavoidable	Increase of up to 2,150 acres of evaporation basins; unavoidable
Construction-related (weighted index - higher number is a more extensive adverse impact)		591; mitigable
Land Use	Inconsistent with existing state and local plans	Inconsistent with existing state and local plans

Table 29. Summary of potential adverse environmental effects (continued)

RECREATION RESOURCES		
San Joaquin Valley Wildlife Viewing/Hunting	Impacts from 1,270 acres of evaporation basins; mitigable	Impacts from 2,150 acres of evaporation basins; mitigable
CULTURAL RESOURCES		
Cultural Resources	Lesser unknown number of resources potentially impacted; mitigable	Unknown number of resources potentially impacted; mitigable

[1] *San Luis Drainage Feature Re-evaluation Final Environmental Impact Statement*, May 2006

Chapter 7
Consultation and Coordination

This chapter summarizes the consultation and coordination efforts Reclamation has conducted in preparation of the environmental impact statement and this feasibility report. Public involvement is summarized, as well as consultation activities with Federal, State, and local agencies.

Public Involvement

A significant public involvement program was implemented throughout the analyses of the environmental impact statement from a Notice of Intent to prepare an EIS in the *Federal Register* in October 2001 and public scoping meetings in November 2001 and January 2003. Additional scoping on land retirement alternatives was held in March 2004.

Interagency workshops were held throughout 2002, and the public draft EIS was available for review and comment for 92 days after filing the Notice of Availability of the EIS with the EPA.

Interagency Meetings and Workshops

Reclamation integrated agency consultation and involvement into the overall planning process starting with the Functional Analysis Workshop that was held from August 20, 2001, through August 24, 2001. The purpose of the Functional Analysis Workshop was to verify the formulation of alternatives previously developed to ensure that current technological developments were not overlooked and to identify any fatal flaws in existing alternatives or components of alternatives before proceeding to further refine these alternatives. Another purpose of the workshop was to gather recommendations on the specific direction the process should take, including additional alternatives that might be considered. At the beginning of the workshop, Reclamation hosted an Open Forum for representatives from the regulatory, environmental, and water user organizations to present their views on how Reclamation should provide drainage service as directed by the court order.

Reclamation also held a series of Interagency Workshops at key points during the plan formulation process. The first of these was held on October 25, 2001, to discuss the key project components, agency roles, public involvement activities, and project work plan.

A second Interagency Workshop was held on March 5, 2002, after Reclamation developed a set of guiding assumptions to assist the team in refining preliminary alternatives and identifying a short list of alternatives for detailed evaluation. Input from State and Federal agencies was solicited on the following:

- Approach to alternatives formulation
- Review of current alternatives
- Assumptions for each alternative
- Areas for improvement and optimization

As Reclamation began to identify the preliminary proposed alternatives, a third Interagency Workshop was held on September 10, 2002, to solicit input from Federal and State agencies. Topic areas covered were:

- Review of the purpose and approach to alternatives development
- Alternative screening process and results
- Input to evaluate the screening process
- Discussion of the remaining alternatives
- Discussion of the impact analysis approach
- Identification of areas for improvement and optimization

On December 12, 2003, Reclamation conducted a fourth Interagency Workshop as preliminary land retirement alternatives were developed. Topic areas covered were:

- Project status update
- Land retirement alternatives development
- Schedule and agency coordination in preparing the draft EIS

In addition to the public scoping meetings and Interagency Workshops, Reclamation conducted 19 briefings for a number of local agencies, environmental groups, and congressional staff from October 2001 through July 2004.

Cooperating Agencies

In November 2002, Reclamation formally invited three State agencies and six Federal agencies to become cooperating agencies for preparing the draft and final EIS. Only the U.S. Fish and Wildlife Service elected to become a cooperating agency.

Agency Consultation

Fish and Wildlife Coordination

Coordination Act Activities

Reclamation requested a series of Planning Aid Memorandums (PAMs) from the Service and a Coordination Act Report (CAR) in compliance with the Fish and Wildlife Coordination Act of 1958. The purpose of the PAMs was to assist Reclamation in scoping, planning, and developing the feasibility study, and communicating Service positions and recommendations. Service staff was also tasked with participating in interagency meetings and workshops and reviewing Reclamation's technical work. One PAM, entitled "Species List for San Luis Drain Feature Re-evaluation, Ocean Disposal Alternative," dated June 3, 2002, and another, entitled "Species List for San Luis Drain Feature Re-evaluation," dated December 4, 2001, were received from the Service. Another PAM was received and dated July 2003. Reclamation also received comments on the San Luis Drainage Feature Re-Evaluation Plan from the Service dated July 15, 2003, and November 17, 2004. In addition, Reclamation requested a CAR, which is included in the final EIS as appendix M1.

Section 7 Consultation

Reclamation prepared a Biological Assessment for the In-Valley Alternatives. The Biological Assessment evaluates potential effects of the alternatives to federally listed threatened and endangered species identified on initial species lists received from the Service and National Oceanic and Atmospheric Administration (NOAA) Fisheries on December 4, 2001, and updated lists from June 3, 2002, and June 3, 2003.

Reclamation initiated formal consultation with the Service on November 7, 2005. On March 16, 2006, the Service issued its biological opinion on the In-Valley Alternatives, completing the formal consultation. Findings of the biological opinion are incorporated into the final EIS as appendix M2.

Reclamation initiated informal consultation with NOAA Fisheries on March 27, 2006. NOAA Fisheries responded in a letter dated April 21, 2006, which is included in the final EIS as appendix M3.

Indian Trust Assets and Native American Consultation

Reclamation reviewed the location of Native American rancherias, reservations, and public domain allotments in relation to each of the alternatives. No Native American lands were found to be in conflict with any of the alternative alignments. Santa Rosa Rancheria is the only Native American land found in or near any alignment. The Santa Rosa Rancheria is southeast of Lemoore Naval Air Station, about 8 miles east of the terminus of the In-Valley Disposal

Alternative pipeline. Reclamation will continue to review any changes in the alternative alignments throughout the planning process to determine whether consultation would be necessary in the future.

National Historic Preservation Act/State Historic Preservation Officer Consultation

As the lead Federal agency, Reclamation has determined that any of the alternatives constitutes an undertaking subject to Section 106 of the National Historic Preservation Act of 1966, as amended. Reclamation is delineating the area of potential effect (APE) for cultural resources and initiating consultation with the State Historic Preservation Officer (SHPO) pursuant to implementing regulations (36 Code of Federal Regulations 800) for Section 106. As appropriate, the Section 106 process will be coordinated with planning and review procedures required under NEPA. If the Congress authorizes implementation, Reclamation will consult with the California SHPO during final design to delineate the APE and identify other consulting parties in the Section 106 process. Once the APE and consulting parties have been established, Section 106 efforts will focus on the identification of historic properties and the assessment and resolution of adverse effects to those properties to be affected by the undertaking.

Chapter 8
Findings and Conclusions

Reclamation conducted the San Luis Drainage Feature Re-Evaluation Feasibility Study to develop feasibility level engineering and economic analyses relating to providing drainage for the San Luis Unit in accordance with the *Principles and Guidelines.* A final EIS was prepared in compliance with NEPA; findings for the final EIS are found in the ROD (*Feasibility Report*, appendix M). This chapter summarizes the major findings and conclusions of this feasibility study.

Findings

Total Estimated Construction Cost

The total estimated construction cost of the two action alternatives is as follows (see chapter 4):

- In-Valley/Drainage-Impaired Land Retirement Alternative – $2.24 billion
- In-Valley/Water Needs Land Retirement Alternative – $2.69 billion

The total estimated construction cost for the two action alternatives is at 3feasibility level with the exception of the costs for the RO treatment plants. Cost estimates for the RO treatment plants are at appraisal level. The cost estimates for the RO treatment plants include higher than normal contingency allowances to address the uncertainties regarding evolving treatment technologies (see appendix A, attachment 3).

Assuming a 10-year implementation schedule for either action alternative, annual appropriations would need to exceed $100 million, with the peak funding requirement in year 6 of project implementation that exceeds $550 million (see appendix A, attachment 4).

Appropriations Ceiling

Authority to construct drainage features of the San Luis Unit was provided by the Congress in the San Luis Unit Act, Public Law 86-488, 74 Statute 156, June 3, 1960 as amended. Section 8(a) of the San Luis Unit Act and other subsequent acts established two construction ceilings for the San Luis Unit. The Congress authorized indexing of the construction cost ceiling for main project features but did not authorize indexing for distribution systems and drains (see chapter 4).

The remaining construction cost ceiling, as of September 30, 2006, for main project features is approximately $361.5 million. The remaining construction cost ceiling, as of September 30, 2006, for distribution systems and drains is approximately $67.2 million (see chapter 4).

Federal Interest

For an action to be implementable, there must be a Federal interest in the action; and the action must be feasible as defined by the *Principles and Guidelines*. The *Principles and Guidelines* require Federal actions contribute to the NED. The San Luis Unit Act of 1960, as amended, establishes Reclamation's Federal interest in the proposed action.

However, the requirement for a net positive contribution to the Nation's economy can not be met (see chapter 5).

Determination of Feasibility

Basically, project feasibility consists of four parts—technical, environmental, economic, and financial. Technical feasibility consists of engineering, operations, and constructability analyses that verify that the project can be constructed, operated, and maintained. Environmental feasibility consists of analyses verifying that constructing or operating the project will not result in unacceptable environmental consequences to endangered species, cultural, Indian trust, or other resources. Economic feasibility consists of analyses verifying that constructing the project is an economically sound investment of capital (i.e., that the project would result in positive net benefits or the projects' benefits would exceed the costs). Financial feasibility consists of (1) an allocation of costs to project purposes, (2) a determination of reimbursable and non-reimbursable costs, (3) a commitment on the part of project beneficiaries to pay the reimbursable costs, and (4) a determination of project beneficiaries' ability to pay their allocated costs, including capital costs and long-term operation, maintenance, and replacement costs. The following findings relate to each of these parts of a feasibility determination. This interest was reaffirmed by the Federal District Court Order dated November 29, 2000 (see chapter 1).

Technical Feasibility

Both action alternatives are technically feasible, constructible, and can be operated and maintained. The RO treatment plants are not at a feasibility level of design. This does not affect the finding of technical feasibility because the RO plants rely on existing technology that is continually improving over time (see chapter 4 and appendix A).

Environmental Feasibility

Both action alternatives, as well as the No-Action Alternative, were included in a final EIS, which was filed in May 2006. The environmental impacts were evaluated, and a mitigation plan was included in the final EIS. The

In-Valley/Drainage-Impaired Land Retirement Alternative was identified as the environmentally preferred alternative. In a March 16, 2006, biological opinion, the Service concluded that the In-Valley/Water Needs Land Retirement Alternative would likely have adverse effects to San Joaquin kit fox, giant garter snake, and California least tern and authorized incidental take of those three species (see chapter 6).

Economic Feasibility

The two action alternatives have a negative net NED benefit as follows (see chapter 5):

- In-Valley/Drainage-Impaired Land Retirement Alternative – ($51,524,000)
- In-Valley/Water Needs Land Retirement Alternative – ($131,146,000)

Because both of the action alternatives would result in net negative NED benefits, neither action alternative is economically justified for implementation. The In-Valley/Drainage-Impaired Land Retirement Alternative is the alternative that reasonably maximizes net NED benefits (although the benefits are negative) and is designated the national economic development plan (NED Plan) in accordance with the *Principles and Guidelines* (see chapter 5).

The In-Valley/Water Needs Land Retirement Alternative is considered the locally preferred plan because it most closely parallels the locally developed Westside Regional Drainage Plan (see chapter 3).

Financial Feasibility

Neither action alternative is financially feasible for implementation. The following supports this determination.

Cost Allocation and Repayment

Under existing authorities, all costs associated with either action alternative would be allocated to irrigation, reimbursable without interest, and subject to repayment during a period not to exceed 40 years (see chapter 5).

Ability to Pay

Implementing either of the action alternatives would result in cost of service that exceeds the ability to pay of all four of the Unit contractors. Figure 13 illustrates the amounts that each contractor would be able to pay of the annual O&M, Restoration Fund, existing capital repayment, and additional O&M and capital repayment relative to their payment capacity if either action alternative is implemented (see chapter 5).

Under both action alternatives, only San Luis and Westlands Water Districts are capable of generating adequate agricultural revenues to pay their existing district O&M and assigned annual OMR&E costs of drainage service. In addition, none

of the four water districts have the ability to fully repay its assigned capital costs of drainage service facilities. The implementation of either action alternative far exceeds their ability to repay the associated costs of the project when coupled with their existing obligations (see chapter 5).

Inability to Pay Annual O&M

Full payment of annual O&M costs is required by section 5 of the Reclamation Extension Act of 1914 (Public Law 63-208; 43 U.S.C. Sections 471 and 472). Full payment in advance of water delivery is mandated by section 46 of the Omnibus Adjustment Act of 1926 (Public Law 69-284; 43 U.S.C. Section 423e) and section 6 of the 1939 Act (Public Law 76-260; 43 U.S.C. Section 485e).

Under Reclamation law, both action alternatives are financially infeasible due to Pacheco's, Panoche's, and San Luis' inability to pay OMR&E costs in advance, a prerequisite to CVP water delivery. Even if Westlands assumes the balance of Pacheco's, Panoche's, and San Luis' annual OMR&E costs, both action alternatives are still financially infeasible because the capital costs cannot be repaid nor can they be assigned to power through aid to irrigation (see chapter 5).

Westlands Water District, which includes Broadview Water District, would be unable to pay a portion of the capital repayment obligation if either action alternative is implemented (see chapter 5).

None of the San Luis Unit contractors would be able to pay the Restoration Fund charges if either action alternative is implemented.

Aid to Irrigation

Section 101(e) of the Continuing Appropriations Act of October 18, 1986 (Public Law 99-500) amended section 8 of the San Luis Unit Act of June 3, 1960 (74 Statute 156; Public Law 86-488) with the addition of section 8(b). Section 8(b) prohibits the Secretary of the Interior from directly or indirectly recovering the costs of drainage service from CVP power contractors. This amendment to the Act of 1960 would prohibit the assignment to CVP power customers of any costs from implementation of either action alternative (see chapter 5). Therefore, if either action alternative is implemented, this will require separate accounting of the OMR&E and capital repayment costs associated with drainage service. If either action alternative is implemented, the Restoration Fund may be adversely affected because it is unclear if the charges that the San Luis Unit contractors are unable to pay can be assigned to power contractors.

Conclusions

Implementation of either action alternative would require the Congress to increase the construction cost ceiling for the San Luis Unit by over $2 billion.

To provide drainage service to the San Luis Unit, both of the action alternatives are technically feasible for implementation by the Federal government.

To provide drainage service to the San Luis Unit, both of the action alternatives are environmentally feasible for implementation by the Federal government.

To provide drainage service to the San Luis Unit, neither of the action alternatives is economically justified for implementation by the Federal government.

For the Federal government to provide drainage service to the San Luis Unit, neither of the action alternatives is financially feasible, within existing authorities.

The No-Action Alternative does not comply with the U.S. District Court Order that states the "…Department of the Interior…shall without delay, provide drainage to the San Luis Unit…."

Chapter 9
Recommendations

The recommendation is to implement the In-Valley/Water Needs Land Retirement Alternative. In order to implement this alternative, it would require Congress to:

- Amend Public Law 96-488, the San Luis Unit, Central Valley Project Act of 1960 designating the In-Valley/Water Needs Land Retirement Alternative as a distribution systems and drains component of the San Luis Unit, increase the construction cost ceiling for distribution systems and drains by $2.69 billion (2006 dollars), and authorize indexing.

- Provide relief from Section 5 of the Reclamation Extension Act of 1914 that requires full payment of the operation and maintenance (O&M) charges related to delivery of water. Authorize Federal appropriations to pay the O&M charges related to implementation of the In-Valley Water Needs Land Retirement Alternative that the Panoche Water District, Pacheco Water District, and San Luis Water District are unable to pay.

- Authorize the Secretary to defer without interest each San Luis Unit contractor's obligation to repay reimbursable capital and/or reimbursable O&M costs incurred to implement the In-Valley Water Needs Land Retirement Alternative, and if necessary, the repayment of some or all of the remaining reimbursable capital costs incurred to construct the pre-existing CVP facilities until the Secretary determines that such contractor has the independent ability to repay its share of such costs without unduly burdening its water users, provided such determinations are made at not more than 5-year intervals.

- Direct the Secretary that the repayment of the reimbursable capital costs and reimbursable O&M costs incurred to implement the In-Valley Water Needs Land Retirement Alternative are to be accounted for separately from the repayment of the reimbursable capital costs and the reimbursable O&M costs incurred to construct and operate the pre-existing CVP facilities.

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