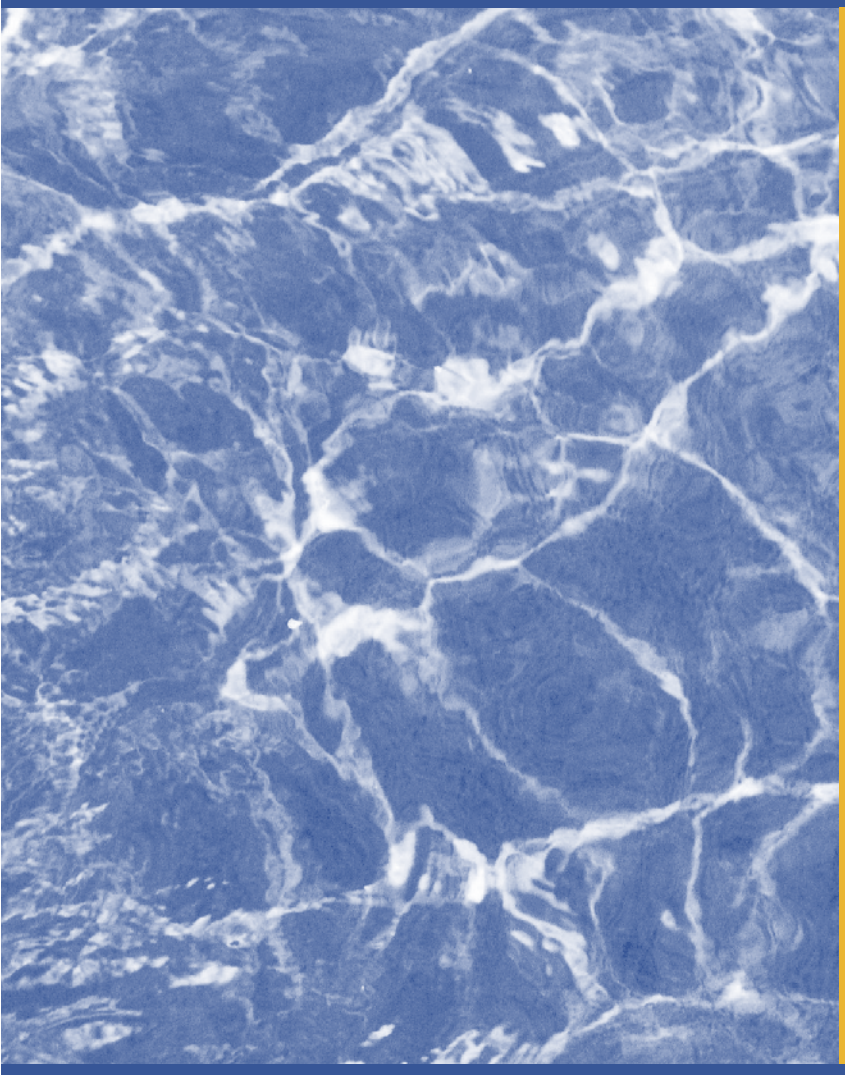
RECLAMATION

Managing Water in the West



San Luis Drainage Feature Re-evaluation

Draft Environmental Impact Statement

May 2005

U.S. Department of the Interior
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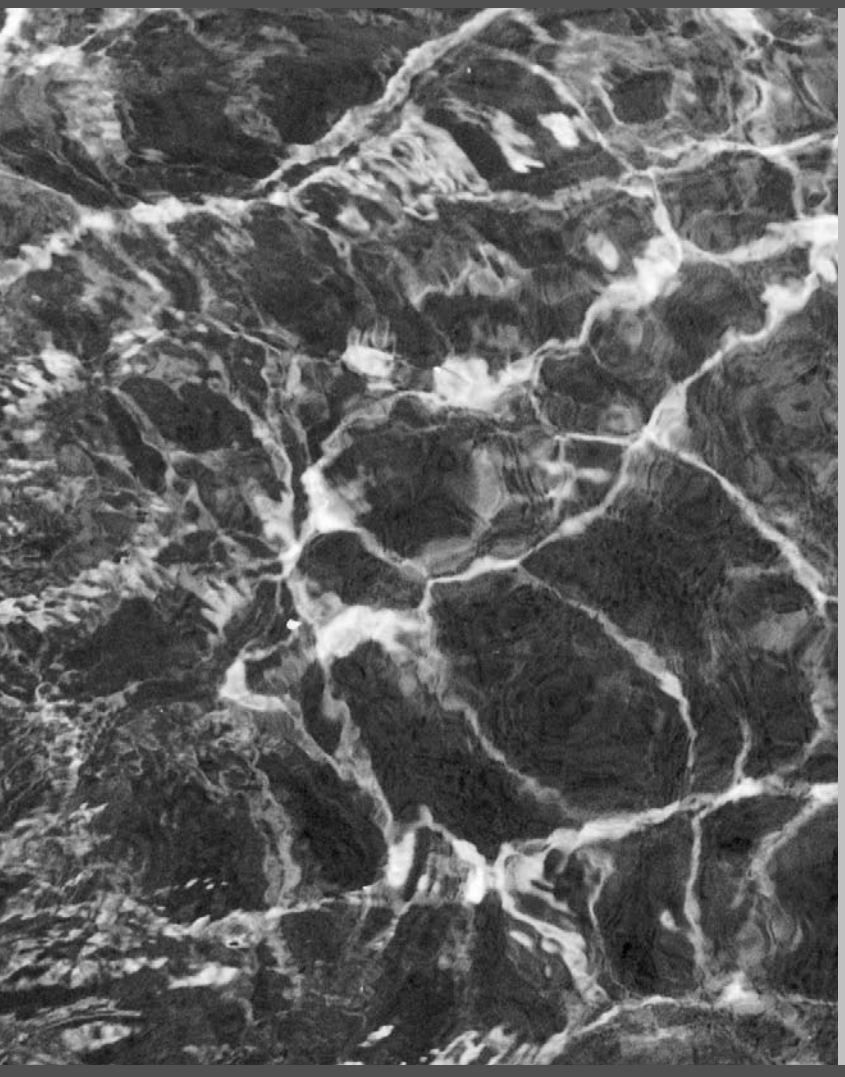

San Luis Drainage Feature Re-evaluation

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NOTICE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
SAN LUIS DRAINAGE FEATURE RE-EVALUATION

Lead Agencies: U.S. Department of the Interior, Bureau of Reclamation (Reclamation)
Mid-Pacific Region, Sacramento, California
Cooperating Agency: U.S. Fish and Wildlife Service

This Draft Environmental Impact Statement (Draft EIS) has been prepared in compliance with the National Environmental Policy Act (NEPA) and Reclamation procedures for NEPA compliance. Reclamation prepared this Draft EIS subsequent to the San Luis Drainage Plan Formulation Report (PFR) of December 2002 and the PFR Addendum of July 2004. Preparation of this EIS is necessary to implement the Preferred Alternative or any other action alternative. The PFR was produced in response to the Ninth Circuit Court of Appeals ruling stating that the "…Department of 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." Reclamation has defined drainage service as the removal of water from irrigated fields to maintain long-term, sustainable salt and water balance in the root zone of irrigated lands where 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.

The project purpose is to provide agricultural drainage service to the San Luis Unit as defined above. In order to meet this overall purpose and need, there are four related project objectives that were used to develop the alternatives evaluated in this EIS:

- 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 proposed Federal action is to plan and construct a drainage system for the San Luis Unit. This proposed action would meet the needs of the Unit for drainage service, fulfill the requirements of the February 2000 Court Order, and be completed under the authority of Public Law 86-488.

The EIS evaluates seven action alternatives in addition to No Action: In-Valley Disposal, In-Valley/Groundwater Quality Land Retirement, In-Valley/Water Needs Land Retirement, In-Valley/Drainage-Impaired Area Land Retirement, Ocean Disposal, Delta-Chipps Island Disposal, and Delta-Carquinez Strait Disposal. All of the alternatives would include common elements: on-farm and in-district actions, drainwater collection systems, regional reuse facilities, the Firebaugh sumps, and land retirement of at least 44,106 acres. In addition to the common elements, the action alternatives (except Ocean Disposal) involve varying levels of drainwater treatment (reverse osmosis and/or biological selenium treatment) and/or additional land retirement before disposal. The Preferred Alternative is to be one of the In-Valley/Land Retirement Alternatives or some other combination of In-Valley disposal and land retirement features.

The In-Valley Disposal and Land Retirement Alternatives are located in the northwestern portion of Kings County, in western Fresno County, and in the southwestern tip of Merced County. In addition to the counties listed for the In-Valley Disposal Alternatives, the Ocean Disposal Alternative would also include facilities in the northwestern tip of Kern County and in northern San Luis Obispo County. The Delta Disposal Alternatives would include facilities in Stanislaus, San Joaquin, Alameda, and Contra Costa counties in addition to the counties listed for the In-Valley Disposal Alternatives.

Public review of this Draft EIS will begin on the date indicated on the attached notice and will extend 60 days. For further information regarding this Draft EIS, contact Mr. Gerald Robbins, U.S. Bureau of Reclamation, Mid-Pacific Region, 2800 Cottage Way, Sacramento, CA 95825, (916) 978-5061.

EXECUTIVE SUMMARY

ES.1 BACKGROUND

This Draft Environmental Impact Statement (EIS) provides information on the environmental effects of seven action alternatives for providing drainage service to the San Luis Unit (the Unit) and provides the public and interested agencies an opportunity for review and comment. Following public review of the draft, comments received will be fully considered by the Bureau of Reclamation (Reclamation), and a final EIS will be issued, to be followed by a Record of Decision, defining Reclamation future actions in providing drainage services to the Unit.

The Federal action, to provide agricultural drainage service, is required in response to the Ninth Circuit Court of Appeals ruling stating that the "…Department of 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." Reclamation has defined drainage service 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.

The proposed Federal action is to provide drainage service to the San Luis Unit. This proposed action would meet the needs of the Unit for drainage service, fulfill the requirements of the February 2000 Court Order, and be completed under the authority of Public Law 86-488. The San Luis Drainage Feature Re-evaluation (Re-evaluation) is being conducted pursuant to Public Law 86-488, which authorized the Unit.

ES1.1 Historical Summary

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. Figure ES-1 provides an overview of historical and future events for San Joaquin Valley drainage planning.

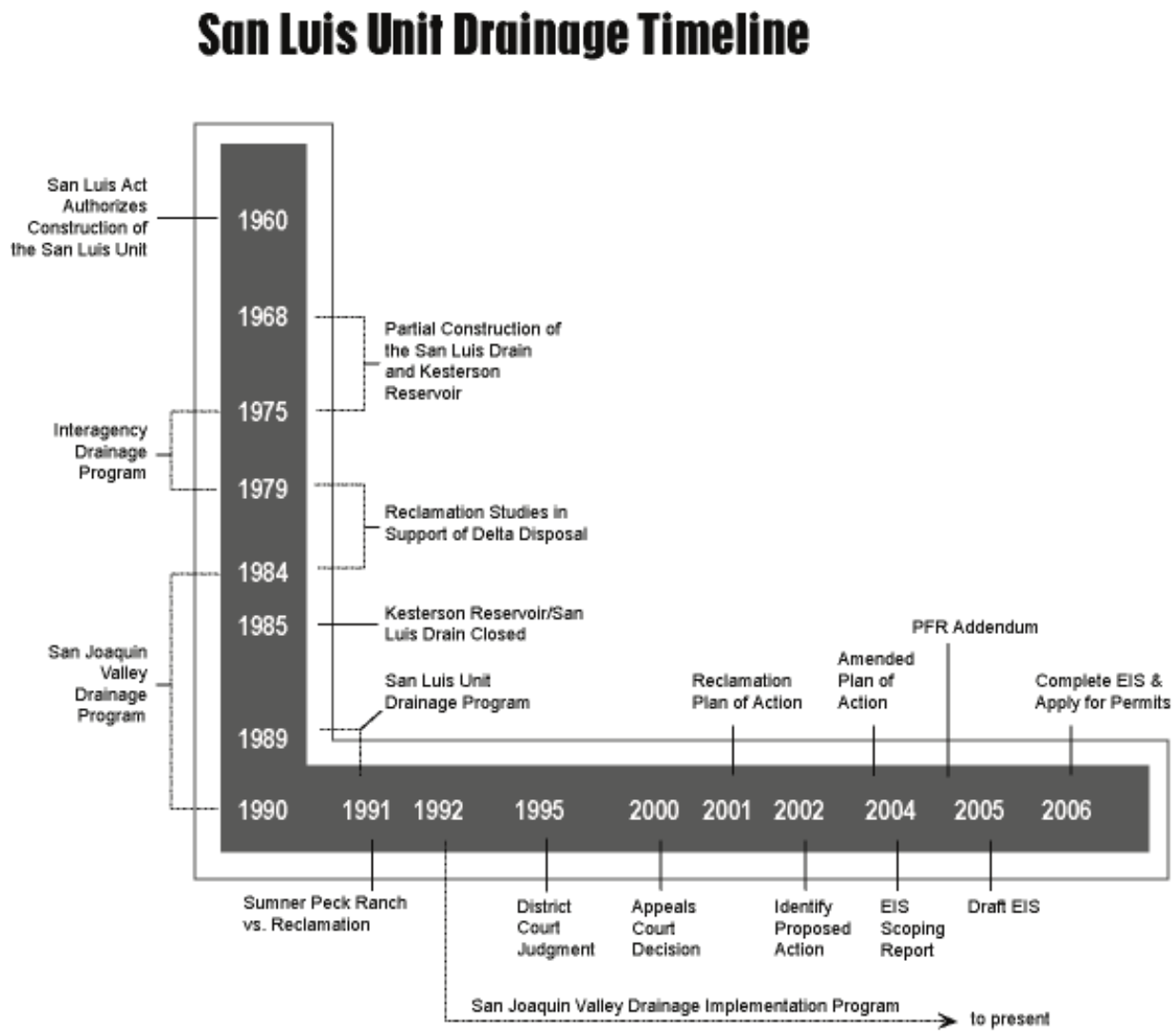


Figure ES-1 San Luis Unit Drainage Timeline

In 1960, Congress enacted Public Law 86-488 authorizing construction of the San Luis Unit of the Central Valley Project (CVP) including drainage systems.

By 1975, an 82-mile segment of the San Luis 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 (Westlands).

Between 1975 and 1979, the San Joaquin Valley Interagency Drainage Program, a joint effort between Reclamation, the Department of Water Resources (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 Sacramento-San Joaquin River Delta (Delta), terminating near Chipps Island. 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 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 San Luis 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 citizens 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* (PFR) and the related Draft EIS.

Several landowners subsequently sued the 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. 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, identified a list of preliminary alternatives that meet 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 will refine the components of the proposed action, provide additional engineering detail, and complete the environmental review of the proposed action and alternatives. The product of this phase is the EIS and the Record of Decision.

The 2002 PFR identified the In-Valley Disposal Alternative as the proposed action to provide drainage service. The In-Valley Disposal Alternative was compared to No Action and the three Out-of-Valley Disposal Alternatives and was selected in 2002 as the proposed action based on cost, implementation, and other environmental information available in 2002.

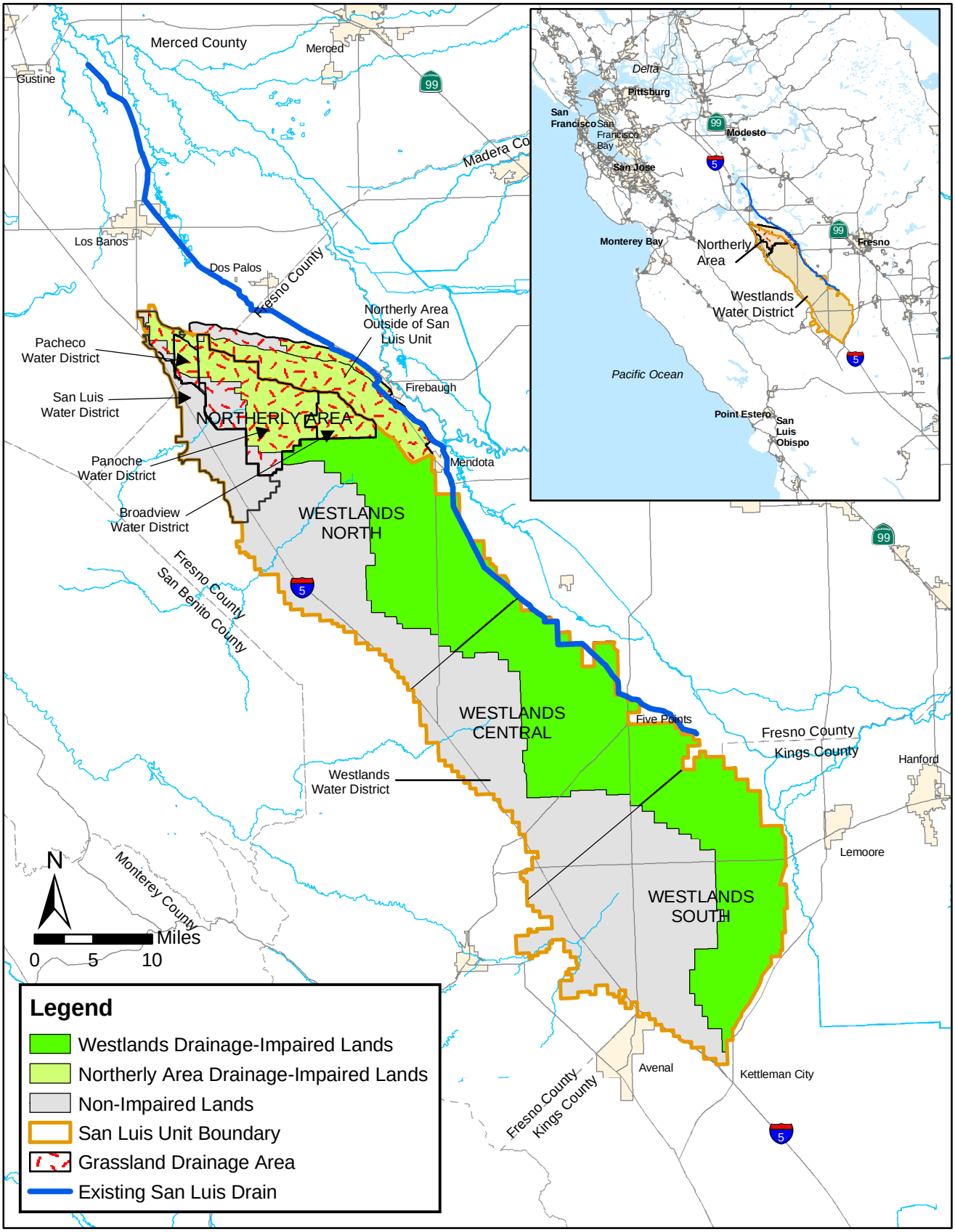
Land retirement was considered in the 2002 PFR but was excluded as a primary drainage reduction component of the Federal drainage service alternatives under consideration at that time because it did not meet the project purpose of "providing drainage service." Land retirement is a measure that removes 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 land retirement as a major 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* (Reclamation 2004a). The Amended Plan of Action states that Reclamation would continue to refine and evaluate all five alternatives described in the PFR for inclusion in the EIS. Additionally, Reclamation would formulate 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.

ES1.2 Project Area

The geographic scope of the analysis (project area) consists of the drainage study area 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 Delta in northern and central California. Features of one or more of the action alternatives are located in nine counties: Fresno, Kings, Merced, Alameda, Contra Costa, San Joaquin, Stanislaus, Kern, and San Luis Obispo.

The drainage study area is located in the western San Joaquin Valley and consists primarily of the lands lying within the boundary of the CVP's San Luis Unit, as shown on Figure ES-2. 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 EIS, the drainage study area has been subdivided into the Westlands Water District and the Northerly Area.



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San Luis Drainage Feature Re-evaluation	Drainage Study Area	Figure ES-2
17324004		

The entire drainage study area (including the lands to the north and outside of the Unit, 40,400 acres) totals approximately 730,000 acres. Of these 730,000 acres, approximately 379,000 acres would be drainage-impaired and constitute the drainage service area. According to Reclamation's estimates, only two-thirds of this area, or 254,000 acres, would have subsurface drainage systems installed, based on localized conditions and economic considerations, by the end of the 50-year planning horizon for the Re-evaluation. Analysis indicates that this would maintain arability throughout the 379,000-acre drainage service area.

ES.2 PURPOSE AND NEED

The project purpose is to provide agricultural drainage service to the San Luis Unit that achieves long-term, sustainable salt and water balance in the root zone of irrigated lands where 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.

To meet this overall purpose and need, Reclamation used four related project objectives to develop the alternatives evaluated in this EIS:

- 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 proposed Federal action is to provide drainage service to the San Luis Unit. This proposed action would meet the needs of the Unit for drainage service, fulfill the requirements of the February 2000 Court Order, and be completed under the authority of Public Law 86-488. The Re-evaluation is being conducted pursuant to Public Law 86-488, which authorized the Unit.

To plan this proposed action, Reclamation has determined a reasonable future drainage output from the Unit and used the best available information to determine the quality of any drainwater produced. All of the action alternatives use the determined values of drainage output and drainwater quality in the design of project features and in the analysis of environmental effects.

ES.3 ALTERNATIVES CONSIDERED

Reasonable alternatives considered in this EIS and facility sizing assumptions related to drainage quantity are summarized below.

ES3.1 Drainage Output

Reclamation developed drainage quantities and flow rates in the PFR (Reclamation 2002) and revised them in the PFR Addendum (Reclamation 2004b). The determined value of future drainage output included the consideration of regional drainwater reuse facilities as well as four cost-effective drainwater reduction measures: drainwater recycling, shallow groundwater

management, seepage reduction, and irrigation system improvements. 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.

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.

Land retirement assumptions for No Action and the action alternatives include:

- The Sumner Peck settlement lands of 34,100 acres, 7,000 acres from the Central Valley Project Improvement Act [CVPIA] land retirement program, and 3,006 acres from the Britz settlement result in a total planned land retirement of 44,106 acres included in all the alternatives.
- The Westlands Water District (Sagouspe) settlement acreage of 65,000 acres remains retired in the No Action Alternative and in some of the land retirement alternatives, but would go back into production under some of the other action alternatives.
- Additional retirement is included in the In-Valley/Land Retirement Alternatives.

The estimates of land retirement acreage for all of the alternatives range from 44,106 to 308,000 acres for the seven action alternatives and up to 109,106 acres for the No Action Alternative.

Table ES-1 shows the estimated drainwater quantity for the various alternatives. The maximum estimated flow of drainwater produced is about 97,000 acre-feet (AF)/year. Different alternatives contain features that reduce this amount. Final drainwater flows for treatment and disposal range from 8,100 to 21,000 AF/year, depending on the amount of land retirement in the alternative.

Table ES-1
Drainwater Reduction and Average Design Flows

	In-Valley Disposal Alternative	Land Retirement Alternatives*			Out-of-Valley (Ocean and Delta) Alternatives
		In-Valley/ Groundwater Quality	In-Valley/ Water Needs	In-Valley Drainage-Impaired Area	
Drainage Flow without Reduction (AF/year)	97,000	85,000	63,000	36,000	97,000
Drainage Flow with Drainwater Reduction Activities (drainwater recycling, shallow groundwater management, and seepage reduction) (AF/year)	70,000	61,000	45,000	27,000	70,000
Drainage Flow with Drainwater Reduction and Regional Reuse Facilities (AF/year)	21,000	18,500	14,000	8,100	21,000
Average Design Flow with Drainwater Reduction and Regional Reuse Facilities (cfs)	29	26	19	11	29

cfs = cubic feet per second
*Alternatives are described in Section 2.3.3.

ES3.2 Action Alternatives

A preferred alternative will be selected for the Final EIS following Reclamation's review of this Draft EIS and comments from reviewing agencies and organizations. Reclamation's preferred alternative is expected to be one of the In-Valley/Land Retirement Alternatives primarily because of the flexibility in implementation, but also because economically it has the greatest net benefit to the nation as a whole.[1] The environmentally preferred alternative is the alternative that is the least damaging to the environment, and it will be identified in the Final EIS to consider public comments. All of the action alternatives would have adverse effects on the environment. Determination of the alternative with the least environmental damage requires balancing of environmental resource values

ES3.2.1 Common Elements to All Action Alternatives

The quantity of drainwater requiring treatment and/or disposal can be reduced by implementing drainwater reduction measures. Results of a cost-effectiveness analysis yielded the reasonable drainwater reduction actions that could be implemented within the drainage area and that are common to all disposal alternatives. These drainwater reduction actions are shown in Figure ES-3 and briefly described below.

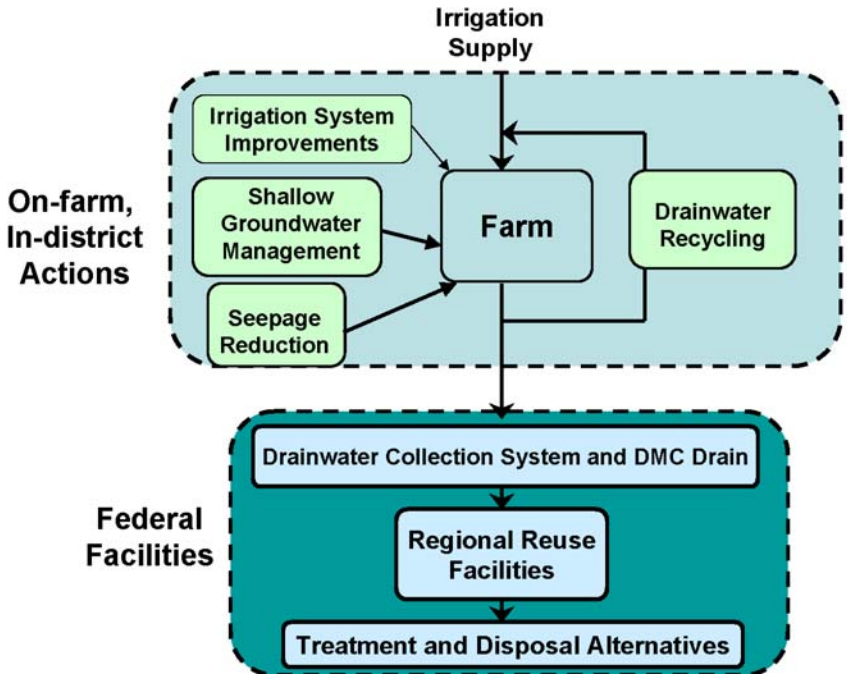

Figure ES-3 Common Elements to All Disposal Alternatives

[1] See Section 3.3.11 of the Plan Formulation Report Addendum for a discussion of benefits and costs from a national perspective.

- **On-Farm, In-District Actions**
  The on-farm, in-district drainwater reduction actions are not components of the drainage service alternatives to be implemented by Reclamation. Rather, they represent the assumptions Reclamation has made regarding the conditions of the area to be served and the reasonable actions that could be implemented by districts within the area to be served once drainage service is provided. Although drainwater reduction measures other than the ones selected could be implemented, they were either not cost effective compared to the disposal facilities, or it was assumed that they would not be implemented due to the uncertainty of the measure's effectiveness. Farmers would also install subsurface tile drains on drainage-impaired lands. In addition, irrigation system improvements for Westlands nondrainage-impaired land and lands in the Northerly Area were found to be cost effective (see PFR Addendum, Section 3.3.10.3).

- **Federal Facilities**
  As part of the action alternatives under the Federal action, Reclamation would construct a closed **collection system** to collect and convey drainwater from on-farm subsurface tile drains to the **regional reuse facilities** located within each of the four zones (Northerly Area, Westlands North, Westlands Central, and Westlands South).

  – The **closed collection system** is composed of 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. Farmers would pump drainwater from their drains into the sumps, and pipelines would convey drainwater from the sumps to the reuse areas.

  – The drainwater would be used to irrigate salt-tolerant crops at up to 16 **regional reuse facilities**. Each reuse facility would also provide an opportunity to control the flow of reused drainwater to downstream features. The water quality of the reused drainwater would initially be the same as the water quality of the perched aquifer beneath the reuse facility. In general, it is expected that water quality of the perched aquifer would gradually decline during long-term use, as do all aquifers underlying irrigated farmlands.

  – The proposed separate Delta-Mendota Canal Drain is designed to intercept high-Se groundwater at the existing **Firebaugh sumps** and convey it to the Northerly Reuse Area for reuse, treatment, and disposal. The drain would consist of two pipelines. This drain would also collect precipitation that percolates through the ground to the underlying drains. The additional infiltration would affect the quantity of drainwater flows. The pipeline capacity allows the infiltrating water to remain in the ground for no more than 2 months before discharging to the reuse area.

- **Land Retirement**
  The minimum land retirement assumptions for all action alternatives compared to existing conditions and No Action are discussed in Section ES3.1 and subsequently displayed in Table 2.3-1. A minimum of 44,106 acres is assumed to be retired for all of the action alternatives (common element). Retired lands are assumed to be managed as dryland farming, grazed, or fallowed. While CVPIA retired lands (7,000 acres) are Federally owned, the remaining retired lands (37,100 acres) are expected to be privately owned.

ES3.2.2 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 Se biotreatment before disposal in evaporation basins.** Figure ES-4 illustrates the key components of the In-Valley Disposal Alternative.

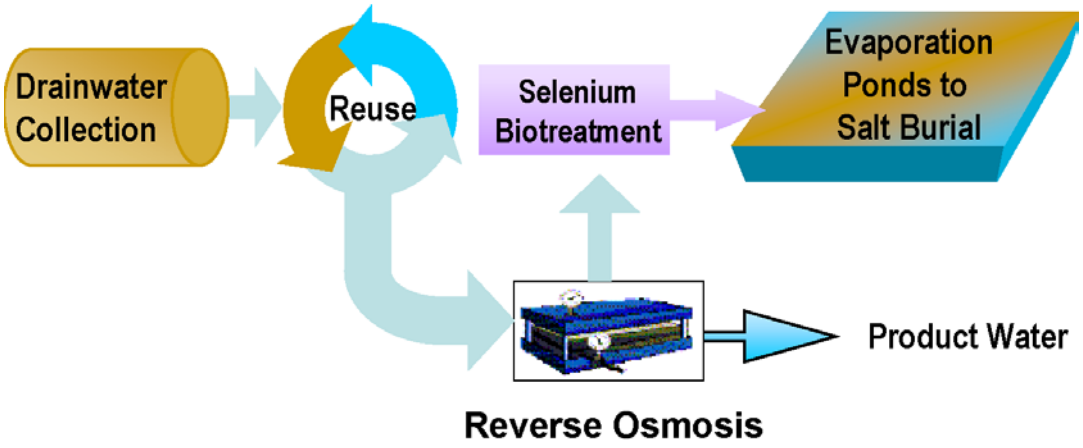

Figure ES-4 Components of the In-Valley Disposal Alternative

The Federal components of this alternative are as follows.

Common Elements:

- Drainwater collection system
- Firebaugh Sumps (Delta-Mendota Canal Drain)
- Regional reuse facilities

Reverse Osmosis Treatment – Reused drainwater from all 16 potential reuse areas would be conveyed to four areas for RO treatment to produce high-quality product water that could be blended with CVP water for irrigation. RO treatment plants would be located near each of four evaporation basins. Each RO system would consist of a single-stage, single-pass array with appropriate pretreatment to achieve 50 percent recovery.

Selenium Biotreatment – The concentrate reject stream from each of the four RO facilities would be conveyed to four Se treatment facilities. The effluent from the Se biotreatment plants would be discharged to evaporation basins in each of the four drainage areas. The flow rate to the biotreatment plant for the Northerly Area would be approximately 4,400 AF/year, while the flow rates for the Westlands North, Central, and South areas would be approximately 1,700, 3,000, and 1,400 AF/year, respectively. The flow-weighted average final Se and total dissolved solids (TDS) concentrations after reuse facility operation and RO treatment are estimated to be 475 micrograms per liter (µg/L) and 35,600 milligrams per liter (mg/L), respectively. Based on

results of laboratory and pilot tests of this technology using actual drainwater, it is estimated that full-scale biotreatment plants can remove Se to below 10 µg/L in the treated effluent.

Evaporation Basins – Four areas are under investigation for evaporation facilities. At present, it is estimated that up to 3,290 acres would be needed in total for the four facilities. This acreage is a maximum estimate for wet years of flow and represents a maximum disturbed land area. It is based on the peak flow being provided by the reuse areas. The average "wetted" area is estimated at 2,870 acres.

Conveyance System – The In-Valley Disposal Alternative conveyance system includes 16 pumping plants. These plants pump reuse water from the reuse areas to either another pumping plant or a treatment and evaporation basin area. All of these pumping plants are in reuse areas.

Table ES-2 summarizes the present value and estimated annual equivalent costs for the In-Valley Disposal Alternative with a less than 70,000-AF/year drainage volume, based on updated feasibility studies.

Table ES-2
In-Valley Disposal Alternative
Present Worth of Federal Project Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	26.6	1.6
Evaporation Basins	114.7	6.9
Reverse Osmosis Facilities	85.4	5.1
Biological Selenium Treatment	59.7	3.6
Land Retirement	10.7	0.6
Subtotal – Alternative-Specific Federal Costs	297.1	17.9
Common Federal Costs		
Drainage Collection System	186.1	11.2
Regional Reuse Facilities	76.8	4.6
Delta-Mendota Canal Drainage Collection/Reuse	1.7	0.1
Subtotal - Common Federal Costs	264.7	15.9
TOTAL – FEDERAL PROJECT COSTS	**561.8**	**33.8**

ES3.2.3 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 Se concentration greater than 50 parts per billion (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 for RO treatment and the evaporation basins, and the changes to Se biotreatment and conveyance are described in the following sections. Lands that could be retired are outside of the areas with drainwater collection but inside the drainage-impaired areas.

Selenium Biotreatment – There would be four Se biotreatment plants, one for each of the drainage areas (Northerly, Westlands North, Westlands Central, and Westlands South) for the In-Valley/Groundwater Quality Land Retirement Alternative. The effluent from the biotreatment plants would be discharged to evaporation basins located in each of the four drainage areas. The flow rate to the biotreatment plant for the Northerly Area would be approximately 4,000 AF/year, while the flow rates for the combined Westlands North, Central, and South areas would be 5,100 AF/year. These flows are based on the assumption that the drainage rate from the reuse area would be maintained at a fairly constant level throughout the year. The flow-weighted average Se and TDS concentrations after several years of reuse facility operation and RO treatment are estimated to be 530 µg/L and 33,000 mg/L, respectively. Flow-weighted average Se concentrations are higher under this alternative as compared to the In-Valley Disposal Alternative because drains from the Northerly Area, which has higher Se concentrations than Westlands, are a larger percentage of the flow-weighted average when Westlands lands are retired. Based on results of laboratory and pilot tests of this technology using actual drainwater, it is estimated that full-scale biotreatment plants can remove Se to below 10 µg/L in the treated effluent.

Conveyance System – Any differences between this alternative and the In-Valley Disposal Alternative would depend upon the quantity of water to be conveyed. A smaller quantity could require a smaller pipe size, and a larger quantity could require a larger pipe size.

Table ES-3 summarizes the present value and estimated annual equivalent costs for the In-Valley/Groundwater Quality Land Retirement Alternative with a less than 61,000-AF/year drainage volume, based on updated feasibility studies.

Table ES-3
In-Valley/Groundwater Quality Land Retirement Alternative
Present Worth of Federal Project Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	25.0	1.5
Evaporation Basins	102.2	6.1
Reverse Osmosis Facilities	77.9	4.7
Biological Selenium Treatment	53.0	3.2
Land Retirement	140.4	8.4
Subtotal – Alternative-Specific Federal Costs	398.5	24.0
Common Federal Costs		
Drainage Collection System	158.4	9.5
Regional Reuse Facilities	67.1	4.0
Delta-Mendota Canal Drainage Collection/Reuse	1.7	0.1
Subtotal - Common Federal Costs	227.3	13.7
TOTAL – FEDERAL PROJECT COSTS	**625.8**	**37.6**

ES3.2.4 In-Valley/Water Needs Land Retirement Alternative

The In-Valley/Water Needs Land Retirement Alternative would retire enough lands to balance the internal water demand of the San Luis Unit with the expected available supply, or 193,956 acres (44,106 acres plus 149,850 additional acres). This value would include lands with Se concentrations greater than 20 ppb in Westlands, lands acquired by Westlands (that could be brought into production with drainage service), and 10,000 acres in Broadview Water District. It is consistent with key elements of the locally developed Westside Regional Drainage Plan (SJRECWA et al. 2003). The alternative would include irrigation system improvements to reduce deep percolation to shallow groundwater. The irrigation system improvement program would be similar to that described for the In-Valley Disposal Alternative.

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 for RO treatment and the evaporation basins, and the changes to Se biotreatment and conveyance are described in the following sections. Lands that could be retired are outside of the areas with drainwater collection but inside the drainage-impaired areas.

Selenium Biotreatment – There would be four Se biotreatment plants as in the previous alternative, one for each of the drainage areas. The flow rate to the biotreatment plant for the Northerly Area would be approximately 4,000 AF/year, while the flow rates for the combined Westlands service areas would be approximately 2,800 AF/year. The flow-weighted average Se and TDS concentrations after several years of reuse facility operation and RO treatment are estimated to be 530 µg/L and 32,500 mg/L, respectively. Based on results of laboratory and pilot tests of this technology using actual drainwater, it is estimated that full-scale biotreatment plants can remove Se to below 10 µg/L in the treated effluent.

Conveyance System – Any differences between this alternative and the In-Valley Disposal Alternative would depend upon the quantity of water to be conveyed. A smaller quantity could require a smaller pipe size, and a larger quantity could require a larger pipe size.

Table ES-4 summarizes the present value and estimated annual equivalent costs for the In-Valley/Water Needs Land Retirement Alternative with an approximately 45,000-AF/year drainage volume, based on updated feasibility studies.

Table ES-4
In-Valley/Water Needs Land Retirement Alternative
Present Worth of Federal Project Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	21.6	1.3
Evaporation Basins	80.6	4.9
Reverse Osmosis Facilities	61.3	3.7
Biological Selenium Treatment	40.9	2.5
Land Retirement	416.7	25.1
Subtotal – Alternative-Specific Federal Costs	621.1	37.4
Common Federal Costs		
Drainage Collection System	89.0	5.4
Regional Reuse Facilities	61.3	3.7
Delta-Mendota Canal Drainage Collection/Reuse	1.8	0.1
Subtotal - Common Federal Costs	152.0	9.1
TOTAL – FEDERAL PROJECT COSTS	**773.1**	**46.5**

ES3.2.5 In-Valley/Drainage-Impaired Area Land Retirement Alternative

The In-Valley/Drainage-Impaired Area 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) and 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 be similar to that described for the In-Valley Disposal Alternative but would occur only in the Northerly Area.

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

Selenium Biotreatment – There would be one Se biotreatment plant in the Northerly Area for the In-Valley/Drainage-Impaired Area Land Retirement Alternative. The effluent from the biotreatment plant would be discharged to an evaporation basin located in the Northerly Area.

The flow rate to the biotreatment plant would be approximately 4,000 AF/year. This flow is based on the assumption that the drainage rate from the Northerly Reuse Area is maintained fairly constant throughout the year. The flow-weighted average Se and TDS concentrations after several years of reuse facility operation and RO treatment are estimated to be 640 µg/L and 30,000 mg/L, respectively. Based on results of laboratory and pilot tests of this technology using actual drainwater, it is estimated that full-scale biotreatment plants will remove Se to below 10 µg/L in the treated effluent.

Conveyance System – Conveyance for the In-Valley/Drainage-Impaired Area Land Retirement Alternative consists of only the 1.1-mile pipeline segment for the Delta-Mendola Canal Drain to the Northerly Area reuse facility.

Table ES-5 summarizes the present value and estimated annual equivalent costs for the In-Valley/Drainage-Impaired Land Retirement Alternative with a less than 27,000-AF/year drainage volume, based on updated feasibility studies.

Table ES-5
In-Valley/Drainage-Impaired Area Land Retirement Alternative
Present Worth of Federal Project Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	2.2	0.1
Evaporation Basins	39.7	2.4
Reverse Osmosis Facilities	30.3	1.8
Biological Selenium Treatment	21.3	1.3
Land Retirement	725.5	43.6
Subtotal – Alternative-Specific Federal Costs	818.9	49.3
Common Federal Costs		
Drainage Collection System	2.8	0.2
Regional Reuse Facilities	34.0	2.0
Delta-Mendota Canal Drainage Collection/Reuse	1.8	0.1
Subtotal - Common Federal Costs	38.6	2.3
TOTAL – FEDERAL PROJECT COSTS	**857.5**	**51.6**

ES3.2.6 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. 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 ES-5 shows the key components of this alternative.

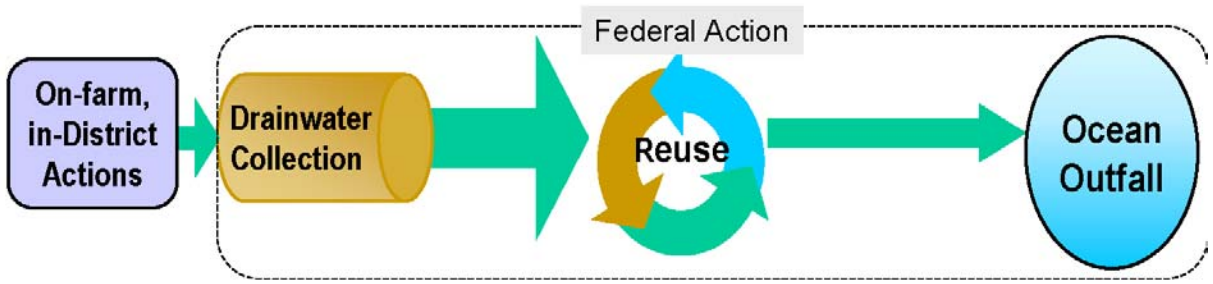

Figure ES-5 Components of the Ocean Disposal Alternative

The Federal components of this alternative are as follows.

Common Elements:

- Drainwater collection system
- Firebaugh Sumps (Delta-Mendota Canal Drain)
- Regional reuse facilities

Conveyance System – The drainwater aqueduct for the Ocean Disposal Alternative would include 211 miles of buried pipeline, with three tunnels through the coastal range and 23 pumping plants and sumps.

Outfall – The aqueduct would have only one diffuser, located 1.4 miles off Point Estero, 10 miles south of the Monterey Bay National Marine Sanctuary.

Table ES-6 summarizes the estimated present value and annual equivalent costs for the Ocean Disposal Alternative with a less than 70,000-AF/year drainage volume, based on updated feasibility studies.

Table ES-6
Ocean Disposal Alternative, Present Worth of Federal Project Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	289.3	17.4
Evaporation Basins	0	0
Reverse Osmosis Facilities	0	0
Biological Selenium Treatment	0	0
Land Retirement	10.2	0.6
Subtotal – Alternative-Specific Federal Costs	299.9	18.0
Common Federal Costs		
Drainage Collection System	184.1	11.1
Regional Reuse Facilities	77.0	4.6
Delta-Mendota Canal Drainage Collection/Reuse	1.7	0.1
Subtotal - Common Federal Costs	262.8	15.8
TOTAL – FEDERAL PROJECT COSTS	**562.7**	**33.8**

ES3.2.7 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 Se 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 Se 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 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 ES-6 shows the key components of this alternative.

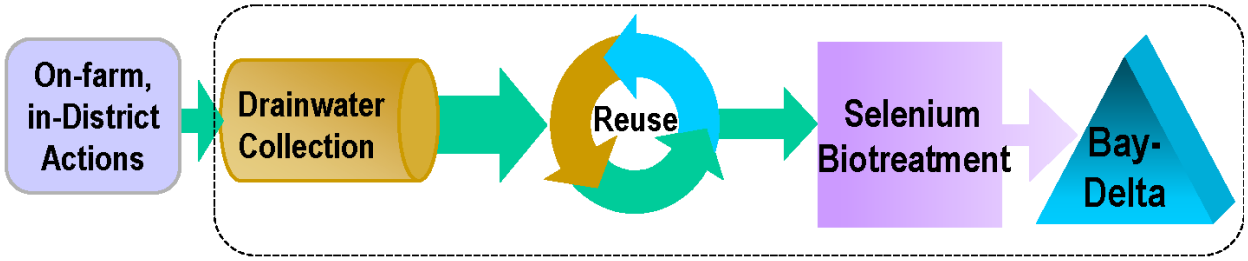

Figure ES-6 Components of the Delta Disposal Alternatives

The Federal components of this alternative are as follows.

Common Elements:

- Drainwater collection system
- Firebaugh Sumps (Delta-Mendota Canal Drain)
- Regional reuse facilities

Selenium Biotreatment – The Se biotreatment plant for the two Delta Disposal Alternatives (Delta-Chipps Island and Delta-Carquinez Strait) would be based on the same modular system described in the In-Valley Disposal Alternative. Drainwater from the four drainage service areas (Northerly, Westlands North, Westlands Central, and Westlands South) would be conveyed to a central Se biotreatment facility before conveyance by canal and pipeline to the Delta for disposal. The facility's location has not been determined.

Conveyance System – The drainwater aqueduct for the Delta-Chipps Island Disposal Alternative would traverse gradually sloping lands to flat lands. A total of about 160 miles of pipeline and canal would be installed, including 1 mile of buried pipe underwater. In addition, about 83 miles of the existing San Luis Drain would be used, for a total conveyance length of 143 miles.

Outfall – The point of discharge for the Delta-Chipps Island Disposal Alternative would be 1 mile from the shoreline at Mallard Slough at a depth of 18 feet.

Table ES-7 summarizes the estimated present value and annual equivalent costs for the Delta-Chipps Island Disposal Alternative with a less than 70,000-AF/year drainage volume, based on updated feasibility studies.

Table ES-7
Delta-Chipps Island Disposal Alternative
Present Worth of Total Federal Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	79.7	10.8
Evaporation Basins	0	0
Reverse Osmosis Facilities	0	0
Biological Selenium Treatment	108.1	6.5
Land Retirement	10.2	0.6
Subtotal – Alternative-Specific Federal Costs	298.0	17.9
Common Federal Costs		
Drainage Collection System	185.7	11.2
Regional Reuse Facilities	77.0	4.6
Delta-Mendota Canal Drainage Collection/Reuse	1.7	0.1
Subtotal - Common Federal Costs	264.5	15.9
TOTAL – FEDERAL PROJECT COSTS	**562.4**	**33.8**

ES3.2.8 Delta-Carquinez Strait 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 ES-6 in the previous section shows the key components of this alternative.

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.

The diffuser would be approximately 16 miles downstream of the western end of the Delta and 1 mile from the shoreline at Crockett at a depth of 18 feet. This disposal location has greater tidal action and is further removed from drinking water intakes than the Delta-Chipps Island Disposal Alternative.

The summary of the estimated present value and annual equivalent costs for the Delta-Carquinez Strait Disposal Alternative with a less than 70,000-AF/year drainage volume is included in Table ES-8. The same design considerations and assumptions identified for the Delta-Chipps Island Disposal Alternative apply to this alternative.

Table ES-8
Delta-Carquinez Strait Disposal Alternative,
Present Worth of Federal Project Costs

Project Features	Present Value ($1,000,000)	Annual Equivalent ($1,000,000)
FEDERAL PROJECT COSTS		
Alternative-Specific Federal Costs		
Conveyance System	215.5	13.0
Evaporation Basins	0	0
Reverse Osmosis Facilities	0	0
Biological Selenium Treatment	108.1	6.5
Land Retirement	10.2	0.6
Subtotal – Alternative-Specific Federal Costs	333.7	20.1
Common Federal Costs		
Drainage Collection System	185.7	11.2
Regional Reuse Facilities	77.0	4.6
Delta-Mendota Canal Drainage Collection/Reuse	1.7	0.1
Subtotal - Common Federal Costs	264.5	15.9
TOTAL – FEDERAL PROJECT COSTS	**598.2**	**36.0**

A summary of the estimated annual equivalent costs for all Action Alternatives is included in Table ES-9.

Table ES-9
All Alternatives
Present Worth of Federal Project Costs
Summary of Federal Project Costs ($ millions, 2002 dollars)

Alternatives	Federal Cost*			
	Construction	Annual OM&R	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 Area	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

Federal Cost – Costs for facilities that would be part of the Federal drainage service plan and are Federally funded. See Section 5.2 for the components that would be Federal facilities.
Construction – All capital costs for lands, ROWs, 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.
*The Federal costs for each of the action alternatives would exceed the current Federal spending limit authorized under the San Luis Act.

ES.4 SUMMARY OF ENVIRONMENTAL EFFECTS

Comprehensive summaries of environmental effects are contained in the text of the EIS at the end of each section for resources potentially affected by any of the alternatives. These summaries contain comparisons to existing conditions as well as to No Action.

Table ES-10 is a summary of resource issues with any significant adverse effect for any of the seven action alternatives in comparison to No Action. A full comparison of all effects (both adverse and beneficial, as well as no significant effects) is provided in Section 2, Table 2.13-2. Most of these significant adverse effects can be mitigated to not significant as shown in Table 2.13-2. Potential mitigation measures are described in the resource sections and in Section 20, Environmental Mitigation. The measures are identified for discussion purposes and do not represent commitments by Reclamation at this stage in the environmental review process.

Table ES-10
Summary of Adverse Environmental Effects for All Action Alternatives Compared to No Action

Affected Resource and Area of Potential Effect	In-Valley Disposal	In-Valley/ Groundwater Quality Land Retirement	In-Valley/ Water Needs Land Retirement	In-Valley/ Drainage-Impaired Area Land Retirement	Ocean Disposal	Delta-Chipps Island Disposal	Delta-Carquinez Strait Disposal
BIOLOGICAL RESOURCES							
Terrestrial Resources							
Permanent loss or degradation of recognized sensitive, rare, or ecologically important natural communities	X	X	X	X	X	X	X
Permanent changes in agricultural and ruderal habitats affecting terrestrial habitat value			X	X			
Permanent changes in native and natural habitats					X	X	X
Population-level effects to terrestrial resources due to Se bioaccumulation in the San Joaquin Valley	X	X	X	X	X	X	X
Aquatic and Wetland Resources							
Adverse effects to aquatic or wetland-dependent species (also see Section 8 for an evaluation of effects due to Se bioaccumulation)	X	X	X	X	X	X	X
Filling, draining, or net loss of existing wetlands	X	X	X	X	X	X	X
Alteration of historic stream channel characteristics	X	X	X	X	X	X	X
Population-level effects to aquatic resources (including waterbirds) due to Se bioaccumulation in the San Joaquin Valley	X	X	X	X			

Table ES-10 (continued)
Summary of Adverse Environmental Effects for All Action Alternatives Compared to No Action

Affected Resource and Area of Potential Effect	In-Valley Disposal	In-Valley/ Groundwater Quality Land Retirement	In-Valley/ Water Needs Land Retirement	In-Valley/ Drainage-Impaired Area Land Retirement	Ocean Disposal	Delta-Chipps Island Disposal	Delta-Carquinez Strait Disposal
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)	X	X	X	X	X	X	X
Adverse effects resulting in take of a listed freshwater aquatic/wetland species or loss, degradation, fragmentation, or disturbance of its habitat(s)	X	X	X	X	X	X	X
Adverse effects resulting in take of a listed marine/coastal aquatic species or loss, degradation, fragmentation, or disturbance of its habitat(s)					X		
Individual-level effects to listed special-status species due to Se bioaccumulation in the Bay-Delta						X	X
Individual-level effects to listed special-status species due to Se bioaccumulation in the San Joaquin Valley	X	X	X	X	X	X	X
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)	X	X	X	X	X	X	X
Adverse effects resulting in take of a listed freshwater aquatic/wetland species or loss, degradation, fragmentation, or disturbance of its habitat(s)	X	X	X	X	X	X	X

Table ES-10 (continued)
Summary of Adverse Environmental Effects for All Action Alternatives Compared to No Action

Affected Resource and Area of Potential Effect	In-Valley Disposal	In-Valley/ Groundwater Quality Land Retirement	In-Valley/ Water Needs Land Retirement	In-Valley/ Drainage-Impaired Area Land Retirement	Ocean Disposal	Delta-Chipps Island Disposal	Delta-Carquinez Strait Disposal
Adverse effects resulting in take of a listed marine/coastal aquatic species or loss, degradation, fragmentation, or disturbance of its habitat(s)					X		
Individual-level effects to listed special-status species due to Se bioaccumulation in the Bay-Delta						X	X
Individual-level effects to listed special-status species due to Se bioaccumulation in the San Joaquin Valley	X	X	X	X	X	X	X
GEOLOGY							
Surface Fault Rupture					X	X	X
Landsliding/Mass Wasting					X		
Subsidence/Uplift	X	X	X	X	X	X	X
Expansive Soils	X	X	X	X	X	X	X
Erosion	X	X	X	X	X	X	X
Tsunami or Seiche					X		
AIR RESOURCES							
Air Quality - Construction Phase • Fugitive PM_{10} Emissions and Equipment Exhaust Emissions	X	X	X	X	X	X	X
Air Quality - Operation Phase • Agricultural Operations	X				X	X	X

Table ES-10 (concluded)
Summary of Adverse Environmental Effects for All Action Alternatives Compared to No Action

Affected Resource and Area of Potential Effect	In-Valley Disposal	In-Valley/ Groundwater Quality Land Retirement	In-Valley/ Water Needs Land Retirement	In-Valley/ Drainage-Impaired Area Land Retirement	Ocean Disposal	Delta-Chipps Island Disposal	Delta-Carquinez Strait Disposal
LAND AND SOIL RESOURCES							
Farmland of Statewide Importance			X	X			
Evaporation Basins	X	X	X	X			
Construction-related	X	X	X		X	X	X
Land Use			X	X			
RECREATION RESOURCES							
Wildlife Viewing/Hunting	X	X	X	X			
CULTURAL RESOURCES							
Cultural Resources	X	X	X	X	X	X	X

X = significant adverse effect

ES.5 PUBLIC AND AGENCY INVOLVEMENT

Reclamation published a Notice of Intent to prepare an EIS in the *Federal Register* in October 2001, and held the first in a series of public scoping meetings in Fresno and Concord on November 14 and 15, 2001, respectively. 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. Notices announcing the meetings were mailed to approximately 425 interested individuals, stakeholders, and organizations. Interested parties were encouraged to ask questions and provide comments on issues of concern.

Reclamation held a second series of scoping meetings to receive comments from the public on issues that should be included in this EIS in Morro Bay, Fresno, Concord, and Sacramento on January 27, 28, 29 and 31, 2003, respectively, after distribution of the PFR in December 2002. At this series of meetings, Reclamation presented a brief history of the project; a review of the In-Valley, Delta, and Ocean Disposal Alternatives; an explanation of the evaluation factors and screening criteria that were applied to identify the proposed alternative; and outlined stages in the environmental review process. Reclamation conducted additional public scoping on land retirement alternatives in early March 2004. Reclamation solicited input from the interested parties, which is detailed in the Scoping Report contained in Appendix A and summarized as follows:

Public concerns and comments received at the public scoping meetings, as well as those received in response to the Notice of Intent, 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. These briefings are detailed in Section 21 of this EIS, which also contains a complete distribution list of Federal and State elected officials, agencies, organizations, and interested individuals.

The public Draft EIS is available for review and comment for 60 days following filing of the Notice of Availability of the EIS with the EPA. The purpose of public review is to receive comments from interested parties on the Draft EIS's completeness and adequacy in disclosing the environmental effects of the alternatives under consideration, and input into Reclamation's determination of a preferred alternative. Following the close of the public review period, a final document will be prepared that will include comments received on the Draft EIS and Reclamation's responses to those comments. After adoption of the Final EIS, Reclamation will use the EIS to make a final decision on the preferred alternative. The decision will be documented in a Record of Decision.

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- In-Valley/Water Needs Land Retirement Alternative[1,2]
- In-Valley/Drainage-Impaired Area Land Retirement Alternative[1,2]
- Ocean Disposal Alternative[3]
- Delta-Chipps Island Disposal Alternative[3,4]
- Delta-Carquinez Strait Disposal Alternative[3,4]

[1]In-Valley Alternatives refers to all four together.

[2]Land Retirement Alternatives refers to all three together.

[3]Out-of-Valley Disposal Alternatives refers to all three together.

[4]Delta Disposal Alternatives refers to both Delta alternatives.

AD	MIKE 21 advection-dispersion module
AF	acre-foot or acre-feet
APE	Area of Potential Effects
ASBS	area of special biological significance
BAAQMD	Bay Area Air Quality Management District
Basin Plan	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins
Bay	San Francisco Bay
Bay-Delta	San Francisco Bay–Sacramento–San Joaquin River Delta
BCF	bioconcentration factor
BMPs	best management practices
BP	before present
Cal/COFI	California Cooperative Oceanic Fisheries Investigations Program
Caltrans	California Department of Transportation
CAR	Coordination Act Report
CBC	California Building Code
CCCCS	Central California Coastal Circulation Study
CCR	California Code of Regulations
CCWD	Contra Costa Water District

CDFG	California Department of Fish and Game
CDIP	Coastal Data Information Program
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
cm	centimeter(s)
CMP	Construction Management Practice (plan)
CNDDB	California Natural Diversity Database
CRSB	Coast Range-Sierran Block
CTR	California Toxics Rule
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act (Title XXXIV of Public Law 102-575)
CWA	Clean Water Act
DBPs	disinfectant by-products
DBPR	Disinfectants/Disinfection By-Products Rule
DDT	dichlorodiphenyltrichloroethane
Delta	Sacramento-San Joaquin River Delta
DHS	California Department of Health and Safety
DOC	dissolved organic carbon
DOS-IR	Drain or Sub-Irrigation Riser (valve)
Drain	San Luis Interceptor Drain, an existing feature of the Central Valley Project that, under the terms of the 1995 Use Agreement with the Grassland Area Farmers, is used to convey agricultural drainwater
DS	dilution standard
dS/m	deciSiemen(s) per meter
DSOD	Division of Safety and Dams
DWR	California Department of Water Resources
EC	electrical conductivity
ECe	electrical conductivity extract
EES	enhanced evaporation system

EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Federal Endangered Species Act
ESU	evolutionarily significant unit
ET	evapotranspiration
FDM	Fischer-Delta Model
FEMA	Federal Emergency Management Agency
FSI	Farmland of Statewide Importance
g	acceleration due to gravity
GDA	Grassland Drainage Area
GIS	Geographic Information System
HAAs	haloacetic acids
HD	MIKE 21 hydrodynamic module
HDPE	high-density polyethylene
IDC	interest during construction
Interior	U.S. Department of the Interior
kg/s	kilogram(s) per second
km	kilometer(s)
kWh	kilowatt-hour
LT2ESWTR	Long-Term Stage 2 Enhanced Surface Water Treatment Rule
M	moment magnitude
MBTA	Migratory Bird Treaty Act
MCL	maximum concentration limit
ME	MIKE 21 heavy metals module
µg/L	microgram(s) per liter
µmhos/cm	micromhos per centimeter, a measure of conductance
µS/cm	microSiemens(s) per centimeter
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mgd	million gallons per day
mL	milliliter(s)

M_L	Richter local magnitude
mm	millimeter(s)
NDBC	National Data Buoy Center
NEHRP	National Earthquake Hazards Reduction Program
NEP	National Earthquake Loss Reduction Program
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
O&M	operation and maintenance
OM&R	operations, maintenance, and replacement
PAHs	polycyclic aromatic hydrocarbons
PAM	Planning Aid Memorandum
PAR	San Luis Drainage Feature Re-evaluation, Preliminary Alternatives Report (Reclamation 2001a)
PCBs	polychlorinated biphenyls
PFR	Plan Formulation Report
PG&E	Pacific Gas and Electric Company
pHp	soil reaction pH of the saturated soil paste
PM_{10}	particulate matter less than 10 microns in diameter
ppb	part(s) per billion
ppm	part(s) per million
ppt	part(s) per thousand
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
Reclamation	Bureau of Reclamation
Regional Board	San Francisco Bay Regional Water Quality Control Board
RMP	Regional Monitoring Program for Trace Substances
RO	reverse osmosis
ROD	Record of Decision
ROW	right-of-way

SAE	seasonal application efficiency
Se	selenium
Service	U.S. Fish and Wildlife Service
SFEI	San Francisco Estuary Institute
SHPO	State Historic Preservation Officer
SJVAPCD	San Joaquin Valley Air Pollution Control District
SJVDP	San Joaquin Valley Drainage Program
SJVDIP	San Joaquin Valley Drainage Implementation Program
SLDFR, Re-evaluation	San Luis Drainage Feature Re-evaluation
State Board	California State Water Resources Control Board
SWPPP	Storm Water Pollution Prevention Plan
TCPU	Transportation, Communication, and Public Utilities
TDS	total dissolved solids
TMDL	total maximum daily load
TOC	total organic carbon
TTHMs	total trihalomethanes
UIC	Underground Inspection Control (Program)
Unit or SLU	San Luis Unit
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VAMP	Vernalis Adaptive Management Plan
VP	Visual Plumes program (EPA)
WDRs	Waste Discharge Requirements
Westlands	Westlands Water District
WMA	Wildlife Management Area
WQOs	water quality objectives
WWTP	wastewater treatment plant

drainwater	water leaving an irrigated area, composed of a combination of tailwater, tilewater, ricewater, and possibly canal seepages
Drainwater reduction	a management action or system used to control drainwater; nine options (excluding the No Action Alternative) are listed below for the San Luis Drainage Feature Re-evaluation: • Annual Fallowing – similar to land retirement but implemented on an annual basis by willing parties • Controlled Drainage – controlling the discharges and water depths from subsurface tile drainage systems so that a portion of irrigation deep percolation is retained in the soil and is available to contribute to crop evapotranspiration (ET) • Drainwater Recycling – reapplying drainwater and mixing it with freshwater for crop irrigation • Land Retirement – changing from irrigated to nonirrigated land uses over the long term so that irrigation deep percolation and the need for drainage is totally eliminated on selected lands • On-Farm Irrigation Systems and Management – improving the uniformity and timing of irrigation to reduce deep percolation • Reuse (Reuse/Drainwater Management) – using drainwater as an irrigation supply for salt-tolerant crops • Seepage Reduction – includes lining or piping of existing unlined irrigation conveyance and distribution facilities to reduce seepage losses • Semiconfined Zone Groundwater Pumping – pumping groundwater from aquifers that overlie more impermeable layers • Shallow Drainage – placing subsurface tile drains at relatively shallow depths so that they intercept less and possibly improve the quality of drainwater
ricewater	surface drainwater from the flooding of a rice field
tailwater	surface irrigation drainwater other than ricewater
tilewater	subsurface irrigation drainwater that is discharged through a sump
Water Year	October 1 to September 30 of each year
2001 Use Agreement	Second Agreement for Use of the San Luis Drain (Agreement No. 01-WC-20-2075) (Grassland Bypass Project)