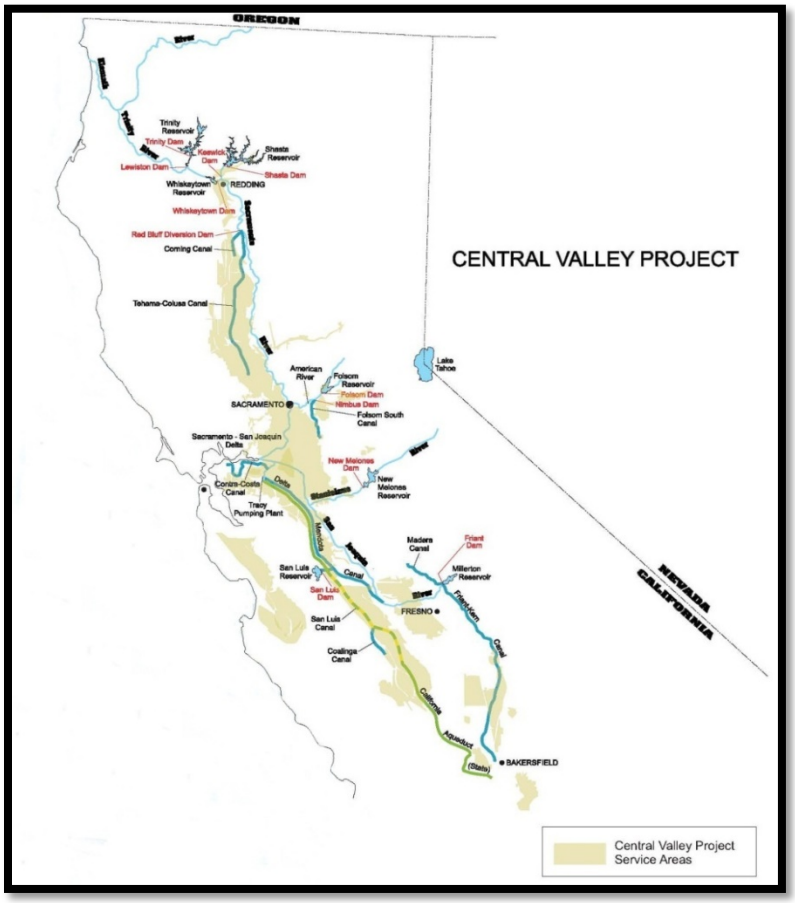
BUREAU OF RECLAMATION

Central Valley Project
Final Cost Allocation Study



U.S. Department of the Interior January 2020

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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Acronyms and Abbreviations

- AF: acre-feet
- BCI: Building Cost Index
- BO: biological opinion
- BPG: Business Practice Guidelines for CVPIA Receipts, Program Accounting, Cost Allocation, and Cost Recovery
- CAISO: California Independent System Operator
- CAS: cost allocation study
- CEC: California Energy Commission
- COA: coordinated operations agreement
- CVP: Central Valley Project
- CVPIA: Central Valley Project Improvement Act
- Delta: San Francisco Bay Delta
- DWR: California Department of Water Resources
- FWPRA: Federal Water Project Recreation Act of 1965
- GDP: gross domestic product
- GWh: gigawatt-hour
- IDC: interest during construction
- km: kilometer(s)
- LCPSIM: least cost planning simulation model
- LTGEN: long-term generation
- M&I: municipal and industrial
- MCD: major cost driver
- MMBtu: million British thermal units
- MW: megawatt
- MWh: megawatt-hour
- O&M: operation and maintenance
- OM&R: operation, maintenance, and replacement
- OMWEM: other municipal water economics model
- P&Gs: Principles and Guidelines

- PG&E: Pacific Gas and Electric
- Pump-Gen: pump-generating
- RAX: replacement, additions, and extraordinary maintenance
- Reclamation: Bureau of Reclamation
- RJE: remaining justifiable expenditure
- ROD: Record of Decision
- RPA: reasonable and prudent alternatives
- SCRB: separable costs-remaining benefits
- SOD: Safety of Dams
- SPA: single-purpose alternative
- SSJRBS: Sacramento and San Joaquin Rivers Basin Study
- SWAP: statewide agricultural production model
- SWP: State Water Project
- SWRCB: State Water Resources Control Board
- TAF: thousand acre-feet
- TBD: to be determined
- USACE: U.S. Army Corps of Engineers; Sacramento District
- USFWS: U.S. Fish and Wildlife Service
- WAPA: Western Area Power Administration
- WRC: Water Resources Council
- XO&M: extraordinary operations and maintenance

Executive Summary

The Central Valley Project (CVP) is a multipurpose water resources project operated by the Bureau of Reclamation (Reclamation) that supplies water to more than 200 long-term water contractors in the Central Valley, the San Francisco Bay Area, and the Santa Clara Valley. The CVP has eight authorized purposes: water supply, power, flood control, water quality, recreation, navigation, fish and wildlife enhancement, and fish and wildlife mitigation.[1]

The CVP is comprised of both single-purpose and multipurpose facilities that, in aggregate, serve the purposes of the project authorized by Congress. In accordance with CVP project authorization, the costs for CVP facilities are to be reimbursed by project beneficiaries. A cost allocation study is designed to identify the repayment obligations for project beneficiaries, as well as those non-reimbursable costs assigned to the Federal government.

The current comprehensive cost allocation study used for calculating repayment obligations of CVP contractors was completed in 1975. As new project facilities have been added and water and power uses have changed over time, updates and adjustments have been made to the cost allocation to determine repayment, but a holistic evaluation has not been completed since 1975. This cost allocation study was initiated based on direction from Congress in Public Law (P.L.) 99-546 and the request of water and power contractors for a final CVP cost allocation to firm up account balances and provide sufficient time for financial planning required to ensure full repayment of the CVP costs by 2030. This report provides the background and methodology for the Final Cost Allocation Study (CAS). Reclamation will apply the Final CAS results to current costs and operational conditions that are in effect at the time the annual plant-in-service and operation and maintenance (O&M) allocations are prepared.

Reclamation developed this CVP Final CAS report in consultation with stakeholders and other Federal agencies, including Western Area Power Administration (WAPA), U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service (USFWS), which participated in the study through coordination on key issues and analyses. This CVP Final CAS commenced in 2010. Throughout the process, information and updates have been shared with stakeholders through a series of over 30 meetings, workshops, and/or briefings.

Purpose and Need for Study

The purpose of the CVP cost allocation study is to develop allocation factors for the authorized purposes of the CVP. These factors will be used to determine the final repayment obligations for CVP facilities subject to the 2030 repayment. Though Reclamation has updated the allocation annually through the ratesetting process, a holistic cost allocation study has not been completed since 1975. A number of changes have occurred since 1975 that Reclamation and CVP contractors

[1] Fish and wildlife mitigation without specific cost recovery guidance is treated as a joint cost.

agree necessitate re-evaluation. Legislative and regulatory changes in the 1990s made considerable changes to the benefits and authorized purposes of the CVP. This cost allocation study allows Reclamation to consider the new CVP facilities, operational requirements, and benefits that have been authorized since 1975. The final cost allocation presented in this document meets the requirement of a final cost allocation in accordance with Reclamation policy for final cost allocations (PEC P01) and in fulfillment of requirements of Public Law 99-546.

Two Cost Allocation and Two-Period Repayment Approach

Throughout the public meetings held for development of the cost allocation study, water and power stakeholders expressed concern that historic project operations and conditions differed significantly from those expected in the future. Reclamation policy (PEC 01-02) defines the period of analysis for the cost allocation as 100 years beyond the initial date of service. To address both Reclamation policy and stakeholder concerns, Reclamation combined the two separate cost allocations, each with their own respective 100-year period of analysis. This approach addresses the concern over disparate historic and future project operating conditions.

The first period (Period 1) reflects historic conditions as represented in the 1975 CVP cost allocation update (as updated through 2013). The second period (Period 2) reflects projected operations and benefits of the CVP. The two periods are then merged by providing equal weight to each period to create the final cost allocation. The two-period approach has been implemented as a means to account for historic operations of the CVP since it was placed into service through the Period 1 allocation while also allowing for the allocation to account for current/projected project operations through the Period 2 allocation.[2] The primary focus of this document is the assumptions, costs, and benefits that are used in the Separable Costs-Remaining Benefit (SCRB) cost allocation process is on the Period 2 allocation. The assumptions and methodology used to develop the cost allocation factors for Period 1 are documented in the 1970 CVP Cost Allocation Report as amended, and references to the Period 1 allocation are presented for context only.

Separable Costs-Remaining Benefits Analysis and Results (Period 2)

The SCRB methodology for the cost allocation is used for the Period 2 cost allocation. The SCRB method is considered the most comprehensive and generally preferred method of allocating costs by Reclamation. The SCRB method is based on the goal of identifying and assigning all project costs that provide only one project benefit to the appropriate project purpose (separable costs), and then equitably distributing those costs that provide benefits to more than one purpose (joint costs) among authorized project purposes.

[2] Note that the allocation of future CVP O&M costs will be based on the Period 2 allocation; thus it will reflect prospective conditions.

Final Cost Allocation (Two-Period Merger)

The CVP plant-in-service (construction) allocation is prepared annually to reflect changes in CVP construction costs and sub-allocation processes that vary year to year. The results of the final cost allocation, which reflects the merger of the Period 1 and Period 2 allocations and sub-allocations, are presented in Table ES-1 and representative of 2013 construction costs. The proposed process for taking the final cost allocation results and applying to annual plant-in-service allocations is described in Chapter 12, *Implementation of the Final Cost Allocation*, of this report.

Table ES-1. Final Cost Allocation (Merge) – Construction (Nominal Dollars)

Type of Cost	Period 1	Period 2	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
Authorized Purposes & Sub-Purposes					
Water Supply – Irrigation	$1,178,115,286	$1,068,517,722	$589,057,643	$534,258,861	$1,123,316,504
Water Supply – M&I	$106,873,582	$142,321,083	$53,436,791	$71,160,542	$124,597,333
Power – Commercial	$674,248,511	$609,891,724	$337,124,256	$304,945,862	$642,070,118
Flood Control	$139,282,872	$331,281,759	$69,641,436	$165,640,880	$235,282,316
Water Quality	$5,607,545	$89,358,743	$2,803,773	$44,679,372	$47,483,145
Recreation	$74,998,433	$5,742,471	$37,499,217	$2,871,236	$40,370,453
Navigation	$6,423,948	$0	$3,211,974	$0	$3,211,974
Fish & Wildlife Enhancement [1]	–	–	–	–	–
Non-Reimbursable (Other)					

Type of Cost	Period 1	Period 2	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
Federal	$258,046,528	$198,271,873	$129,023,264	$99,135,936	$228,159,200
State	$250,429,656	$248,502,699	$125,214,828	$124,251,349	$249,466,177
State & Local	$4,329,037	$4,467,386	$2,164,519	$2,233,693	$4,398,212
Repayment Contracts					
Irrigation	$361,392,079	$361,392,079	$180,696,040	$180,696,040	$361,392,079
M&I	$227,656,572	$227,656,572	$113,828,286	$113,828,286	$227,656,572
Commercial Power	$8,568,500	$8,568,500	$4,274,250	$4,274,250	$8,568,500
Facility List Sub-Total	***$3,295,972,549***	***$3,295,972,610***	***$1,647,986,276***	***$1,647,986,307***	***$3,295,972,584***
Additional Repayment Obligations					
Repayment Obligations – USACE					
Irrigation	$19,686,165	$19,686,165	$9,843,083	$9,843,083	$19,686,166
M&I	$447,937	$447,937	$223,969	$223,969	$447,938
WAPA Retired Assets					
Irrigation	$8,464,815	$8,464,815	$4,232,408	$4,232,408	$8,464,816
M&I	$1,207,155	$1,207,155	$603,578	$603,578	$1,207,156
Commercial Power	$35,649,679	$35,649,679	$17,824,840	$17,824,840	$35,649,680

Type of Cost	Period 1	Period 2	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
Non-Reimbursable (Federal)	$213,468	$213,468	$106,734	$106,734	$213,468
Non-Reimbursable (State)	$16,115	$16,115	$8,058	$8,058	$16,116
CA-OR Transmission Project	$20,282,786	$20,282,786	$10,141,393	$10,141,393	$20,282,786
Additional Repayment Obligations Sub-Total	***$85,968,120***	***$85,968,120***	***$42,984,063***	***$42,984,063***	***$85,968,126***
Costs Not Allocated					
Authorized Deferred Use	$56,875,000	$56,875,000	$28,437,500	$28,437,500	$56,875,000
CVPIA	$340,872,120	$340,872,120	$170,436,060	$170,436,060	$340,872,120
Folsom SOD – Not in Repayment	$120,512,509	$120,512,509	$60,256,255	$60,256,255	$120,512,510
Costs Not Allocated Sub-Total	***$518,259,629***	***$518,259,629***	***$259,129,815***	***$259,129,815***	***$518,259,629***
Total Cost	**$3,900,200,298**	**$3,900,200,359**	**$1,950,100,154**	**$1,950,100,185**	**$3,900,200,339**

1. Fish and wildlife mitigation costs are allocated to applicable categories for repayment, including non-reimbursable costs.

Repayment Obligations

The summary of estimated repayment obligations for CVP construction costs is presented in Table ES-2. These repayment obligations reflect the construction costs allocated (and sub-allocated) to reimbursable and non-reimbursable purposes in Period 1, Period 2, and the final cost allocation. The breakdown of construction costs allocated across reimbursable sub-purposes is shown Table ES-3.

Table ES-2. Summary of Repayment Obligations – Construction Costs Only (Excludes IDC and OM&R)

Category	Period 1 Value ($)	Period 1 Percent of Total	Period 2 Value ($)	Period 2 Percent (%)	Period 2 Change from P1	Final Cost Allocation (Merge) Value ($)	Final Cost Allocation (Merge) Percent (%)	Final Cost Allocation (Merge) Change from P1
Irrigation	$1,206,266,266	30.93%	$1,096,668,702	28.12%	($109,597,564)	$1,151,467,486	29.52%	($54,798,780)
M&I	$108,528,674	2.78%	$143,976,175	3.69%	$35,447,501	$126,252,427	3.24%	$17,723,753
Commercial Power	$730,180,976	18.72%	$665,824,189	17.07%	($64,356,787)	$698,002,584	17.90%	($32,178,392)
Repayment Contracts	$597,617,151	15.32%	$597,617,151	15.32%	$0	$597,617,152	15.32%	$0
Non-reimbursable	$739,347,602	18.96%	$877,854,513	22.51%	$138,506,911	$808,601,061	20.73%	$69,253,459
CVPIA	$340,872,120	8.74%	$340,872,120	8.74%	$0	$340,872,120	8.74%	$0
Authorized Deferred Use	$56,875,000	1.46%	$56,875,000	1.46%	$0	$56,875,000	1.46%	$0
SOD – Not in Repayment	$120,512,509	3.09%	$120,512,509	3.09%	$0	$120,512,509	3.09%	$0
Total	$3,900,200,298	100.00%	$3,900,200,359	100.00%	NA	$3,900,200,339	100.00%	NA

P1 = Period 1
SOD = Safety of Dams

Table ES-3. Reimbursable Costs Distribution – Construction Costs Only (Excludes IDC and OM&R)

Category[1]	Period 1 Value ($)	Period 1 Percent (%)	Period 2 Value ($)	Period 2 Percent (%)	Final Cost Allocation (Merge) Value ($)	Final Cost Allocation (Merge) Percent (%)
Irrigation	$1,206,266,266	58.99%	$1,096,668,702	57.52%	$1,151,467,486	58.28%
M&I	$108,528,674	5.31%	$143,976,175	7.55%	$126,252,427	6.39%
Commercial Power	$730,180,976	35.71%	$665,824,189	34.92%	$698,002,584	35.33%
Total	**$2,044,975,916**	**100.00%**	**$1,906,469,066**	**100.00%**	**$1,975,722,497**	**100.00%**

1. Values presented in this table do not include repayment contracts

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Chapter 1. Introduction

This chapter provides general background on the CVP Final CAS, including an overview of public outreach and involvement.

1.1 Background & Overview

In 2010, Reclamation commenced efforts to complete a new cost allocation for the CVP that updates the costs allocated among the authorized eight purposes of the project:

- Water Supply
- Hydropower
- Flood Control
- Water Quality
- Recreation
- Navigation
- Fish and Wildlife Enhancement
- Fish and Wildlife Mitigation[3] (treated as joint cost)

The final cost allocation proposed herein will be utilized for the allocation of repayment obligations for CVP facilities subject to the 2030 repayment requirement. Reclamation conducted the final CAS in consultation with CVP stakeholders and other Federal agencies, including WAPA, USACE and USFWS through coordination on key issues and analyses. Information on the public outreach process is presented in Chapter 1.4.

1.1.1 Two Cost Allocation and Two-Period Repayment Approach

Through the stakeholder engagement process, it was identified that historic project operations and conditions differed significantly from operational conditions expected in the future. Reclamation policy (PEC 01-02) defines the appropriate period of analysis for the cost allocation as 100 years beyond the initial date of service (Reclamation 2015). Combining two separate cost allocations, each

[3] The Central Valley Project Improvement Act (CVPIA) added "mitigation, protection, and restoration of fish and wildlife," hereafter referred to as "fish and wildlife mitigation," as an authorized purpose of the CVP. Fish and wildlife enhancement can share in joint costs if all requirements of P.L. 89-72 (Federal Water Project Recreation Act) are met, while fish and wildlife mitigation is not a purpose that shares joint costs. Any mitigation not specifically authorized under CVPIA is considered a joint cost that is shared among all other project purposes that can share in joint costs. The repayment of fish and wildlife mitigation costs is addressed in Section 5.11.1.

with a 100-year period of analysis, allows the CAS to include current/future operational conditions in accordance with Reclamation policy.

The first period (Period 1) reflects historic conditions as utilized in the 1975 CVP cost allocation update (as updated through 2013). The second period (Period 2) reflects projected operations and benefits of the CVP[4]. The final cost allocation represents a merger of the two periods (see Chapter 11, *Final Cost Allocation (Two Period Merger))*.

This document focuses on the assumptions, costs, and benefits used in the cost allocation process for period 2. The assumptions and methodology used to develop the cost allocation factors for Period 1 are documented separately, and references to the Period 1 allocation are presented for context only. More detailed information on the two-cost allocation and two-period repayment approach is presented in Chapter 5.1.

1.1.2 Costs to Be Allocated

The costs allocated in the final CAS are the plant-in-service costs for all CVP facilities, which include facilities owned and operated by Reclamation as well as power facilities owned and operated by WAPA that are considered an integral part of the CVP. Reclamation performs the cost allocation for WAPA's CVP facilities; however, WAPA is responsible for recovering costs from its power customers. Chapter 3, *Project Facilities and Costs* provides details on project facilities and costs subject to the final cost allocation. Costs with prescribed allocations are treated as direct assigned costs (see Section 3.3).

1.1.3 Cost Allocation Versus Repayment

The cost allocation process is used to allocate project costs among its authorized purposes. Costs allocated across project purposes are identified as reimbursable and non-reimbursable costs. Reimbursable costs are then assigned to water and power customers for repayment. Non-reimbursable costs are not subject to repayment.

1.2 Purpose and Need for Study

The purpose of the Final CAS is to develop allocation factors which determine the final repayment obligations for each of the CVP customer classes. The allocation factors are used to determine repayment obligations for construction costs of project facilities with repayment targets of 2030. Reclamation policy, Federal legislation[5], and customer requests require the completion of the final CAS for the CVP.

The final CAS considers changes to the CVP's authorized purposes and operations resulting from changes to legislation and evolving regulatory conditions. The CVP has continually added new

[4] Period 2 analyses rely on recent information from the Sacramento and San Joaquin Rivers Basin Study (SSJRBS) to assess the potential differences in water supply availability that might occur between a no-climate-change scenario and various other future climate change projections (see Chapter 6.7 *Hydrology Sensitivity Analysis*).
[5] Public Law 99-546 directed Reclamation to conduct and implement a final cost allocation study of the Central Valley Project.

features based on a financially and operationally integrated project. Re-operation of the CVP with the additions of new features complicates a clearly defined point of substantial completion. Congress and contractors have identified those facilities with repayment in 2030 as what constitutes the basis for the final allocation for the CVP.

1.3 Approval of Cost Allocations

Reclamation policy PEC P01 (Final Cost Allocations) (Reclamation 1995) indicates the Commissioner is authorized to approve the CVP Final CAS.

1.4 Public Outreach & Involvement

This CAS was initiated in 2010, and since that time, project information has been shared with stakeholders through a series of meetings, workshops, briefings, and the project website. An initial public meeting was held on October 1, 2010, to commence the project. Since that time, Reclamation has held over 30 additional meetings to solicit input and present information regarding cost allocation methodology and preliminary results and findings. Those stakeholders who commented on the Draft CVP Final CAS during the public review process (January 2019 – April 2019) were invited to a series of four listening sessions to provide Reclamation with additional context to comments and help prioritize efforts for completion of the study.

Throughout the process, Reclamation received over 700 written comments on the study, and stakeholders have provided input via direct contact with Reclamation staff. Comments were received from over 40 stakeholders including Federal agencies, CVP customers, regional and local governments and agencies, and special interest groups. Efforts were taken to review all stakeholder comments as they were received so that they could be incorporated into the development of the CAS, including the supporting technical analysis. All comments received on the Draft CVP Final CAS have been considered in the CVP Final CAS.

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Chapter 2. Overview of the Central Valley Project

This chapter provides an overview of the CVP, including project operations and related legislation and agreements that are integral to the project. Information on CVP facilities included in the CAS is presented in Chapter 3, *Project Facilities and Costs*.

2.1 Project Overview

The CVP is the largest surface water storage and delivery system in California and the largest irrigation water supply project constructed and operated by Reclamation. Facilities and service areas of the CVP cover a large geographic area and include 35 of the State's 58 counties. The CVP includes 20 reservoirs, with a combined storage capacity of nearly 12 million acre-feet; 8 power plants and 2 pumping-generating plants, with a combined capacity of approximately 2 million kilowatts; 2 pumping plants; and approximately 500 miles of major canals and aqueducts. The CVP supplies water to more than 200 long-term water contractors in the Central Valley, the San Francisco Bay Area, and the Santa Clara Valley.

Historically, approximately 90 percent of the water delivered by the CVP has been for agricultural uses. At present, increasing quantities of water are being provided to municipal customers, including the cities of Redding, Sacramento, Folsom, Tracy, and Fresno; most of Santa Clara County; and the northeastern portion of Contra Costa County.

The CVP has eight authorized purposes. Congress authorized the CVP to serve water supply, power, flood control, water quality, recreation, navigation, fish and wildlife enhancement, and fish and wildlife mitigation, with portions of the costs for CVP facilities to be reimbursed by the water and power users. Additional information on the authorized purposes of the CVP is presented in Chapter 5.7.

2.2 Project Area

The CVP is authorized as a single financially and operationally integrated multipurpose water supply project, providing water storage both north and south of the Sacramento-San Joaquin River/San Francisco Bay Delta (Delta). As shown in Figure 2-1, major CVP dams and reservoirs are located on the Trinity, Sacramento, American, Stanislaus, and San Joaquin Rivers. CVP water supplies north of the Delta are controlled by Shasta and Folsom Dams on the Sacramento and American Rivers, respectively. Water from the Trinity River is stored, re-regulated, and diverted through a system of dams, reservoirs, tunnels, and power plants to the Sacramento River to supplement the supply developed by Shasta Reservoir.

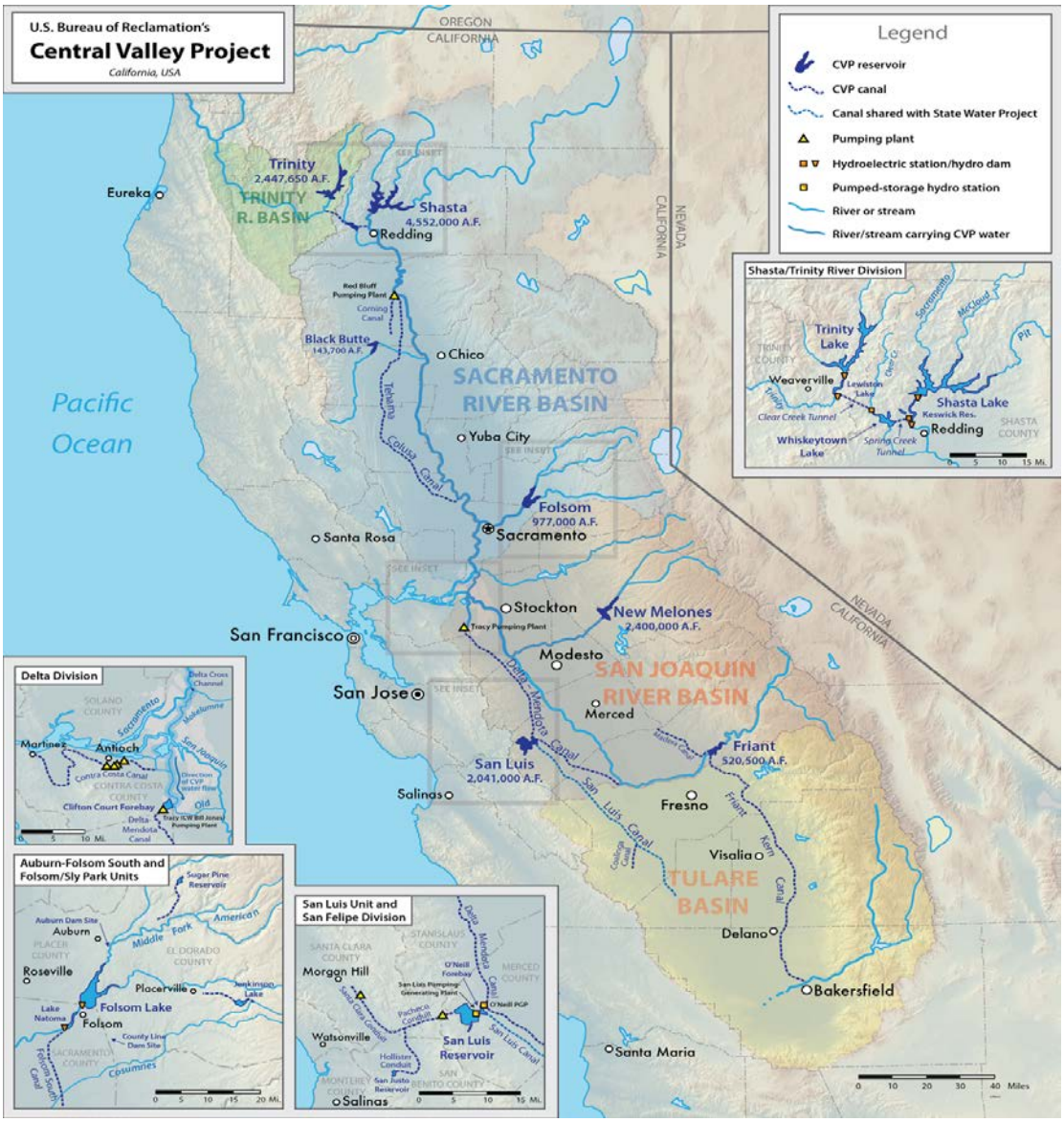

Figure 2-1. CVP Project Area

2.3 Project Development and Authorization

The CVP resulted from long-term interaction among State, Federal, and private parties sharing a common interest in developing California's water resources. The CVP was authorized through a series of legislative acts, beginning with the Rivers and Harbors Act of 1935, which authorized construction of initial features on the Sacramento and San Joaquin Rivers and in the Delta by the USACE. The River and Harbors Act of August 26, 1937, reauthorized the CVP for construction under provisions of Federal reclamation laws by the Secretary of the Interior.

Construction of the first major CVP facility, Shasta Dam, began in 1938. Successive congressional acts authorized additional facilities based on geographical proximity and purposes served. The final dam and reservoir, New Melones, was officially transferred to Reclamation from the USACE by P.L. 87-874 in November 1979.

2.4 Project Facilities & Operations

Extending 400 miles through central California, the CVP is a complex, multipurpose network of dams, reservoirs, canals, hydroelectric power plants, and other facilities. The CVP provides flood protection for the Central Valley and supplies irrigation water throughout the valley thereby supporting California's agricultural economy. It also supplies municipal and industrial water to major urban centers in the greater Sacramento and San Francisco Bay areas, as well as producing electrical power and offering various recreational opportunities. In addition, the project provides water to restore and protect fish and wildlife, and to enhance water quality.

Long-term contracts for CVP water, in total, exceed 9 million acre-feet per year. The CVP has long-term agreements to supply water to more than 200 contractors in 29 of California's 58 counties. Deliveries by the CVP include providing an annual average of 5 million acre-feet of water for farms; 600,000 acre-feet of water for municipal and industrial (M&I) uses (enough water to supply about 2.5 million people for a year); and water for wildlife refuges and maintaining water quality in the Sacramento-San Joaquin Delta. The CVP dedicates 800,000 acre-feet per year to fish and wildlife and their habitat and 410,000 acre-feet to State and Federal wildlife refuges and wetlands, pursuant to the Central Valley Project Improvement Act (CVPIA).

Overall, CVP operations are coordinated to obtain maximum yields and to deliver water into the main river channels and canals of the project in the most efficient and economical manner. Project operations are implemented in conjunction with State Water Project (SWP) operations based on the Coordinated Operations Agreement (COA), the Bay-Delta Accord, and other agreements. Irrigation and M&I water is delivered to project contractors from the main canals in accordance with long-term contracts negotiated with irrigation districts and other local organizations. Distribution of water from the main canals to the individual users is the responsibility of the local districts, which use distribution systems comprised of lateral canals and pipelines to convey water to individual farms and municipalities.

2.5 Key CVP Agreements and Legislation

There are a wide range of laws and agreements that affect CVP and SWP operations. Throughout the life of the CVP, the allocation of its costs has been affected directly or indirectly by Federal legislation, continuing up to the recent specific allocation of costs of certain actions and facilities mandated by the CVPIA. This has meant that different rules may apply to different groups of CVP facilities or facilities built during different periods of time. The current CVP cost allocation study must be understood in the context of these changing mandates and application of different procedures to different sets of CVP facilities. It is also important to note that the existing CVP water

ratesetting process, dependent as it is on the allocation of CVP costs, has relied on this amalgamation of practices. The discussion below highlights several key provisions that play a critical role in CVP operations that in turn affect project costs and benefits and ultimately the allocation of project costs.

2.5.1 Coordinated Operations Agreement

In 1986, Reclamation and the State entered into a COA that described how the CVP and the SWP are to be operated in a coordinated manner to jointly meet Delta salinity control and water quality standards as defined by the State Water Resources Control Board (SWRCB). The COA included many provisions concerning the joint operations of CVP and SWP, including methods to ensure that water demands in specific areas north of the Delta and in the Delta are met prior to exporting water to areas south of the Delta. In addition, COA provisions defined how much water the CVP and the SWP can export when the Delta conditions allow exports.

Title I of P.L. 99-546 directed the Secretary to operate the CVP in conformity with State water quality standards for the Delta. The act specified that costs associated with providing CVP water supplies for salinity control and complying with State water quality standards be allocated among project purposes and reimbursed in accordance with existing Reclamation law and policy.

2.5.2 State Water Resources Control Board Water Quality Requirements

The CVP and SWP are also operated pursuant to SWRCB decisions and orders related to water rights permits for the CVP and SWP. The SWRCB is responsible for setting water quality standards governing the operations of the CVP and SWP for the San Francisco Bay/Sacramento-San Joaquin Delta and Estuary. Under P.L. 99-546, both projects were authorized to operate in close coordination pursuant to the COA, which also required the CVP and SWP to share responsibility to meet the SWRCB Water Rights Decision 1485 (D-1485) water quality standards. In 1999, the SWRCB adopted Water Rights Decision 1641 (D-1641), amending certain water quality terms and conditions. Meeting D-1641 water quality standards requires exceeding the Delta outflow standards set by D-1485.

2.5.3 Central Valley Project Improvement Act

On October 30, 1992, the President signed into law the Reclamation Projects Authorization and Adjustment Act of 1992 (P.L. 102-575) that included Title 34, the CVPIA. The CVPIA amended the Act of August 26, 1937, the basic authorizing legislation for the CVP, to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation.

The CVPIA identified a number of specific measures to meet these new purposes. It also directed the Secretary of the Interior to operate the CVP consistent with these purposes, to meet the Federal trust responsibilities to protect the fishery resources of affected federally recognized Indian tribes, to meet all requirements of Federal and State law, and to achieve a reasonable balance among competing demands for CVP water.

Many of the provisions included in the CVPIA identified specific measures intended to improve fishery conditions in Central Valley rivers and the Delta. In many cases, the provisions also provided specific cost-sharing and allocation criteria. As a result, the allocation of costs for CVPIA-mandated actions was directed by Congress, with Congress specifying the percentage of costs to be allocated to water and power users, the Federal government, and the State. Relevant examples are the actions specified in Section 3406(b)(4)(23) and refuge water supplies addressed in Section 3406(d).

The CVPIA also contains requirements that could affect CVP water availability and use without directing that a new cost allocation be undertaken or providing a cost allocation formula. Section 3406(b)(2) of the CVPIA directed the Secretary to dedicate and manage 800,000 acre-feet of CVP yield for the primary purpose of implementing the fish, wildlife, and restoration purposes of the act, to assist the State in its efforts to protect Bay/Delta waters, and to help meet other legally imposed obligations on the CVP, including but not limited to additional obligations under the Federal Endangered Species Act (ESA). The dedication of this water reduced the capability of the CVP to deliver contracted amounts of water to M&I and irrigation contractors. Congress neither directed that a new cost allocation study be undertaken as a result of likely reductions in water contract deliveries nor provided a cost allocation formula related to the dedicated water. Additional information on the treatment of CVPIA costs in the final CAS is presented in Chapter 5.11.

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Chapter 3. Project Facilities and Costs

This chapter presents the project facilities and associated costs included in the final CAS. Most of the facilities and costs are subject to the SCRB cost allocation methodology utilized in this study (described in detail in Chapter 4, Cost Allocation Methodology). Facility costs that are not included in the SCRB analysis but remain part of the overall CAS include direct assigned costs, repayment contracts, additional repayment obligations, and costs not allocated. These costs are accounted for in the final CAS summary tables presented in Chapter 10, *Cost Allocation Results (Period 2)* and Chapter 11, *Final Cost Allocation (Two Period Merger)*. Unless noted otherwise, the costs referenced in this chapter represent CVP plant-in-service (construction) costs only. Chapter 9, *Cost Estimates* outlines cost estimates for interest during construction (IDC) and operation, maintenance, and replacement (OM&R) necessary for performing the SCRB analysis.

3.1 Project Facilities (CAS Facility List)

The CAS covers most CVP facilities that are considered plant-in-service based on Schedule 1 of the 2013 CVP Financial Statement (see the CAS Facility List Attachment at the end of this report). Facilities with prescribed repayment obligations are included in the CAS as direct assigned costs. Facilities that support project benefits and do not have prescribed repayment obligations are allocated through the SCRB analysis. The cost of CVP facilities owned and operated by WAPA and identified as financially and operationally integrated with the CVP are included in the CAS.

The CAS allocates costs of project facilities in the following CVP divisions/units:

- Shasta and Trinity River Divisions
- Friant Division
- Sacramento River Division
- American River Division
- Delta Division
- San Felipe Division
- West San Joaquin Division, San Luis Unit
- Stanislaus (East Side) Division

3.2 Adjustments to the CVP Financial Statement

The CAS allocates plant-in-service costs shown in Schedule No. 1 of the 2013 CVP Financial Statement, which represent the costs as of September 30, 2013 (Reclamation 2013a). Several modifications to the 2013 Financial Statements are necessary to exclude costs that are not allocated through the CAS.

Facilities Not Considered Plant-In-Service: Schedule No. 1 of the CVP Financial Statement include costs associated with construction in abeyance, general construction, and O&M construction. These are costs expended, but not yet placed into plant-in-service. Costs for facilities not yet placed in service are not allocated for repayment because they do not yet provide benefits to the project.

Land and Land Rights: Land and land rights (LLR) costs presented in Schedule No. 1 are the value of the land on which project facilities are constructed. LLR costs for facilities that are plant-in-service are included in the construction costs of each appurtenant facility and are allocated in the CAS. If a facility has not yet been placed in plant-in-service, the associated LLR costs for the facility are not allocated in the CAS.

Reimbursable Interest During Construction: IDC is an allowance for earnings foregone on funds used to construct the facility. IDC is included in the CAS for facilities placed into plant-in-service that are subject to the SCRB analysis. The reimbursable IDC costs for facilities in plant-in-service included in Schedule No. 1 have been removed before the SCRB analysis was performed because the SCRB relies on an estimate of total IDC for the entire facility cost.

Depreciation Expense: All depreciation expenses are excluded from the CAS study because the allocation of construction costs and repayment requirements apply to original cost, not costs reduced through depreciation.

Other Costs Excluded: Other Schedule No. 1 values excluded from the CAS are associated with equipment, information technology software, and amortization.

Transferred Title Facilities: The construction cost of Coleman National Fish Hatchery is removed from the plant-in-service value for Shasta Dam and Reservoir shown on Schedule No. 1 of the 2013 Financial Statement. Title to the hatchery was transferred from Reclamation to USFWS so the construction cost of the hatchery is excluded from the CAS.

Operation, Maintenance, and Replacement (OM&R) Costs: There are costs referred to as extraordinary operations and maintenance (EOM) that are included as plant-in-service in Schedule No. 1 but are repaid to Reclamation as annual O&M costs. EOM costs are excluded from the SCRB analysis to avoid double counting with estimated OM&R costs presented in Chapter 9, *Cost Estimates*.

Financial System Reconciliation: In 2013, Reclamation adopted a new financial reporting system known as the Financial and Business Management System (FBMS) and discontinued use of the Federal Financial System (FFS). In the process, the FBMS system reclassified some assets formerly categorized as plant-in-service to buildings. For the CAS, the cost of these buildings is included as part of the plant-in-service costs being allocated.

3.3 Direct Assigned Costs

CVP facility repayment obligations directly defined by legislation, agreement, or contract are not included in the SCRB analysis. Facility costs (or portions thereof) that are directly assigned are added to the applicable repayment category after the SCRB process is complete. Adding together the costs allocated by the SCRB process and the direct assigned costs provides the total CVP cost allocated, which represents a significant portion of the total repayment obligation of CVP contractors. In total, direct assigned costs, including IDC, accounted for in the CAS are $502,712,342.[6]

The following facility or program costs that are designated as direct assigned costs include:

- **State Share of San Luis Unit Construction** ($248,310,255)
    - The State's share of costs of construction of the San Luis Unit is removed from the allocation process because only Federal costs are being allocated. P.L. 86-488 authorized construction of the San Luis Unit of the CVP and provided for the sharing of costs with the State of California.
- **Archaeological, Cultural, and Historical** ($4,245,665)
    - The costs associated with archaeological, cultural, and historic investigations and documentation are directly assigned as Federal non-reimbursable. P.L. 93-291 provides that up to 1 percent of project construction costs can be spent on archaeological, cultural, and historical investigations and cataloging.
- **Fish and Wildlife, Nimbus Dam** ($40,000)
    - Prior to completion of the fish hatchery, additional expenses were incurred during construction of Nimbus Dam to facilitate fish passage. The cost over-run is directly assigned as non-reimbursable fish and wildlife costs.
- **Highway Improvement** ($14,663,318)
    - Highway improvements at New Melones Dam and San Luis Dam are directly assigned to Federal non-reimbursable. P.L. 87-874 provides that the cost of replacing highways with an improved version as part of a project is non-reimbursable.
- **Safety, Security, and Law Enforcement** ($25,476,432)
    - Safety, Security, and Law Enforcement activities at the Folsom Unit, San Felipe Division, San Luis Unit, and the Shasta Unit are directly assigned as Federal non-reimbursable pursuant to P.L. 110-229.

[6] This value includes IDC that is direct assigned. Direct assigned IDC costs are not reflected in the CAS results presented in Chapters 10 and 11 or the CAS Facility List Attachment, which focus on CVP construction costs.

- **Kesterson Reservoir Clean-up Program** ($6,800,000)
    - The costs of clean-up activities at Kesterson Reservoir resulting from selenium contamination from San Luis Drain is directly assigned as Federal non-reimbursable. Language in Reclamation's annual appropriations bill provides that $6,800,000 of the cost to clean up is considered Federal non-reimbursable expense.
- **Capitalized Interest During Construction**: ($31,112,020)
    - **New Melones Unit:** IDC costs associated with the New Melones Unit are directly assigned as Federal non-reimbursable. When New Melones Dam was transferred to Reclamation by the USACE, $27,012,918 was included as capitalized IDC allocated to irrigation. Reclamation does not charge IDC on irrigation costs so the IDC was classified as non-reimbursable.
    - **San Felipe Division:** IDC costs associated with the San Felipe Division are directly assigned as Federal non-reimbursable. $4,099,102 of IDC calculated against the M&I portion of the construction cost of the San Felipe Division is classified as Federal non-reimbursable pursuant to an agreement with division contractors.
- **San Felipe Division Non-Reimbursable Construction Costs** ($32,678,447)
    - Ten percent of construction cost of the San Felipe Division is classified as Federal non-reimbursable pursuant to an agreement with division contractors. The non-reimbursable portion of construction costs is based on anticipated development of recreation and fish and wildlife facilities. Accordingly, these costs are assigned and split equally among non-reimbursable recreation and fish and wildlife purposes.
- **American River Pumping Station** ($3,589,560)
    - The cost of restoring the American River Pumping Station for the Placer County Water Agency is a Federal non-reimbursable cost pursuant to P.L. 110-229.
- **Safety of Dams (SOD) Program** ($31,810,865)[7]
    - SOD costs are associated with the following facilities: Folsom Dam and Reservoir ($26,385,404),[8] Little Panoche Creek Detention Dam ($6,536), Los Banos Creek Detention Dam and Reservoir ($10,784), and O'Neill Dam Forebay and Waterway ($5,408,141). Eighty-five percent of SOD costs are Federal non-reimbursable and 15 percent are reimbursable pursuant to P.L. 98-404.
- **Fish and Wildlife Activities** ($103,829,746)
    - Certain fish and wildlife facilities authorized separately from CVPIA have been directly assigned as reimbursable or non-reimbursable through legislation or agreement ($103,829,746).
    - Fish and wildlife costs that are not authorized under CVPIA and not direct assigned are considered mitigation and are treated as joint costs allocated across all project purposes

[7] This value includes both reimbursable and non-reimbursable SOD costs.
[8] This value excludes Folsom Dam SOD costs that are not in repayment (refer to Section 3.6).

by the SCRB process ($28,495,676). Refer to Section 5.11, *Mitigation Costs*, and the CAS Facility List Attachment for additional details.

- **Recreation Cost Sharing** ($156,034)
    - Reclamation maintains cost sharing agreements on two recreation facilities in the CVP – Lake Woollomes Recreation Facilities and San Justo Reservoir Recreation Facilities. The cost sharing agreements for these two facilities divide the obligation evenly between Federal non-reimbursable (as part of the recreation purpose) and State/local non-reimbursable. Accordingly, the cost of Lake Woollomes recreation facilities ($54,500) is allocated 50 percent to Federal non-reimbursable and 50 percent is direct assigned to local/State non-reimbursable pursuant to P.L. 89-72, Sec. 7(a). The cost of San Justo Reservoir recreation facilities ($257,568) is allocated 50 percent to Federal non-reimbursable and 50 percent is direct assigned to local/State non-reimbursable per Cooperative Agreement No. 4-FC-01430.

3.4 Defined Repayment Obligations

Defined repayment obligations of the CVP include repayment contracts between contractors and Reclamation and WAPA. These costs are excluded from the SCRB analysis.

- **Reclamation Distribution System Repayment Contracts ($624,827,547)**

  Water distribution system costs subject to Reclamation repayment contracts are assigned directly to the applicable contractors, rather than through the CAS process. The costs of distribution systems that are not owned or financed by Reclamation are not within the scope of the CAS.

- **Repayment Contracts, WAPA ($8,980,301)**

  Similar to repayments contracts for Reclamation facilities, WAPA has incurred costs that are directly repayable by a particular entity pursuant to contract and do not affect market power rates. The contract is with Lawrence Livermore Labs (Contract 89-SA-90001) in the amount of $8,980,301.

3.5 Additional Repayment Obligations

The final CAS accounts for costs that are not subject to the cost allocation but are included either as part of the water ratesetting process or the repayment obligation of commercial power. Accordingly, these costs are accounted for in Chapter 11, *Final Cost Allocation (Two Period Merger),* in an effort to provide a comprehensive overview of existing and future repayment obligations of project beneficiaries.

The following represents the additional costs included in the CVP water ratesetting process, and in the calculation of the repayment obligations for commercial power interests administered by WAPA.

- **Repayment Obligations Assumed (USACE)**. Reclamation is responsible for repayment of costs for several projects constructed by USACE, including Hidden Reservoir on the Fresno River, Buchanan Reservoir on the Chowchilla River, and the Black Butte project on Stony Creek. Hidden Reservoir and Buchanan Reservoir were authorized by the Flood Control Act of 1962, and the repayment obligations have been integrated into Reclamation's ratesetting process where costs are allocated to the water supply purpose and distributed in total to the irrigation sub-purpose. The Black Butte project was authorized by the Flood Control Act of 1944, and subsequently P.L. 91-502 provided that the project would be financially integrated with the CVP. The water supply costs of the Black Butte project are sub-allocated to the irrigation and M&I sub-purposes based on relative water deliveries. Title (ownership) of all three projects remains with USACE. The total value of repayment obligations assumed from USACE for the three projects is $20,134,102.
- **WAPA Retired Assets**. Repayment obligations for commercial power include WAPA retired assets. The costs of retired assets are not included in the SCRB analysis because when a unit is replaced the cost is "removed" from Schedule 1 in WAPA's Results of Operation and the new cost is included instead. Therefore, to include both the retired asset cost and replacement cost in the SCRB analysis would count the value of the capital twice. However, from a cost recovery perspective, WAPA needs to recover both the original cost and the replacement cost. Therefore, the value of retired assets is included for cost recovery purposes. The total value of WAPA retired assets is $45,551,232.
- **California-Oregon Transmission Project (WAPA)**. The SCRB analysis excludes the cost of the California-Oregon Transmission Project (COTP) because it is not directly connected to any CVP hydropower generation resources, nor used to move CVP hydropower to CVP preference power customers. However, the cost of the COTP ($22,135,133) represents a repayment obligation of commercial power.

3.6 Costs Not Allocated

The costs of facilities that have not yet entered repayment, facilities that have authorized deferred use, and CVPIA facilities are not allocated in the CAS, but a portion of these costs represent a future obligation of CVP water and power contractors. The results of the CAS will be used to allocate these costs at some future point in time where applicable.

- **Facilities Not Yet in Repayment:**

  Folsom Safety of Dams: The Folsom Dam Safety and Flood Damage Reduction Joint Federal Project is a collaborative effort by Reclamation and USACE to address the dam safety hydrologic risk at the Folsom Facility (including Mormon Island Auxiliary Dam and several dikes) and improve flood protection. The Folsom project is included in plant-in-service in Schedule No. 1, but the costs are not allocated because the project has not yet entered repayment. The project took place over multiple years and work was completed in phases. As phases are completed, they are transferred from work in progress to plant-in-service. An agreement was reached between Reclamation and CVP

water contractors that the reimbursable 15 percent of project construction costs would not be placed into repayment status until 2021. The total value of Folsom SOD costs not in repayment is $120,755,310[9]. The reimbursable costs will be allocated in accordance with the final cost allocation when it is completed, as directed by P.L. 99-546. Repayment will begin the year following substantial completion of construction of each SOD modification and be completed within 50 years as provided by the SOD Act. Note that these costs are not reflected in the CAS Facility List Attachment.

- **Authorized Deferred Use**:
    - **Folsom South Canal and Tehama-Colusa Canal:** P.L. 89-161 and P.L. 90-65 authorized construction of extra conveyance capacity in the Folsom South Canal and Tehama-Colusa Canal, respectively, to provide for an expanded service area which could receive project water, if necessary. If the additional irrigation service materializes, the cost of the additional capacity – $2,425,000 for Folsom South Canal and $54,450,000 for Tehama-Colusa Canal – is to be repaid by project beneficiaries in accordance with applicable cost allocation procedures. If not, the authorized deferred use costs would be repaid from revenues of the CVP. Specific procedures consistent with existing law and Reclamation policy will be developed for the repayment of authorized deferred use costs prior to 2030. In the interim, the construction costs of the additional capacity are deferred and not being recovered through water rates.
- **CVPIA Facilities:** The costs of CVPIA facilities are not allocated through the CAS. The repayment obligations for CVPIA facility costs are directly assigned to reimbursable and non-reimbursable obligations by statute. The sub-allocation of reimbursable costs between Irrigation, M&I, and commercial power users will be determined through a separate process based on the results of the CAS.

[9] This value represents costs in the 2013 CVP financial statements. The estimated total Folsom Facility SOD modification cost is $507,000,000, of which 15 percent ($76,050,000) is reimbursable.

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Chapter 4. Cost Allocation Methodology

This chapter discusses cost allocation principles and presents the process for implementing the SCRB methodology. Chapter 10 of this report, *Cost Allocation Results (Period 2),* presents the application of the SCRB process for the CAS, including the resulting allocation of CVP costs for the Period 2 allocation.

4.1 Cost Allocation Background and Objectives

Early efforts in the field of water resources development consisted of simple, single-purpose projects, but the trend soon shifted toward increasingly complex, multipurpose projects because one large project is typically a more efficient means of providing benefits across a wide geographic area and range than constructing multiple single-purpose projects. As a result, techniques have been developed for the distribution of the costs of facilities serving more than one project purpose.

Cost allocation is concerned with the distribution or assignment of the total costs of a multipurpose project among its authorized purposes according to the principles of economic efficiency and equity. Once costs are initially allocated to the appropriate purpose, they are assigned to project beneficiaries as reimbursable costs and to the appropriate Federal or State governments as non-reimbursable costs. For the CVP CAS, reimbursable costs are the costs that are repaid to the government through some form of upfront cost sharing, repayment (including designations through public laws), or other financial agreements. Specific legislation and Reclamation policy establish the framework for designating costs as reimbursable, non-reimbursable, or partially reimbursable for a given project.

Generally, cost allocations are first performed during project planning (before construction begins) to give beneficiaries an estimate of their repayment responsibility and to determine whether the project is financially feasible. Interim cost allocations are needed for projects with any substantive changes (additions, legislation, and other factors), including construction of facilities over a longer period of time placed into service in stages. When construction of a project is determined to be substantially complete, a final cost allocation is required for the purpose of repayment. At that point, most post-authorization planning, design, construction, and IDC costs are known and OM&R costs are more clearly defined.

The CVP is a complex multipurpose project composed of both single-purpose and multipurpose facilities. The objective of the CVP CAS is to identify responsibilities for repayment of reimbursable costs by distributing the costs of multipurpose project facilities among the authorized purposes served by the CVP. Costs of single-purpose facilities, such as canals to provide M&I water and irrigation water, are directly assigned to the purposes they serve. Costs of multipurpose facilities, such as dams and reservoirs that are designed to serve more than one authorized purpose, are allocated to the appropriate authorized purposes through the SCRB allocation technique.

4.2 Separable Costs-Remaining Benefits Methodology

The SCRB method for allocating costs is Reclamation's preferred approach for allocating costs amongst multipurpose projects. Reclamation has determined the SCRB methodology to be sufficiently comprehensive, particularly for projects where separable costs greatly exceed specific costs for any or all purposes.[10]

The SCRB method is based on the goal of identifying and allocating all project costs to authorized purposes of the project. First, the SCRB approach looks to allocate the separable costs, which are the costs incurred that only support one authorized purpose. Once all separable costs have been defined, the SCRB approach allocates the costs that remain, which are referred to as joint costs. Joint costs are the remaining facility costs that serve multiple authorized purposes.

The SCRB process distributes joint costs that provide benefits to more than one purpose among all authorized purposes served by that facility. Joint costs are distributed among the appropriate authorized purposes proportional to the benefits received by each authorized purpose from the facility. Benefits, as outlined in Reclamation's Directives and Standards for Project Cost Allocations (PEC 01-02) and pursuant to the Federal Principles and Guidelines (P&Gs) (WRC 1983), are measured from a national perspective as opposed to a localized increase or improvement to society.[11]

4.2.1 Steps in the SCRB Process

The 9 steps in performing a SCRB cost allocation for a multipurpose project are listed below.

Step 1: Determine total project costs to be allocated.

Step 2: Estimate benefits produced by each authorized purpose.

Step 3: Estimate the single-purpose alternative (SPA) cost for each authorized purpose.

Step 4: Determine the Justifiable Expenditure for each authorized purpose.

Step 5: Estimate Separable Costs

- **a.** Estimate the Omitted Purpose Project Cost for each authorized purpose.
- **b.** Estimate the Separable Costs for each authorized purpose.

Step 6: Determine the Remaining Justifiable Expenditure for each purpose.

Step 7: Determine the Joint Cost Factors for each authorized purpose.

[10] The Reclamation report, "Central Valley Project Cost Allocation Study," May 2001, closely examined various cost allocation methods and at that time recommended that the existing method would remain in place; the 1975 allocation (with interim updates) was conducted using the SCRB method.

[11] Although the 1983 P&Gs have been superseded by the current Principles, Requirements, and Guidelines (PR&Gs), the requirements regarding Reclamation and its approach for cost allocations remain unchanged.

Step 8: Allocate Joint Costs

a. Calculate Total Joint Costs to be allocated among all project purposes.

b. Allocate joint costs between each authorized purpose.

Step 9: Calculate total costs allocated to each authorized purpose.

Step 1: Determine total project costs to be allocated. Total plant-in-service project costs are gathered or estimated across all cost categories and then converted to a common price level[12] for consistency and comparative purposes.[13] Total costs are the sum of construction (includes planning, design, and construction), IDC, and the capitalized value of annual OM&R costs.

Step 2: Estimate benefits produced by each authorized project. Benefits represent the increase in the value of the national output of goods and services associated with each purpose derived from the provision of project water. Benefits are estimated annually across the entire period of analysis. Annual benefits for each purpose may be estimated either as an average or individually for each year. Average annual benefits are based on historical or estimated future hydrology by water year type. Applying benefits by water year type to associated water year probabilities results in an expected average annual value. Like annual OM&R costs, annual benefits are assumed to occur each year of the period of analysis, thereby requiring discounting into a present value using a predetermined interest rate.

Step 3: Estimate the SPA Cost for each authorized purpose. The SPA Cost for each purpose reflects the costs of building and operating a theoretical single-purpose Federal project that would provide the same level of benefits, by purpose, as the multipurpose project. The SPA cost includes construction, IDC, and OM&R costs. A SPA may be located at the multipurpose project site, or at other sites, and several SPAs for different purposes may occupy the same site. Although a SPA may be a different size or an entirely different physical plan, it must be capable of producing the same level of benefits for any given purpose. Because each SPA is designed to support a single purpose only, the size of the SPA may be scaled down from the multipurpose project.

Step 4: Determine the Justifiable Expenditure for each authorized purpose. Justifiable Expenditure is the maximum amount of costs to be allocated to an authorized purpose. Justifiable Expenditure is determined by the lesser of the benefits produced by the authorized purpose or the SPA costs. Justifiable Expenditure is used to allocate separable costs, because it is assumed that a given purpose should not be assigned more costs than either 1) the value of the benefits the project generates for that purpose or 2) the costs of building a project exclusively for that purpose.

Step 5a: Estimate the Omitted Purpose Project Cost for each authorized purpose. Estimating the cost of the multipurpose project with each authorized purpose omitted allows for an estimate of the incremental cost of including each authorized purpose in the multipurpose project. The intent is to identify those costs that are attributable to a single purpose (separable costs) and those that

[12] The time value of money suggests that a dollar obtained today would be more valuable than a dollar obtained a number of years from now because today's dollar could be invested and earn interest. The foregone interest reflects the opportunity cost associated with the future year dollar. For this reason, cost and benefit dollar values obtained at various points in the future must be discounted (decreased) to a common year present dollar value.

[13] Plant-in-service is the date the project or facility was effectively placed into service.

cannot be attributed to a single project purpose (joint costs). The total cost of the multipurpose project is estimated for the project including all authorized purposes, then a series of estimates of the same multipurpose project with each authorized purpose omitted (omitted purpose projects) is made. Each omitted purpose project cost estimate is created by designing a project with the same benefits for all authorized purposes of the multipurpose project other than the purpose being omitted. The benefits for the omitted purpose are assumed zero.

Step 5b: Estimate the Separable Costs for each authorized purpose. Separable costs for each purpose equal the difference between the total costs of the multipurpose project (Step 1) and the estimated hypothetical total costs of the multipurpose project with the purpose removed (Step 5a). Separable costs for each authorized purpose include the costs of single-purpose facilities (i.e., specific costs) plus a portion of joint costs directly attributed to that purpose, referred to as separable joint costs.[14] Separable costs constitute the minimum costs that can be assigned to any given purpose.

Step 6: Determine the Remaining Justifiable Expenditure for each purpose. The remaining justifiable expenditure for each purpose equals the difference between the justifiable expenditure estimated in Step 4 and the separable cost estimated in Step 5b. Remaining justifiable expenditure provides the basis for allocating the joint costs.

Step 7: Determine the Joint Cost Factors for each authorized purpose. The Joint Cost factor for each authorized purpose is calculated by dividing the remaining justifiable expenditures for each purpose by the total remaining justifiable expenditure.

Step 8a: Calculate the Total Joint Costs to be allocated among all project purposes. Total Joint Costs is the difference between the sum of the Separable Costs for all authorized purposes (developed in Step 5b) and the Total Project Costs (developed in Step 1). Joint Costs are the costs of the multipurpose project that are not assignable through the estimation of Separable Costs.

Step 8b: Allocate joint costs between each authorized purpose. The Joint Cost Factors calculated in Step 7 are used to distribute the total remaining joint costs among the authorized purposes of the project. The Joint Cost Factor for each authorized purpose is multiplied by the Total Joint Cost to calculate the joint cost allocated to each purpose.

Step 9: Calculate total costs allocated to each authorized purpose. Add the Separable Cost and the Joint Cost for each project purpose to get the total cost allocated to each authorized purpose. The sum of the costs allocated to each purpose equals the total project cost calculated in Step 1.

4.3 Sub-Allocation Process

Water and Power are two CVP authorized purposes which include multiple sub-purposes with different repayment requirements. As a result, after the SCRB analysis is complete, it is necessary to sub-allocate costs assigned to these purposes. Costs are sub-allocated on the basis of use or

[14] Separable joint costs result from the reduced size of multi-purpose facilities when a given purpose is removed. The reduction in costs associated with the hypothetically re-sized facility reflects separable joint costs.

consumption, namely water deliveries and power generation. For the CAS, the sub-allocation of costs allocated to the water supply purpose is based on the proportion of water use across sub-purposes, and costs allocated to the power purpose are sub-allocated based on the proportionate share of power use. When units are not comparable between water and power, costs are allocated based on the relative investment for each purpose. More information on the water and power sub-allocation process is presented in Chapter 10.3.

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Chapter 5. Key Concepts and Assumptions

This chapter presents key concepts and assumptions used in the CVP CAS. The assumptions are applied to the allocation methodology outlined in Chapter 4, *Cost Allocation Methodology*.

5.1 Two Cost Allocation and Two-Period Repayment Approach

Reclamation policy (PEC 01-02) states that the period for estimating benefits and costs used in the cost allocation process will be the same as that used in project formulation and evaluation, which is the lesser of the economic life of the project or 100 years beyond the initial date of service. Since Shasta Dam was placed into service in 1945, major infrastructure additions, policy changes, and new regulations have altered the operations, authorized purposes, and benefits of the CVP. The SCRB methodology requires accurate estimation of benefits in order to appropriately allocate costs. Due to the substantial changes to the benefits and authorized purposes of CVP following the passage of CVPIA, Reclamation determined it prudent to evaluate the benefits of the CVP for two periods.

The first period (Period 1) allocation reflects historic operations and benefits as developed in the 1975 CVP cost allocation. The second period (Period 2) cost allocation represents current operations and benefits of the CVP following the passage of CVPIA. The final cost allocation presented in the CAS merges Period 1 and Period 2 allocations, putting equal weight to each period.[15] The equal weight given to each period is supported by the approximate mid-point of the 100-year repayment period coinciding with the passing of the COA in 1986, and the subsequent changes to benefits and authorized purposes of the CVP.

The costs allocated in both Period 1 and Period 2 allocations are the total project costs presented in Chapter 3, *Project Facilities and Costs*, which consist of plant-in-service costs for both Reclamation and WAPA as of September 30, 2013.

5.2 Period of Analysis

For cost allocations, Reclamation is required to compare costs and benefits over the period of analysis. PEC 01-02 states: "The period for estimating benefits and costs used in the cost allocation process will be the same as that used in project formulation and evaluation which is the lesser of the economic life of the project, or 100 years beyond the initial date of service" (Reclamation 2013b). Given that the economic life of the CVP is expected to exceed 100 years, the CAS uses a 100-year period of analysis.

[15] Note that the sub-allocation processes in Period 2 will be updated annually (see Chapter 12, *Implementation of the Final Cost Allocation*)

5.3 Base Year (2013)

Comparing costs and benefits that occur at different points in time requires that both benefits and costs be adjusted to a common price level for comparability. The year 2013 was selected as the base year because it corresponds to the underlying cost basis used in the CAS, namely the 2013 CVP financial statement. All historic costs are indexed to 2013 dollars. In addition, all prospective costs and economic benefits are measured in 2013 dollars.

5.4 Treatment of Post-Base Year Activities

Typically, the period of analysis is separated into historic and prospective conditions. Analysis of historic costs and benefits are estimated on actual observations, whereas prospective costs and benefits are forecasted. Estimation techniques are limited to information that is available at the time the analysis is initiated.

It is acknowledged that conditions in which the CVP operates vary over time as laws and policies change and other information becomes known. A common starting point for facts and data used to develop assumptions was selected corresponding to the base year of 2013 to maintain consistent data and assumptions across analyses. Future conditions known as of the base year and expected to exist over the 100-year period of analysis are included in the CAS. Reclamation has determined it prudent to utilize 2013 conditions to allow for timely completion of the CAS. Updating conditions, costs, and benefits would require Reclamation to perform the entire SCRB process again with new assumptions and would likely delay the completion of the CAS.

5.5 Interest Rate

Section 8 of PEC 01-02 states that all benefits and costs for allocation purposes will be placed on a comparable basis in relation to time of occurrence using the same interest rate and period of analysis. The interest rate (also referred to as discount rate) used for the CAS is 3.25 percent. The interest rate used complies with Section 80(b) of P.L. 93-251, which required a December 1968 discount rate for facilities authorized prior to January 1969 (this rate is 3.25 percent). The interest rate used in the CAS is the same interest rate used in past CVP cost allocation studies.

5.6 Single CVP-Wide Allocation

Unlike the existing allocation (Period 1) which utilized the concept of project "bases" for various types of facilities that were grouped together and subject to separate cost allocations, the Period 2 allocation treats CVP facilities across all divisions, units, regions, and programs as a single unit for the purposes of allocating costs. The Period 2 allocation returns to a project-wide approach because the CVP is financially and operationally integrated. The features constructed by USACE and the San Luis, Auburn-Folsom South, and San Felipe units have achieved their ultimate roles in the integrated

CVP. Through a single, integrated operational approach for the cost allocation, the final cost allocation factors can be clearly identified.

5.7 CVP Authorized Purposes

The CAS allocated costs among the following congressionally authorized purposes of the CVP: water supply, power, flood control, water quality, recreation, navigation, fish and wildlife enhancement, and fish and wildlife mitigation (which is treated as a joint cost for cost recovery). A description of each authorized purpose in the context of the cost allocation process is presented below.

5.7.1 Water Supply Purpose

The water supply purpose reflects the CVP's ability to deliver water. The objective of this section is to identify the components of the water supply purpose, discuss how water supply is treated in the CAS, and describe the water supply sub-allocation process.

5.7.1.1 Water Supply as a Single Purpose

Typically, irrigation and M&I water are treated as separate project purposes within a cost allocation. However, in the 1970 (Reclamation 1970) and updated 1975 (Reclamation 1975) CVP cost allocations, these purposes were combined into a water supply function which is further sub-allocated between irrigation, M&I, wildlife refuge, and waterfowl conservation based on the proportion of water delivered to each. This CAS similarly treats water supply as a single water supply function which is sub-allocated to specific water delivery purposes.

The use of a combined water supply purpose allows for adjustments to the proportionate share of costs allocated to irrigation and M&I as deliveries change over time. Additionally, when new units (San Luis and New Melones) are added to the project, the water supply approach allows for relatively easy incorporation of those costs into a CVP-wide allocation compared to treating irrigation and M&I as separate purposes. The 1970 cost allocation stated: "It was recognized that this approach may lose some conceptual correctness, but it was decided the accuracy lost is outweighed by the practical advantage gained from the water supply approach."

5.7.1.2 Components of Water Supply

The water supply purpose for Period 2 is comprised of irrigation, M&I, wildlife refuge, and CVPIA Section 3406(b)(2) (referred to as B2) water. Irrigation water supplies support irrigated agriculture in the CVP service area. M&I water supplies support urban development by providing reliable water supplies to the expanding population base. The CVP also provides water to refuges throughout the State in an effort to help support wildlife populations. Finally, the B2 component of the water supply purpose is measured based on both the volume released for B2 actions during excess conditions and the reduction in Delta exports required to meet B2 actions during balanced conditions. (See the *Hydrological Modeling Appendix* for more details.) Any water stored for the purpose of meeting the SWRCB D-1485 as well as the reasonable and prudent alternatives (RPA) of the biological opinions (BO) is not considered part of the water supply purpose and is considered a

joint cost in the CAS. Additionally, any water stored for the purpose of exceeding SWRCB D-1485 is not considered part of the water supply purpose (included as part of the water quality purpose).

5.7.1.3 Sub-Allocation of Water Supply

Water supply costs are sub-allocated to irrigation, municipal and industrial, wildlife refuge, and B2 functions on the basis of water use. Water supply delivery distributions are estimated by facility. Because Period 2 is a prospective analysis, the water delivery data is based on CalSim 2 modeling that is reflective of the current operating and regulatory environment. Information on B2 water supplies is derived from CVPIA water accounting records.

5.7.1.4 Water Supply Benefits and Costs

Irrigation and M&I benefits are estimated individually to arrive at the water supply total benefit value. Benefits are not estimated for wildlife refuge and B2 water supplies as benefits exceed the SPA. More information on the water supply benefit analysis is presented in Chapter 7, *Economic Benefits*.

In terms of costs, conveyance and pumping facilities generally accommodate water supply deliveries, so all of their costs are assigned to the water supply purpose. Storage facilities, on the other hand, typically serve multiple purposes, including water supply. Separable costs of multipurpose facilities to water supply required additional analysis. The SPA for water supply is based on determining the hypothetical size of each reservoir if it only served water supply purposes, plus all single-purpose water supply facilities.

5.7.2 Fish and Wildlife Enhancement Purpose

The fish and wildlife enhancement purpose is complex and requires additional attention to understand. CVPIA (P.L. 102-575) added "domestic uses and fish and wildlife mitigation, protection and restoration purposes" and "power and fish and wildlife enhancement" as authorized purposes for the CVP. For consistency with Reclamation practice, policy, and law, mitigation costs in the CAS are allocated to all project purposes as joint costs unless specified in specific legislation. The burden for operating the project is shared project-wide and not solely by the reimbursable purposes.

Fish and wildlife enhancement has requirements for allocating joint costs that have not been met, and therefore this purpose does not have costs allocated to it in the CVP. The Fish and Wildlife Coordination Act (60 Stat. 1080) dated August 14, 1946, and P.L. 85-624 dated August 12, 1958, provided that "measures to prevent loss of and damage to wildlife resources" were to be non-reimbursable costs.

Additionally, under PL 89-72, to allocate joint costs to the fish and wildlife enhancement purpose, there must be a commitment by a non-Federal entity to manage project land and water areas for fish and wildlife, as well as to pay a portion of the separable costs. Unless project-specific legislation exists regarding the allocation of joint costs to the fish and wildlife enhancement purpose, Reclamation typically relies on Section 2 of the Federal Water Project Recreation Act (FWPRA) (P.L. 89-72) of 1965, as amended, to determine how costs should be allocated to this purpose.

Prior to project authorization, FWPRA requires that a non-Federal public entity commit in writing to administer project land and water areas for fish and wildlife enhancement, to bear a portion of separable costs allocated to fish and wildlife enhancement, and to bear all operating costs. Because no such commitments by non-Federal entities exist for the CVP, Reclamation determined that the Period 2 allocation would not allocate joint project costs to the fish and wildlife enhancement purpose.

5.7.3 Recreation Purpose

Reclamation relies on Section 2 of the FWPRA of 1965, as amended, to determine the allocation of joint costs to recreation. FWPRA requires that a non-Federal public entity commit in writing, prior to authorization, to administer project land and water areas for recreation, bear a portion of separable construction costs, and bear at least half of all operating costs.

Similar to fish and wildlife enhancement costs, absent any specific authorizing legislation and/or cost sharing agreements with non-federal entities for recreation facilities, no joint construction costs are allocated to the recreation purpose on a CVP-wide basis for Period 2. Certain single-purpose recreation facility costs are allocated to the recreation purpose as separable costs, including the Federal share of non-reimbursable costs associated with Lake Woollomes recreation facilities and San Justo Reservoir recreation facilities. The remaining portion of these recreation costs are also direct assigned to State and local entities pursuant to cost-sharing agreements.

5.7.4 Navigation Purpose

There are no costs allocated to the navigation purpose in Period 2. Navigation was originally a CVP purpose in recognition of historical commerce on the Sacramento River, which was supported by a CVP-authorized minimum flow of 5,000 cubic feet per second (cfs) at Chico Landing. However, there is no navigation currently supported by the CVP. The USACE has not dredged the reach between Sacramento and Chico Landing to preserve channel depths for navigation purposes since 1972. Furthermore, the CVP has no effect on the navigation of ocean-going ships calling at the ports of West Sacramento and Stockton.

5.7.5 Water Quality Purpose

For the Period 2 allocation, Reclamation has determined that it is appropriate to allocate joint project costs to the water quality purpose. Water quality benefits are estimated using the value of irrigation water as the most cost-effective source of water to meet water quality requirements. Water quality SPA costs are estimated using CalSim 2 hydrology modeling to identify the quantity of water stored specifically to exceed D-1485 water quality standards.

The SWRCB is responsible for setting water quality standards which govern the operations of both the CVP and the SWP for the San Francisco Bay/Sacramento-San Joaquin Delta and Estuary. Under P.L. 99-546, both the CVP and SWP are authorized to operate in close coordination pursuant to a Delta cooperative operating agreement. The COA also authorized the CVP to be specifically operated to meet SWRCB's D-1485 water outflow standard. P.L. 99-546 states:

> The costs associated with providing Central Valley project water supplies for the purpose of salinity control and for complying with State water quality standards identified in exhibit A of the Agreement Between the United States of America and the Department of Water Resources of the State of California for the Coordinated Operations of the Central Valley Project and the State Water Project, dated May 20, 1985, shall be allocated among the project purposes and shall be reimbursed in accordance with existing Reclamation law and policy. The costs of providing water for salinity control and for complying with State water quality standards above those standards identified in the previous sentence shall be non-reimbursable.

CVP water supplies provide water quality benefits through increased river flows that help meet water quality standards. In terms of reimbursement of costs allocated to water quality, P.L. 99-546 directs that costs associated with providing CVP water supplies for salinity control and complying with State water quality standards (D-1485) are to be allocated among purposes and reimbursed according to Reclamation law and policy. Costs of exceeding D-1485 water quality standards are directed to be non-reimbursable. In 1999, the SWRCB adopted D-1641, amending certain water quality terms and conditions. Meeting D-1641 water quality standards requires exceeding the Delta outflow standards set by D-1485.

5.7.6 Flood Control Purpose

The CVP includes several dams and reservoirs authorized and constructed to meet multiple purposes, including flood control. There are facilities not authorized for flood control that do, in fact, provide flood protection, including Trinity Dam and Reservoir. Therefore, Trinity is included in the flood control analysis in the CAS, specifically the sizing of the flood control SPA. Flood control benefits are based on the value of flood damages prevented as estimated by the USACE. For SPA costs, reservoirs are re-sized for flood protection only based on hydrology analysis. All costs allocated to flood control are considered non-reimbursable.

5.7.7 Power Purpose

The power purpose in the CVP reflects hydropower generation at project facilities that are used for both commercial and project use purposes. Project use energy (PUE) is the power required to operate CVP facilities, such as pumping plants. Any power generated that is not used by the project is considered commercial power, which is marketed by WAPA.

The power purpose benefits are estimated using market prices. Power SPA costs are estimated based on a hypothetical thermal natural gas power plant, which is specifically authorized to serve the CVP. Separable costs assigned to power in the SCRB process are limited primarily to single-purpose power facilities.

Costs allocated to the power purpose are sub-allocated between commercial power and PUE proportionate to their respective projected use of CVP power. PUE costs are further sub-allocated among irrigation, M&I, and wildlife refuges proportionate to their projected water use (similar to the water supply sub-allocation, with exception of B2 water supplies). Costs allocated to commercial power are reimbursable from CVP power preference customers.

5.7.8 Fish and Wildlife Mitigation Purpose

P.L. 89-72, FWPRA, dated July 9, 1965, repealed the non-reimbursable provision for mitigation costs while maintaining only fish and wildlife enhancement costs as non-reimbursable. Consequently, fish and wildlife mitigation activities that were authorized and implemented between 1946 and 1965 are treated as non-reimbursable costs, and mitigation activities implemented after 1965 are considered reimbursable. Fish and wildlife mitigation activities have stipulations in legislation that also provide specific allocations, CVPIA being a clear example. Non-reimbursable fish and wildlife mitigation is different than fish and wildlife enhancement, which is also a non-reimbursable cost.

5.8 Allocation of New Melones Unit Cost

The New Melones Unit was first authorized in 1944 to be constructed by the USACE and upon completion was transferred to Reclamation for integration into the CVP. Reclamation has been using the USACE cost allocation for the New Melones Unit (House Doc 453, March 22, 1962) since it became an integrated part of the CVP. The initial USACE allocation was based on significant recreation development that was never realized. Reclamation continued to incorporate the USACE cost allocation into CVP allocations after the inception of the New Melones Unit.

Reclamation determined that no legislative authorities preclude the modification of the USACE allocation for New Melones (or other facilities constructed by USACE). The transfer of facilities to Reclamation included transfer of responsibility to achieve operational and financial integration into the CVP. The CAS reallocates New Melones costs as part of the CAS.

5.9 Water Distribution Systems (Repayment Contracts)

Distribution of water from CVP conveyance facilities (i.e., canals) to the individual water users is the responsibility of the local districts, which use distribution systems comprised of lateral canals and pipelines to convey water to individual farms and municipalities. The costs included in the SCRB process are those costs associated with storage and conveyance of water, but not any distribution system costs beyond the contractor turnout. Water distribution system costs subject to Reclamation repayment contracts are assigned directly to the applicable contractors, rather than through the CAS process. Privately-financed distribution systems are not within the scope of the CAS.

5.10 Safety of Dams Costs

Several dams in the CVP have been modified since their construction for seismic, security, and potential failure risks under Reclamation's Safety of Dams program. These include Folsom Dam and Reservoir, Little Panoche Creek Detention Dam, Los Banos Creek Detention Dam and Reservoir, and O'Neill Dam Forebay and Waterway. SOD legislation stipulates that 15 percent of SOD costs are to be reimbursed by water and power users and the remaining 85 percent of costs are non-reimbursable. With the exception of recent SOD activities at Folsom Dam that are not in repayment

(and not allocated in the CAS), all existing SOD-related costs are treated as direct assigned costs, and thereby excluded from the SCRB analysis. Reimbursable SOD costs are assigned to the reimbursable purposes according to Reclamation policy and practice described below.

On April 17, 2007, the Mid-Pacific Region of Reclamation requested approval from Reclamation's Office of Program and Policy Services to utilize the CVP Irrigation and M&I Ratesetting Policies to repay these SOD costs assigned to water contractors. Under the ratesetting policy, reimbursable SOD costs are collected as storage from all CVP water contractors with the exception of Class 2 water contractors in the Friant Division. In keeping with the spirit of a repayment contract, the split of repayment responsibility between water supply and commercial power remains static, while the split between irrigation and M&I varies annually depending on actual water use. Approval to use the ratesetting policy was granted September 21, 2007.

5.11 Mitigation Costs

Mitigation is broadly defined as project-related activities to avoid, minimize, or compensate for the adverse effects of project construction and operations on affected resources (i.e., environmental, archeological, or cultural). Within the CVP, mitigation costs are commonly associated with two types of activities:

- **ESA-Related RPA Mandates**. CVP facility costs associated with reservoir releases to augment fish flows mandated by the National Marine Fisheries Service (NFMS) of the National Oceanic and Atmospheric Administration (NOAA) and RPAs in the BOs prepared by the USFWS.
- **Non-CVPIA Facilities**. Other fish and wildlife facility costs not authorized under CVPIA. Refer to the CAS Facility List Attachment for additional details.

5.11.1 Reimbursement of Mitigation Costs

For consistency with Reclamation practice, policy, and law, mitigation costs in the CAS are treated as joint costs and allocated to all project purposes unless specified in specific legislation. The burden for operating the project is shared project-wide and not solely by the reimbursable purposes.

5.12 Central Valley Project Improvement Act Costs

As a separate program, CVPIA also mitigates for impacts to fish and wildlife resources from the CVP. Mitigation under CVPIA is distinct from general mitigation costs referenced in Section 5.11 in that the activities are specifically authorized under CVPIA and have specific cost recovery assignments. There are different types of costs associated with the implementation of CVPIA. First, there are plant-in-service CVPIA facilities shown in Schedule No. 1 of the CVP financial statements. There are also CVPIA O&M costs that are recovered in part by payments to the CVPIA Restoration Fund. Finally, there are costs of CVP facilities (both construction and O&M) that get assigned to CVPIA activities that are recovered through the CVP water ratesetting process. The treatment of

CVPIA costs are described in Reclamation's Business Practice Guidelines for CVPIA Receipts, Program Accounting, Cost Allocation, and Cost Recovery (BPG).

5.12.1 CVP Facility Costs Assigned to CVPIA

The portion of the cost of CVP facilities that is required to store and convey CVP water to meet CVPIA requirements is sub-allocated as part of the water supply purpose.[16] The water supply sub-allocation assigns costs to the refuge water supplies outlined in section 3406(d)(1) of the CVPIA and the mitigation water supplies referenced in section 3406(b)(2) of the CVPIA.

CVPIA Section 3406(d)(1) Wildlife Refuge (also referred to as Refuge Water Supply): Section 3406(d) of the CVPIA requires Reclamation to provide CVP water to meet Level 2 water demands and to obtain water supplies to meet Incremental Level 4 water demands for optimal waterfowl habitat management needs at identified wildlife refuges managed by the USFWS (Reclamation 1989). Water supply costs associated with storage and delivery of Level 2 water supplies are assigned to Level 2 as part of the water supply sub-allocation and are considered reimbursable by water and power users exclusively.

Incremental Level 4 water costs are associated with water acquisition independent from CVP water supplies. Although Incremental Level 4 refuge supplies are purchased from non-CVP sources, Incremental Level 4 refuge water supply costs associated with CVP conveyance facilities are captured as part of the water supply sub-allocation process and are considered non-reimbursable, and they are allocated 75 percent to Federal government and 25 percent to the State of California.

O&M costs of conveying both Level 2 and Incremental Level 4 water supplies are recovered independently as part of the CVPIA program. However, a portion of the construction costs of CVP conveyance facilities is also sub-allocated to refuges (both Level 2 and Incremental Level 4) as part of the water supply sub-allocation process and collected through water rates.

CVPIA Section 3406(b)(2) Water Supplies (also referred to as B2 Water Supply): The sub-allocation of water supply costs includes the B2 sub-purpose, which is considered reimbursable. More information on the treatment of B2 costs is presented in Chapter 10, *Cost Allocation Results (Period 2)*. Section 3406(b)(2) provides for the dedication and management of 800,000 acre-feet (AF) of CVP yield to be used for the "primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by [CVPIA] (also referred to as B2 water supplies); to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to help meet such obligations as may be legally imposed upon the CVP under State or Federal law…including but not limited to additional obligations under the Federal ESA."

[16] The sub-allocation of PUE costs also includes an allocation to the refuge water supply sub-purpose, but not B2 water supply.

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Chapter 6. Hydrological Modeling

This chapter briefly describes the hydrological modeling analyses and results developed to support the CAS. See the *Hydrological Modeling Appendix* for more detailed description of tools, assumptions, and data used for the CVP CAS. The CAS relies on hydrological modeling for two main purposes: (1) the development of hydrological inputs used to estimate the economic benefits presented in Chapter 7, *Economic Benefits,* and (2) the development of multipurpose facility SPA sizes discussed further in Chapter 8, *Single-Purpose Alternatives*. In addition, hydrological modeling was considered to estimate separable costs for multipurpose facilities ("omitted purpose analysis") and it was determined that no re-sizing was necessary. The primary hydrological model used to support the CAS is CalSim 2, which models CVP reservoir storage and conveyance deliveries under a range of hydrological and regulatory conditions. An overview of the hydrological modeling and results for the water supply, water quality, hydropower, and flood control purpose are provided below. In addition, sizing multipurpose storage facilities to meet CVPIA is described, followed by a brief description of a hydrology sensitivity analysis.

6.1 Overview of the Hydrological Modeling

Hydrological model applications used in the CAS analysis include CalSim 2, Flow Tracker, and the Single Purpose Facility Sizing Model (Sizing Model). CalSim 2 is a reservoir-river simulation model developed by the California Department of Water Resources (DWR) and Reclamation commonly used for long-term water supply reliability planning.

The Flow Tracker model was developed to identify SWP storage releases made specifically for Delta outflow as input to the Sizing Model. Additional analysis included post-processing of CalSim 2 results and evaluation of CVPIA records. A spreadsheet post-processor for CalSim 2 results refined the model's representation of drought year allocation decisions to ensure that delivery results reflect recent operations. An evaluation was made of CVPIA 3406(b)(2) accounting records to determine the use of storage to accomplish the goals of this program.

The CAS analysis uses CalSim 2 to estimate project deliveries and flows under a range of regulatory environments[17]. CalSim 2 results are used as the basis for economic benefits of water supply, water quality, flood control, and hydropower as well as in the SPA sizing analyses. Flood control benefit and hydropower SPA facility sizing analyses do not directly use CalSim 2 output.

[17] CalSim 2 modeling incorporated the regulatory environment as of 2013 and is based on an historic 82-year hydrological record (1922–2003). The model has various constraints, including contract maximums, which are used as an upper bound for water deliveries. CalSim 2 estimates deliveries in consideration of the constraints, regulations, available water supply, and other factors explained in the *Hydrological Modeling Appendix*.

6.2 Water Supply Purpose

CalSim 2 input criteria is used to quantify the deliveries that define the water supply purpose and to determine the water supply SPA storage facility sizes for the major CVP reservoirs. Estimated deliveries are summarized by water year type for irrigation, M&I, and wildlife refuges (Level 2) in Table 6-1. Note that these deliveries are summarized from the post-processed CalSim 2 delivery results, which differ from the water deliveries used as input to the economic models (see the *Economic Benefits Analysis Appendix* for more details). Table 6-2 displays the full size and water supply SPA size for the five multipurpose CVP reservoirs that serve the water supply purpose – Friant, New Melones, Trinity, Shasta, and Folsom. Reservoir sizes are measured in thousand acre-feet (TAF). Note that water supply SPA sizes displayed here include volumes associated with CVPIA B2 management actions. Volumes associated with CVPIA B2 management actions are estimated separately, discussed below, and included in the CVP reservoir sizes used in cost estimates (see Chapter 8, *Single-Purpose Alternatives*).

Table 6-1. Estimated Annual Water Supply Deliveries by Water Year Type (TAF)

Delivery Type	Wet	Above Normal	Below Normal	Dry	Critical
Irrigation	6,118	5,603	4,946	4,353	3,121
M&I	606	606	506	447	357
Level 2 Refuge	369	369	369	362	291

Table 6-2. Water Supply SPA Storage Facility Sizing (TAF)

CVP Reservoirs	Full Size	SPA Size (without CVPIA B2)[1]	SPA Size (CVPIA B2)	Total SPA Size
Trinity	2,447	709	24	733
Shasta	4,552	1,391	44	1,435
Folsom	967	181	10	191
New Melones	2,420	640	2	642
Friant	524	476	0	476

1. Includes dead pool storage requirements

6.3 Water Quality Purpose

Water quality responsibilities of the CVP are expressed both by salinity standards, which are met by flow, and by flow requirements that can be surrogates for temperature or dissolved oxygen. Under the complex combined operations of the CVP and SWP, water that is provided to meet a water quality standard at one location can also be used to satisfy a delivery or water quality standard at another location. It can thus be difficult to discern a specific operation for incremental water quality. Quantifying the differences between CVP operations to meet D-1485 and D-1641, and determining the storage necessary to accomplish this, were the goals of the hydrology analysis for the water quality purpose. Separate CalSim 2 studies were developed to represent system operations under both D-1641 and D-1485. A comparison of results between these scenarios shows differences in river flows, Delta outflow, deliveries, exports, and storage conditions, particularly in the Sacramento River basin. The differences in deliveries between these studies reflect the water deliveries that are foregone in order to meet the higher water quality standards of D-1641. These foregone deliveries were used as inputs to economic benefits models to calculate the representation of economic benefit for the water quality purpose. Table 6-3 displays estimated annual delta outflows and foregone irrigation, M&I, and refuge water deliveries by water year type.

Table 6-3. D-1641 Estimated Annual Water Requirements by Source and Water Year Type (TAF)

Parameter	Wet	Above Normal	Below Normal	Dry	Critical
Delta Outflows[1,2]	0	0	206	338	449
Foregone Irrigation Deliveries	34	114	167	118	171
Foregone M&I Deliveries	2	5	7	4	10
Total	**36**	**119**	**380**	**460**	**630**

1. Represents CVP portion of Delta outflow requirement
2. CalSim 2 modeling shows that estimated Delta outflow requirements in wet and above normal years are negative; these values have been adjusted to zero.

Table 6-4 shows the storage facility Sizing Model results for the SPA for water quality. New Melones does not appear in Table 6-4 because the difference in SPA is negligible. New Melones does meet water quality standards at Vernalis and dissolved oxygen standards at Ripon, but overall differences in the combinations of criteria between D-1485 and D-1641 resulted in the reservoir needing to be the same size under both regulatory environments. Friant does not serve a water quality purpose.

Table 6-4. SPA Storage Size Results for the Water Quality Purpose (TAF)

CVP Reservoir	Full Size	D-1485 with Current Deliveries	D-1641 with Current Deliveries	Difference = SPA storage size for water quality	Minimum Storage (Deadpool)	Total SPA Size[1]
Trinity	2,447	1,793	1,905	112	240	353
Shasta	4,552	3,361	3,567	206	550	756
Folsom	967	718	757	39	90	129

1. Includes storage requirements for CVPIA B2 water quality objectives

6.4 Hydropower Purpose

Estimated energy generation in the CVP system is the basis of the hydropower economic benefit analysis and thermal plant SPA sizing for the hydropower purpose (see Section 8.5 for details on the thermal plant SPA). The long-term generation (LTGEN) model (developed by Reclamation and WAPA) converted monthly data of reservoir releases from the CalSim 2 hydrology model to estimate hourly CVP power generation available to meet preference power and project use requirements. The LTGEN model estimated monthly power generation and use in megawatt hours (MWh) for each CVP power facility based on CalSim 2 modeling.

CalSim 2 delivery and release data is used as an input for the LTGEN model to estimate the annual amount of energy that would be produced by CVP power facilities for the 100-year period of analysis. Table 6-5 displays the CVP system estimated annual energy generation and consumption by water year type.

Table 6-5. Estimated Annual Power Generation and Consumption by Water Year Type (GWh)

Power Component	Wet	Above Normal	Below Normal	Dry	Critical
Energy Generation	6,463	5,211	4,226	3,909	3,024
Energy Use	1,417	1,216	1,126	1,017	694
Net Generation	5,046	3,995	3,100	2,891	2,330

6.5 Flood Control Purpose

CalSim 2 output is used to develop SPA storage facility sizing for the flood control purpose. The CVP storage facilities which operate for flood control are Trinity, Shasta, Folsom, New Melones,

and Friant (Millerton). All of these facilities except for Trinity include flood control in their authorizing legislation. The flood control rule method is used for determining the SPA sizes of a reservoir, which involves selecting the largest value for required flood space in a reservoir from the historical flood control diagrams and adding this to the dead pool space. Table 6-6 provides a summary of sizing results produced by this method.

Table 6-6. SPA Storage Size Results for the Flood Control Purpose (TAF)

CVP Reservoir	Minimum Flood Control Rule	Storage Capacity	Flood Space Required	Minimum Storage (Dead Pool)	Flood Control SPA Size
Shasta	3,250	4,552	1,302	550	1,852
Folsom	367	967	670	90	690
New Melones	1,970	2,420	450	80	530
Millerton	351	524	174	135	309

Trinity has a unique flood control mandate relative to the other four facilities since flood control is not an explicitly authorized purpose. Instead the dam operates to protect downstream assets under the Trinity River Mainstem Fishery Restoration ROD. Due to the unique nature of the flood control mandate for Trinity, a daily hydrology model analysis is used to determine the flood control SPA for Trinity of 578 TAF.

6.6 Sizing Multipurpose Storage Facilities to Meet B2 Objectives

CVPIA Section 3406(b)(2), or B2, dedicates an annual portion of project yield for the "primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by this title; to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to help meet such obligations as may be legally imposed upon the Central Valley Project under State or Federal law following the date of enactment of this title, including but not limited to additional obligations under the Federal Endangered Species Act."

Reclamation records of annual B2 accounting specify how much B2 water is ultimately used by purpose, although water that is ultimately exported is not included in the accounting. Existing analysis identified the water storage requirements specifically for B2 to be 208 TAF, excluding B2 water that is ultimately exported as irrigation or M&I water. This figure can be broken into three pieces: B2 actions attributed to the water supply purpose (79 TAF); B2 for RPA mitigation (69 TAF); and B2 for water quality (60 TAF) (see the *Hydrological Modeling Appendix*).

The CAS considers the storage cost of producing CVPIA instream flow actions and of exports that are foregone due to CVPIA Delta actions. Due to the continuous and evolving nature of CVPIA

accounting methodologies, it has not been possible to include a consistent long-term plan for B2 actions in the CalSim 2 model. Consequently, daily accounting records detailing historical storage releases and export reductions used for actions from 2008 to 2014 were analyzed.

The required storage for B2 water supply actions is calculated as the 2008-2014 average annual total of the volume of releases designated to have been made for B2 actions during excess conditions and the average annual volume of exports reduced for B2 actions during balanced conditions. This average annual volume is distributed among the storage facilities based on proportional B2 releases from each reservoir (instream release element) and distribution of north-of-Delta CVP reservoir sizes (export reduction element). Table 6-7 displays the estimated storage reserves used to meet B2 action management for Trinity, Shasta, Folsom, and New Melones storage facilities.

Table 6-7. Estimated Average Annual Storage Requirements Used to Meet B2 Water Supply Objectives (TAF)

B2 Objective	Trinity	Shasta	Folsom	New Melones	Total
B2 – Water Supply	24.1	43.7	9.6	1.6	79.0

6.7 Hydrology Sensitivity Analysis

The CAS relies on recent information from the Sacramento and San Joaquin Rivers Basin Study (SSJRBS) to assess the potential differences in water supply availability that might occur between a no-climate-change scenario and various other future climate change projections (see the Hydrology Sensitivity Analysis Attachment to the *Hydrological Modeling Appendix* for more details).

The SSJRBS modeling generated a substantial amount of quantitative information, some of which is used for this CAS assessment. The assessment is composed of specific statistical tests, which describe how the hydrology may differ under various climate projections (i.e., warm-dry, hot-dry, hot-wet, warm-wet, and central tendency). One statistical test compared the hydrologic inflows into the Sacramento and San Joaquin Valleys under a no-climate-change scenario to the inflows under a range of future climate projections by annual total and monthly distribution, and in groups of average annual totals by water year type. Another test compared CVP water deliveries under a no-climate-change scenario to CVP deliveries under a range of future climate projections. The results of the statistical assessment were used to qualitatively characterize potential climate change effects on CVP benefits and SPAs estimated for the CAS.

Since the central tendency projection includes a relatively large ensemble of 175 different projections, it is believed that it provides a reasonable and appropriate reference point to compare its associated inflows/deliveries to those associated with the no-climate-change projection. The results of the tests indicate that the inflows into the Sacramento and San Joaquin Valleys associated with the no-climate-change scenario and the inflows associated with the central tendency climate projection are not significantly different. Similarly, no significant difference was found between the

no-climate-change and central tendency projections in terms of total CVP deliveries. The results of the climate change statistical tests indicate, in terms of inflows and deliveries, the hydrology used in the CAS was reasonable and appropriate and by extension, that the estimate of benefits and SPA sizing of storage facilities was reasonable. See the Hydrology Sensitivity Analysis Attachment to the *Hydrological Modeling Appendix* for more details.

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Chapter 7. Economic Benefits

This chapter presents the results of the economic benefit analyses prepared for the CAS. The economic benefits for each authorized purpose are used to evaluate the justifiable expenditure for each authorized purpose in the SCRB analysis. The justifiable expenditure for each authorized purpose is the lesser of the SPA cost (presented in Chapter 9, *Cost Estimates)* and the economic benefits of the authorized purpose described in this chapter. Detailed documentation of the economic benefit analyses prepared for the CAS is presented in the *Economic Benefits Analysis Appendix*.

7.1 Overview of the Economic Benefits Analyses

The economic valuation approach for the CVP CAS is consistent with the *Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G) (WRC 1983). The P&G indicate the Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

CVP CAS economic benefits are estimated for the four purposes that generate benefits and meet cost-sharing requirements: water supply, water quality, flood control, and power. Water supply benefits are attributed to two water supply sub-purposes, irrigation and M&I. Water quality benefits are based on the water supply required to meet water quality standards. Flood control benefits are based on the avoided flood damages provided by CVP facilities. Power benefits are based primarily on the market value of power produced by CVP hydropower generation facilities, in conjunction with ancillary service and capacity benefits.

7.2 Economic Analysis Parameters

The economic benefits presented in this chapter are based on analysis of operations of the CVP over a 100-year period. The operational conditions assumed over the 100-year period are designed to be representative of the benefits and authorized purposes under current regulatory conditions. The methodology used to estimate economic benefits has the following common elements, except where noted:

- Hydrology outputs from the CalSim 2 model presented in the *Hydrological Modeling Appendix* are used as inputs for the economics models, with the exception of flood control which are based on damages avoided as estimated by the USACE.
- All benefit values are presented in 2013 dollars.
- The annual economic benefits attributed to each project purpose are estimated for each water year type. A representative annual benefit is developed for each project purpose by calculating

the weighted average of benefits based on the distribution of water year types in the hydrologic record.

- The total benefit estimated for each project purpose in the SCRB reflects the present value of the representative annual benefit received each year over a 100-year period using a discount rate of 3.25 percent.
- The benefits estimated for each water-year type are based on the 82-year hydrological record (1922 – 2003) in CalSim 2. Subsequent to model runs and prior to completion of the CAS, additional water-year type data through 2013 became available. Reclamation, in coordination with CAS stakeholders agreed to include the water years 2004 – 2013 for the sole purpose of computing water-year type weights. The different water-year types are weighted based on the relative distribution in the hydrologic record extended through 2013. Water year classifications are based on the SWRCB Sacramento Valley index. The weights across the five water-year types are:
    - Wet (30.4 percent)
    - Above Normal (14.1 percent)
    - Below Normal (18.5 percent)
    - Dry (22.8 percent)
    - Critical (14.1 percent)

7.3 Irrigation Water Supply Benefits

This section presents a summary of the methodology and results of the analysis used to estimate economic benefits attributed to CVP irrigation water supplies. More detailed information about the irrigation benefit analysis is in the *Economic Benefit Analysis Appendix* to this report.

7.3.1 Irrigation Benefits – Methodology

Irrigation water supply benefits are based on the change in net farm income that results from the application of CVP water to irrigate crops. The Irrigation water supply benefits are quantified using the Statewide Agricultural Production (SWAP) model and irrigation water delivery data developed with the CalSim 2 hydrological model (see Chapter 6, *Hydrological Modeling*). The SWAP model is a regional agricultural production and economic optimization model used to simulate the decisions of farmers across agricultural land in California. The SWAP model has been used to estimate CVP irrigation benefits for numerous Reclamation and DWR studies. The SWAP model assumes growers select the level of inputs such as cropping acreages, labor, and water use to maximize profit subject to resource, market, and technology constraints. The SWAP model used for the CAS was calibrated to observed cropping patterns and land use data (year 2010 data).

7.3.2 Irrigation Benefits – Results

The economic benefits associated with CVP irrigation water supplies are estimated as the additional profit realized by farmers across SWAP regions from applying CVP water supplies. Irrigation

benefits are comprised of four components: net farm income (excluding water and land fallowing costs), avoided surface water costs, avoided groundwater pumping costs,[18] and avoided land fallowing costs. Table 7-1 displays estimated irrigation benefits attributed to the CVP. The greatest benefits occur in wet years ($877.2 million annually) based on the relatively high quantity of CVP surface water that is delivered while the lowest benefits occur in critical years ($176.9 million annually).

Table 7-1. Estimated Annual Economic Benefits of CVP Irrigation Water Supplies, by Water Year Type ($millions)

Benefit	Wet	Above Normal	Below Normal	Dry	Critical	Weighted Average
Irrigation	$877.2	$642.3	$485.7	$316.6	$176.9	**$544.7**

The weighted average annual irrigation benefit ($544.7 million) is capitalized over the 100-year period of analysis using a 3.25 percent interest rate. The present value of estimated CVP irrigation benefits is approximately $16.1 billion.

7.4 Municipal & Industrial Water Supply Benefits

The economic benefits associated with CVP M&I water are estimated as the avoided costs associated with CVP M&I surface water deliveries. Additional information about the M&I benefit analysis is presented in the *Economic Benefit Analysis Appendix* to this report.

7.4.1 M&I Benefits – Methodology

M&I water supply benefits are estimated as the avoided costs of water supply reliability with-CVP in place relative to costs without-CVP in place. M&I benefits are estimated using two economic planning models widely used in California. The Least Cost Planning Simulation Model (LCPSIM) and the Other Municipal Water Economics Model (OMWEM) are used to estimate CVP M&I benefits with water delivery data developed with the CalSim 2 hydrological model (see Chapter 6, *Hydrological Modeling*). The LCPSIM is used to estimate M&I benefits in the San Francisco Bay Area and OMWEM is used to estimate benefits to CVP contractors outside the San Francisco Bay Area. A small portion of CVP M&I contractors' benefits are estimated using output from OMWEM and are not modeled directly in OMWEM or LCPSIM. The results from each model are combined for estimating total benefit by creating a weighted average based on acre-foot deliveries to customers in each area.

[18] The irrigation benefits presented in this study do not account for projected groundwater conditions anticipated under the Sustainable Groundwater Management Act (SGMA) enacted in 2014. Implementation of SGMA over the period of analysis will likely increase the value of irrigation benefits in the CVP; however, additional irrigation benefits will not affect the results of the cost allocation as the water supply SPA costs represent the justifiable expenditure for that authorized purpose in the SCRB analysis.

LCPSIM and OMWEM models are annual time-step urban water service system simulation and optimization models with the objective of finding the least-cost water management strategy for a region, given the mix of demands and available supplies. The models estimated benefits based on the least-cost water management strategy for a region using the most likely non-Federal options that would be implemented in the absence of the CVP. The two models have been used to estimate CVP M&I benefits for numerous Reclamation and DWR studies and were selected because of the need to estimate system-wide benefits rather than benefits at the margin of the California water market.

The models use contract delivery data (modeled in CalSim 2), local water supply information, and imported water information (if applicable) to simulate the decision-making needed to meet 2030 water demand levels at the lowest economic cost. The models include shortage management measures (e.g., use of regional carryover storage, water market transfers, and contingency conservation) and shortage allocation rules to reduce regional costs and losses associated with shortage events. The models also include long-term regional demand reduction and supply augmentation measures (e.g., toilet retrofit programs and wastewater recycling) that reduce the frequency, magnitude, and duration of shortage events.

7.4.2 M&I Benefits – Results

Table 7-2 presents CVP M&I benefits by water year type. The benefits represent the avoided costs of water supply reliability with-CVP in place relative to costs without-CVP in place. The M&I water supply benefit is estimated to be approximately $220 million. The total benefit is estimated as the weighted average of expected costs with-CVP, minus weighted average expected costs without-CVP ($207.6 million), plus the total benefits of other CVP M&I contractors not included in OMWEM or LCPSIM ($12.4 million).

Table 7-2. Estimated Annual Economic Benefits of CVP M&I Water Supplies, by Water Year Type ($millions)

Benefit	Wet	Above Normal	Below Normal	Dry	Critical	Weighted Average
CVP M&I Benefits Estimated with LCPSIM and OMWEM	$213.2	$201.2	$190.6	$223.1	$198.9	$207.6
CVP M&I Benefits for Other CVP Contractors						$12.4
Total						**$220.0**

The weighted average value of M&I benefits is estimated to be $220 million annually. The present value of CVP M&I benefits is approximately $6.5 billion based on a project life of 100 years and a discount rate of 3.25 percent.

7.5 Water Quality Benefits

This section presents a summary of the methodology and results of the analysis used to estimate the economic benefits attributed to water quality provided by the CVP. Additional information about the water quality benefit analysis is presented in the *Economic Benefit Analysis Appendix* to this report.

7.5.1 Water Quality Benefits – Methodology

Water quality benefits for the CAS are based on the foregone value of the next best use of the water used to meet water quality standards. CVP water quality benefits are based on the irrigation value of water which is estimated using the SWAP model. Water Quality benefits are quantified using the SWAP model and foregone water delivery data developed with the CalSim 2 hydrologic model (see Chapter 6, *Hydrological Modeling*).

The fundamental premise of the water quality benefit analysis is that all CVP water required to meet incremental D-1641 water quality (above D-1485 requirements, also referred to as incremental difference) requirements must be valued, including foregone irrigation and M&I/refuge deliveries and Delta outflows. As shown in Chapter 6, *Hydrological Modeling* (Table 6-3), this quantity ranges from a low of 36 TAF in wet years to nearly 630 TAF in critical years, averaging 172 TAF across all water years.

7.5.2 Water Quality Benefits – Results

The water quality benefits for the CVP are based on SWAP modeling, which provided a proxy value for water quality benefits using agricultural values. The benefits reported by SWAP are calculated based on changes in net farm income, surface water and groundwater costs, and land fallowing costs.

Table 7-3 displays estimated water quality benefits attributed to the CVP. Water quality benefits are estimated to be $49.4 million annually, on average. The greatest benefits occur in critical years ($103.3 million annually) based on the relatively large quantity of CVP water that is needed to meet incremental D-1641 water quality standards. Conversely, the lowest benefits occur in wet years ($7.0 million annually).

Table 7-3. Estimated Annual Economic Benefits of CVP Water Quality, by Water Year Type ($millions)

Benefit	Wet	Above Normal	Below Normal	Dry	Critical	Weighted Average
Water Quality	$7.0	$21.4	$60.7	$80.6	$103.3	**$49.4**

For the CAS, annual water quality benefits are discounted over the 100-year period of analysis using a 3.25 percent interest rate. The present value of estimated CVP water quality benefits is estimated to be approximately $1.5 billion.

7.6 Flood Control Benefits

The CVP is composed of several dams and reservoirs that are authorized and constructed to meet multiple purposes, including flood control. Flood control benefits are estimated for Shasta, Folsom, New Melones, and Friant CVP dams/reservoirs.

There are several other CVP facilities that provide flood control benefits which have not been quantified for the CAS. These facilities include Trinity Dam and Reservoir, Los Banos Creek Detention Dam, and Whiskeytown Dam and Reservoir. Although these facilities provide flood control benefits, they have not been quantified due to lack of available data. As such, the benefits provided in this paper represent a lower bound of flood control benefits provided by the CVP.

The omission of flood control benefits at these facilities does not affect the cost allocation because the flood control SPA (and not benefits) represents the justifiable expenditure for flood control in the SCRB calculations. Additional information about the flood control benefit analysis is presented in the *Economic Benefit Analysis Appendix* to this report.

7.6.1 Flood Control Benefits – Methodology

The flood control benefit estimates are made for Shasta Dam and Reservoir, Folsom Dam and Reservoir, the New Melones Dam and Reservoir, and Friant Dam and Reservoir using historical annual damages-prevented information provided by the USACE, Sacramento District. The USACE calculates annual damages prevented by comparing downstream river stages at selected sites under regulated flow conditions and unregulated flow conditions. The river stages under each condition are then compared to a stage-damage curve which describes the amount of damages that could be expected based on a range of river stages representing high exceedance probability to low exceedance probability flow events. The lower amount of damages under the with-project condition as compared to the without-project condition reflects the positive effects of reservoir operations on downstream flows and are considered to be the damages prevented (benefits). The USACE dataset on flood control benefits used for this report covers historical conditions through the year 2010. The estimates of nominal flood control benefits are updated to October 2013 price levels using the Gross Domestic Product (GDP) Implicit Price Deflator.

7.6.2 Flood Control Benefits – Results

The total damages prevented are divided by the number of years of record, by facility, to derive an average annual damages-prevented value. For example, the total damages prevented for Shasta Dam and Reservoir over the entire period of record for that reservoir (1952 to 2010) were approximately $29.0 billion (2013 dollars). This value is then divided by 59 (the number of years in the period of record for Shasta Dam) to derive an average annual value for prevented flood damages of approximately $491.5 million (note that the period of record for each dam and reservoir varies). Table 7-4 displays the average annual flood control damages-prevented values for each dam/reservoir. Total flood control benefits are estimated to be nearly $1.3 billion annually, on average.

Table 7-4. Estimated Annual Economic Benefits of CVP Flood Control, ($millions)

CVP Reservoir	Benefits (Annual)
Shasta	$491.5
Folsom	$761.2
New Melones	$15.9
Friant (Millerton)	$18.8
Total	**$1,287.3**

For the CAS, annual flood control benefits are discounted over the 100-year period of analysis using a 3.25 percent interest rate. The present value of estimated CVP flood control benefits is approximately $38.0 billion. As noted above, the estimated benefits represent a lower bound of flood control benefits provided by the CVP.

7.7 Power Benefits

This section summarizes the results, and the analytical method used to estimate the economic benefits attributable to CVP hydropower generation. Treatment of the San Luis pump-generating unit in relation to hydropower and water supply benefits is also discussed. Power benefits are estimated based on the actual or simulated market prices associated with CVP hydropower services. Additional information about the power benefit analysis is presented in the *Economic Benefit Analysis Appendix* to this report.

7.7.1 Power Benefits – Methodology

Hydropower benefits are estimated in consultation with WAPA. The value of power benefits evaluated for the CAS is composed of the following three elements: (1) forecasted California Independent System Operator (CAISO) hourly day-ahead market prices for energy from PLEXOS model, (2) forecasted CAISO hourly day-ahead market prices for ancillary services from PLEXOS model, and (3) planning capacity/resource adequacy to meet expected future demand/load growth considerations by applying CAISO market prices for resource adequacy to the estimated capacity provided by the CVP resource. CVP energy generation is estimated using output from CalSim 2 and LTGEN models (see Chapter 6, *Hydrological Modeling,* for more details), and inputs into the PLEXOS model used a forecasted database used by the California Public Utilities Commission for energy resource planning (see the *Economic Benefits Analysis Appendix* for more details).

Energy, ancillary services, and planning capacity/resource adequacy components of estimated annual CVP hydropower benefits are described below:

- **Energy** – Electricity generation that is scheduled to be provided when it is most valuable, if possible.
- **Ancillary Services** – For the purposes of the CVP CAS, only include spinning, non-spinning, and replacement reserves used in estimating power benefits. Other ancillary services as defined by Western Electricity Coordinating Council/North American Electric Reliability Corporation operating criteria are not included for consistency with the services under contract to CVP Power Preference Customers.
- **Capacity/Resource Adequacy** – Amount of electric power for which a generating unit, generating station, or other electrical apparatus is rated either by the user or manufacturer. Capacity is valuable because of the need for sufficient machine capability to meet the peak electrical load hour during the hottest summer day. Resource Adequacy is a mandatory planning and procurement process to ensure resources are secured by Load Serving Entities to meet the ISO's forecast system, local, and flexible capacity needs.

The PLEXOS Model is used to estimate energy and ancillary service benefits. The PLEXOS model was selected for use in the CVP CAS based on a variety of factors including (but not limited to) its relative ability to accurately simulate different future scenarios given specific constraints, as well as its widespread usage in the power industry. It simulates power markets by optimizing energy, ancillary services, generation, and transmission utilization subject to physical and operational constraints. Two simulations were run to determine CVP power benefits. The first covered the entire Western Electricity Coordinating Council's (WECC) system to generate projected pricing and ancillary services data, including CVP facilities. A subsequent simulation optimized the dispatch of the CVP facilities using the projected pricing and ancillary services data generated in the first simulation. The simulated generation data is a 2024 baseline year used to calculate annual benefits across the period of analysis used in the study. The PLEXOS model used output data from LTGEN (i.e. total monthly generation) as inputs that were incorporated into the simulation to estimate benefits. Please refer to the *Economic Benefits Analysis Appendix* for a more detailed description of the model and reasons for its usage to estimate economic benefits for the CVP CAS.

Capacity/resource adequacy is estimated outside of the PLEXOS model. Although WAPA only markets two non-firm variable products, energy and ancillary services, some of WAPA's customers claim their CVP allocation for capacity purposes, thus avoiding certain CAISO costs related to short-term operational requirements to ensure grid reliability. These grid reliability requirements are referred to as resource adequacy. Using the CAISO market value for resource adequacy is considered to be representative of the actual value that WAPA preference power customers realize when claiming CVP capacity benefits. A CAISO market-based price for resource adequacy is used as a proxy for that value now and for the foreseeable future, since its value is calibrated to the amount of capacity present in the existing and predicted future system.

7.7.1.1 LTGEN and PLEXOS Adjustments for Flood Bypass

After the PLEXOS CVP benefit simulation was completed, it was determined that the version of the LTGEN model used to develop inputs to the PLEXOS model overestimated generation when compared to the historical generation levels due to underestimation of generator flood bypasses. A methodology was developed to isolate the missed flood bypass from LTGEN to adjust the power

benefits estimated by PLEXOS. This post-process adjustment of LTGEN and PLEXOS results was performed for the energy component of the power benefits in the CAS. An analysis was performed to map the historical record to the respective CalSim 2 data input to LTGEN and the energy benefits were reduced by water year type. Further explanation of this analysis can be found in the *Economic Benefits Analysis Appendix*.

Table 7-5 displays the resulting energy benefits that include the post-process adjustment to the PLEXOS results that are informed by the LTGEN analysis.

7.7.1.2 Treatment of San Luis Unit Pump-Generating Unit

The San Luis Unit is part of both the Federal CVP and the California SWP. Authorized by the San Luis Act in June 1960 (Public Law 86-488), it is jointly operated by Reclamation and the DWR primarily for the purpose of water supply. Two features of the San Luis Unit are pump-generating ("pump-gen") plants – the O'Neill Pump-Generating Plant and the William R. Gianelli Pump-Generating Plant. These two facilities pump water into the O'Neill Forebay and San Luis Reservoir respectively, for off-stream storage. During water operations, water is either released for delivery from O'Neill Forebay into the Delta Mendota Canal or from San Luis Reservoir back through the pump-turbines of both facilities to generate reclaimed energy. The reclaimed energy helps offset part, but not all of the cost of pumping water into San Luis Reservoir.

Because the energy required to pump water into the reservoir is greater than the energy generated when the water is released for delivery, all of the energy generated by these pump-gen plants is considered to be an offset to the cost of pumping. Accordingly, the total cost of both pump-gen plants, as well as the value of the energy generated by them, was assigned to the water supply purpose. As a result, it was necessary to adjust (reduce) the energy power benefits modeled in PLEXOS by the value of generation produced by the pump-gen plants and add that value to the water supply benefits. This adjustment factor (0.975) was multiplied by the estimated annual energy generation benefits prior to calculating the discounted net present value over the planning horizon. The adjustment factor did not affect the benefits attributed to ancillary services or resource adequacy.

7.7.2 Power Benefits – Results

The estimated energy and ancillary service CVP power benefits are shown in Table 7-5, and estimated total hydropower benefits are shown in Table 7-6. As discussed above, the benefit values used in the CAS for the power purpose are the values of CVP energy generated without the San Luis Unit. The value of energy generated by the O'Neill and Gianelli pump-generating plants is subtracted from the estimated hydropower benefit and added to the estimated water supply benefit. The energy generation benefits reported in Table 7-5 are subject to the adjustment described in the previous section. In addition (shown in Table 7-6), the estimated capacity/resource adequacy value is added and total hydropower benefits (without San Luis Unit) and other benefits are estimated to be nearly $193.9 million annually.

Table 7-5. Estimated Annual CVP Hydropower Benefits, by Water Year Type ($millions)

Benefit Component	Wet	Above Normal	Below Normal	Dry	Critical	Weighted Average
Energy	$228.1	$201.5	$170.6	$155.1	$115.4	$181.1
Ancillary Services	$0.7	$0.5	$0.4	$0.4	$0.5	$0.5
Total	**$228.7**	**$202.1**	**$171.0**	**$155.5**	**$116.0**	**$181.6**

Table 7-6. Estimated Annual Total CVP Hydropower Benefits ($millions)

CVP Hydropower Energy and Ancillary Service Benefit (with San Luis Unit)	**$181.6**
Less: San Luis Unit Energy Benefit (Water Supply Cost Saving Benefit)	$4.5
CVP Hydropower Energy and Ancillary Service Benefit	**$177.1**
Plus: CVP Capacity (Resource Adequacy) Benefit	$16.8
Total Estimated Annual CVP Hydropower Benefit	**$193.9**

For the CAS, annual power benefits are discounted over the 100-year period of analysis using a 3.25 percent interest rate. The present value of CVP power benefits is approximately $5.7 billion.

7.8 Summary of Economic Benefits

For the CAS, all of the CVP economic benefits are based on a 100-year prospective analysis as discussed in more detail in Chapter 5, *Key Concepts and Assumptions*, of this report. All results are discounted to a present value in 2013 dollars using 3.25 percent interest rate. Table 7-7 displays the total benefits for each of the purposes analyzed. These values are used as inputs to the SCRB analysis presented in Chapter 10, *Cost Allocation Results (Period 2)*.

Table 7-7. Summary of Estimated Economic Benefits of the CVP (2013 Dollars) ($millions)

Type of Benefit (Purpose)	Average Annual Benefit	Present Value Benefit (100 Years)
Water Supply	**$769.2**	**$22,702.5**
Irrigation	$544.7	$16,076.1
M&I	$220.0	$6,492.7
San Luis Unit Pump-Gen	$4.5	$133.7
Water Quality	**$49.4**	**$1,457.6**
Flood Control	**$1,287.3**	**$37,992.2**
Hydropower	**$193.9**	**$5,723.6**

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Chapter 8. Single-Purpose Alternatives

This chapter presents an overview of the development of the single-purpose alternatives required for the SCRB analysis. The cost estimates associated with the SPAs are presented and described in Chapter 9, *Cost Estimates* (see Table 9-4). Additional facility-level information supporting the SPA cost analysis is presented in the *Cost Estimates Summary Table Appendix*.

8.1 Conceptual Approach to Single-Purpose Alternative Analyses

The SCRB analysis requires SPA costs for each authorized project purpose that will share in joint project costs. In the context of the CAS, these purposes are water supply, water quality, flood control, and power. The SPA cost is the cost of the most likely federally financed alternative that provides the same level of benefits to a particular purpose as the existing project. As explained in Chapter 4, *Cost Allocation Methodology*, the lesser of the economic benefits or SPA costs constitute the justifiable expenditure for each purpose in the SCRB process. The focus of this chapter is the methodology for development of the SPAs for the water supply, water quality, flood control, and power purposes. SPA cost estimates are not required for the recreation, fish and wildlife enhancement, and navigation purposes because they do not share in joint costs.

In order to formulate the SPA for each project purpose, existing CVP facilities were evaluated to determine if they were required to provide the benefits for that purpose, and if so, whether the facility would need to be modified for that purpose only. The exception to this process is the power SPA, which is based on a thermal power plant that provides power benefits equivalent to the existing project rather than existing CVP hydropower facilities. Once the features (and appropriate scale of features) are identified for each SPA, cost estimates are developed. The SPA cost for each respective purpose is the sum of construction, IDC, and OM&R[19] costs for all features that support that purpose (see Chapter 9, *Cost Estimates*).

8.1.1 Single-Purpose Facilities

The cost of each single-purpose facility is included in the respective SPA that it serves. For example, a single-purpose water supply canal is included in the water supply SPA only. Because single-purpose facilities do not support other purposes by definition, they do not need to be re-sized and are included at full scale in the applicable SPA. The individual single-purpose facilities included in each SPA are presented in the SPA descriptions below.

8.1.2 Multipurpose Facilities

Because multipurpose facilities serve more than one purpose, they had to be hypothetically re-sized, as necessary, to provide only the benefits of the specific purpose being evaluated. In other words, the SPA sizing analysis calculated operations for multipurpose facilities as if the one purpose being evaluated was its sole function. For the CAS, a small group of multipurpose facilities (primarily dams

[19] OM&R costs include "soft" costs that are attributable to the CVP as a whole rather than a specific project feature; soft costs were added to all SPAs.

and reservoirs) are re-sized for the water supply, water quality, and flood control SPAs using CalSim 2 hydrology modeling described in Chapter 6, *Hydrological Modeling,* and the *Hydrological Modeling Appendix* to this report.

Other multipurpose facilities were not re-sized for any given SPA. In other words, the full size (and cost) of the facility is required to provide the benefits for any given SPA. Other multipurpose facilities that could not be resized that are included as part of all SPAs include:

- Centralized Water & Power System Control
- Spring Creek Debris Dam and Reservoir
- CVP Radio Network
- Clear Creek Tunnel
- Telemetering Equipment
- Permanent Operating Facilities – Folsom
- Permanent Operating Facilities – Trinity
- Keswick-Carr Microwave System
- Radio Stream Gauges
- Permanent Operating Facilities – Shasta
- Whiskeytown Dam & Reservoir
- Radio Rain Gauges

8.1.3 Mitigation

In addition, some facilities (or portions of facilities) in the CVP are considered mitigation costs. In theory, mitigation activities are addressing adverse impacts of the CVP as a whole so it is not appropriate to assign mitigation to any single purpose. Instead, for the purpose of estimating SPA costs, mitigation costs are included, in total, as part of each SPA. Mitigation activities that are included as part of all SPAs include:

- Tracy Fish Collection Facility – Replace Transformers
- Red Bluff Diversion Dam – Mitigation
- Tehama-Colusa Canal – Mitigation
- San Luis Unit Fish and Wildlife Facility
- Trinity River Restoration Project

8.1.4 Activities with Direct Assigned Costs

Direct assigned costs are not included in the SPAs developed for each project purpose. Direct assigned costs do not contribute towards CVP project benefits and would not be required to operate the CVP if it were operated for any single purpose.

8.1.5 Summary of SPA Approach

In summary, the total cost of each SPA includes the estimated cost of the re-sized multipurpose reservoirs (if applicable) plus the cost of non-diminishable multipurpose facilities, all single-purpose facilities for each respective purpose, and mitigation costs. The SPAs exclude direct assigned costs. An overview of each respective SPA is presented below.

8.2 Water Supply SPA

8.2.1 Multipurpose Facility Resizing

Conceptually, the hydrology analysis for the water supply SPA is based on reservoir sizing as if the CVP was operated solely for the purpose of water supply. Because of geographical considerations in the CVP, single-reservoir scenarios had limited applicability because one reservoir typically could not provide water to the entire CVP service area. For this reason, multiple reservoirs are included in the water supply SPA.

The SPA for water supply is based, in part, on reservoir storage required to provide CVP water for irrigation, M&I, and wildlife refuge deliveries, and meeting CVPIA B2 requirements. Five multipurpose CVP reservoirs served the water supply purpose: Friant, New Melones, Trinity, Shasta, and Folsom. Friant provides for direct diversions into the Madera Canal and Friant Kern Canal. New Melones provides water for CVP contracts with Stockton East Water District and Central San Joaquin Water District, along with settlement obligations to Oakdale Irrigation District and South San Joaquin Irrigation District. Trinity, Shasta, and Folsom collectively provide water for CVP water users in the Sacramento and American River basins and exports at Jones Pumping Plant. The hydrology sizing model described in the *Hydrological Modeling Appendix* is used in determining what size each of these facilities had to be so that only the water supply purpose of the CVP was served. In addition, costs associated solely with B2 actions (79 TAF) are included in the water supply purpose SPA.[20] See Chapter 6 *Hydrological Modeling* (Table 6-2) for the multipurpose reservoir sizes included as part of the Water Supply SPA.

8.2.2 Multipurpose Facilities – Other

Other multipurpose facilities that could not be resized that are included as part of the Water Supply SPA are presented above in Section 8.1.2.

[20] Historically, the treatment of B2-related costs has not been included in the water supply purpose for the purpose of sub-allocating costs. Several options were considered for the CAS and it was decided that costs associated solely with B2 actions (79 TAF) would be included in the water supply purpose SPA.

8.2.3 Single-Purpose Facilities

Single-purpose facilities that are included as part of the Water Supply SPA include:

- Folsom South Canal
- Permanent Operation Facilities – Folsom South
- Folsom Dam Pumping Plant – Enhancement
- Folsom Pumps – 4160 Feeder Cable Replacement
- Clayton Canal & Pumping Plant
- Columbia Mowry Pumping Plant
- Contra Costa Canal
- Contra Costa Canal System – Deferred Maintenance
- Contra Costa Pumping Plant
- Contra Loma Dam & Reservoir
- Delta Cross Channel
- Delta-Mendota Canal
- Delta-Mendota Intake Channel
- Delta-Mendota Canal California Aqueduct Intertie
- Martinez Dam & Reservoir
- Permanent Operating Facilities – Tracy
- Shortcut Pipeline
- Tracy Pumping Plant
- Ygnacio Canal & Pumping Plant
- Friant-Kern Canal
- Madera Canal
- 4-M Water District
- Colusa County Water District Relift Pumping Plant
- Colusa Service Area – Cortina
- Colusa Service Area – Davis
- Colusa Service Area – Other
- Corning Canal
- Corning Canal Pumping Plant
- Corning Canal Relift Pumping Plant
- Glenn Valley Water District Relift Pumping Plant
- Dunnigan Water District Relift Pumping Plant
- Glide Irrigation District Relift Pumping Plant
- Kanawha Water District Relift Pumping Plant
- La Grande Water District
- Orland-Artois Water District Relift Pumping Plant
- Permanent Operating Facilities – Arbuckle
- Permanent Operating Facilities – Red Bluff
- Permanent Operating Facilities – Red Bluff Suboffice
- Permanent Operating Facilities – Willows
- Permanent Operating Facilities – Willows Suboffice
- Pilot Research Pumping Plant
- Proberta Water District Relift Pumping Plant
- Red Bluff Diversion Dam
- Tehama-Colusa Canal
- Westside Water District Relift Pumping Plant

- Arroyo Pasajero
- B.F. Sisk San Luis Dam & Reservoir
- Dos Amigos Pumping Plant
- Dos Amigos Switchyard
- Little Panoche Creek Detention Dam & Reservoir
- Los Banos Creek Detention Dam & Reservoir
- O'Neill Dam, Forebay & Wasteway
- Permanent Operating Facilities – State/Federal
- San Luis Canal
- San Luis Canal Turnouts
- San Luis Drain
- San Luis Switchyard
- William R. Gianelli Pumping-Generating Plant
- Coalinga Canal
- Los Banos Substation
- O'Neill Pumping Plant
- O'Neill Pumping Plant Intake Channel
- O'Neill Switchyard Station
- Permanent Operating Facilities – San Luis
- Pleasant Valley Pumping Plant
- San Luis Relift Pumping Plant – Pleasant Valley Water District
- San Luis Relift Pumping Plant – Westlands Water District
- Toyon Pipeline
- Clear Creek Conveyance
- Cow Creek Conveyance System
- Wintu Pumping Plant

8.2.4 Mitigation Activities

Mitigation activities that are included as part of the Water Supply SPA are presented above in Section 8.1.3.

8.3 Water Quality SPA

8.3.1 Multipurpose Facility Resizing

The Period 2 allocation treats the costs of meeting water quality requirements associated with D-1485 as joint costs assigned to all project purposes. Actions for salinity control and actions for compliance with State water quality standards exceeding D-1485 are assigned to the water quality purpose as non-reimbursable, consistent with the COA. The SPA reservoir storage required to satisfy water quality standards of D-1641 over those of D-1485 is analyzed by calculating the SPA for satisfying D-1641 and the SPA for satisfying D-1485 and then taking the difference between the two to determine the incremental storage cost. This difference in cost is used as the SPA cost estimate for the water quality purpose.

The Delta outflow that is required to meet water quality standards in the Delta depends on export level. In order to correctly identify the increment of SPA storage required to satisfy the D-1641 water quality standards compared to those in D-1485, the increment had to be defined given the

same level of export and delivery. See Chapter 6 *Hydrological Modeling* (Table 6-4) for the Water Quality SPA storage sizing requirements. New Melones is not included because the difference in cost of New Melones to meet D-1485 versus D-1641 is negligible. Friant did not serve a water quality purpose since water is not released from the reservoir to meet water quality standards under either D-1485 or D-1641.

8.3.2 Multipurpose Facilities – Other

Other multipurpose facilities that could not be resized that are included as part of the Water Quality SPA are listed above in Section 8.1.2.

8.3.3 Single-Purpose Facilities

There are no single-purpose facilities that are included as part of the Water Quality SPA.

8.3.4 Mitigation Activities

Mitigation activities that are included as part of the Water Quality SPA are presented above in Section 8.1.3.

8.4 Flood Control SPA

8.4.1 Multipurpose Facility Resizing

The CVP storage facilities operated for flood control are Trinity, Shasta, Folsom, New Melones, and Friant. All of these facilities except Trinity included flood control in their authorizing legislation. Trinity provides protection to downstream assets under guidelines set by the Trinity River Mainstem Fishery Restoration Record of Decision (ROD) and therefore is included as part of the flood control SPA.

Flood control rules limit the volume of water that may occupy space in a reservoir, mandating that a certain amount of empty space be maintained in order to accommodate anticipated seasonal runoff. The flood control rule method for determining the single-purpose size of a reservoir selects the largest value for required flood space in a reservoir from the historical flood control diagrams and adds this value to the minimum operating storage level in the reservoir, or dead pool, to calculate the SPA size for each reservoir. SPA sizes for the four flood control reservoirs are shown in Chapter 6 *Hydrological Modeling* (Table 6-6).

8.4.2 Multipurpose Facilities – Other

Other multipurpose facilities that could not be resized that are included as part of the Flood Control SPA are listed above in Section 8.1.2.

8.4.3 Single-Purpose Facilities

There are no single-purpose facilities that are included as part of the Flood Control SPA.

8.4.4 Mitigation Activities

Mitigation activities that are included as part of the Flood Control SPA are presented above in Section 8.1.3.

8.5 Power SPA

8.5.1 Power SPA – Thermal Facility

Under past policy and practice, Reclamation has typically used a hydropower-based single-purpose power alternative when conducting cost allocation studies. However, a nuclear power single-purpose power alternative has been used in prior CVP cost allocation studies based on the premise that the CVP authorizing legislation (50 Stat. 850) authorized Reclamation to construct a steam generator plant.

For the CVP Final CAS, a thermal (natural gas) power plant was determined as the most likely alternative constructed by the Federal government in the absence of CVP hydropower plants.[21] Past precedent and authorizing CVP legislation has given Reclamation the discretion to use a thermal-based SPA for the power purpose of the CVP. The thermal-based SPA is configured and sized to incorporate existing CVP operational limitations and constraints, including the required associated transmission facilities needed to serve power customers.

Consequently, the thermal-based SPA reflected the current level of benefits associated with power generation and associated ancillary services provided by the CVP. The thermal power SPA is sized to generate enough energy to provide not only the amount of energy used by project beneficiaries but to account for system losses as well. The SPA cost for the thermal power facility include all costs, including design and construction, ownership costs, emission reduction credits, environmental mitigation, fuel (natural gas) costs, and other costs. The CVP power generation is estimated based on CalSim 2 and LTGEN modeling (see Section 6.4).

The CVP produces (at plant) an average of about 4,828.74 GWh/year. The capacity of a thermal SPA power plant needed to produce the same amount of energy was estimated to be 1,190 MW. The type of thermal plant used to estimate facility capitalized costs was a 500 MW combined cycle plant without duct-firing. The heat rate used to estimate SPA costs was 6,750 Btu/kWh (British thermal units/kilowatt hours). Life-cycle costs are based on a period of 100 years using an interest rate of 3.25 percent and assuming a 40-year lifespan of a typical plant. The cost of fuel used for the analysis was $4.24/MMBtu (million British thermal units) for natural gas.

8.5.2 Multipurpose Facilities

There are no multipurpose facilities included as part of the Power SPA.

[21] Because the Power SPA does not involve re-operation of existing CVP hydropower facilities, no hydrology analysis was required.

8.5.3 Single-Purpose Facilities

The only single-purpose facilities that are included as part of the Power SPA are select transmission facilities owned and operated by WAPA.

8.5.4 Mitigation Activities

Mitigation activities that are included as part of the Power SPA are presented above in Section 8.1.3.

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Chapter 9. Cost Estimates

This chapter outlines the cost estimating methods developed at an appraisal level for the CVP CAS and presents the cost estimates used as inputs to the SCRB analysis. More detailed cost estimate results are presented in the *Cost Estimates Summary Tables Appendix*.

9.1 Cost Estimating Overview

The SCRB methodology requires several sets of cost estimate inputs. These include total project costs, as well as separable costs and SPA costs by authorized purpose. The cost analysis is conducted at the facility level to account for the complexity and quantity for all of the CVP features. The facility-level analysis also facilitates the water ratesetting process described in Chapter 12, *Implementation of the Final Cost Allocation*.

The SCRB methodology requires separate cost estimates for (1) construction, (2) IDC, and (3) OM&R of project facilities over the 100-year period. The sum of these three cost components is considered the total cost of any given facility. Although these cost components are tracked separately, the calculations within the SCRB process are based on total costs of all three cost components over a 100-year period. The approach used to estimate each type of cost varies as explained below.

SCRB also requires that all cost estimates be in constant price level to allow a consistent comparison. As a result, all cost estimates are indexed to the base year 2013 (see Section 5.3). The nominal (unindexed) cost of facilities are tracked in order to reconcile to actual costs in the CVP financial records.

There are several fundamental tenets underlying the cost estimating used for the CAS.

- Costs are estimated at an appraisal level.
- Cost indexing is required to adjust price levels to the CAS base year (2013).
- Estimated facility costs are based on a wide range of data sources, including Reclamation financial reports, historical construction pricing, material quantities from completion reports, and contract administration documentation.

9.1.1 Appraisal-Level Analysis

Reclamation uses several different levels of detail when estimating costs in the context of project planning and development, including preliminary, appraisal, and feasibility levels within the planning phase of Reclamation's design process (Reclamation 2007). Of these approaches, appraisal and feasibility levels have been deemed suitable for the purpose of cost allocation (Reclamation 2013b). Appraisal level are used due to the number of facilities being considered in this CAS. A feasibility-level analysis for the CAS would require further refinement of the cost estimates, including the need for detailed estimates created during the design, solicitation, and construction stages of each facility.

This would have significantly increased the complexity, cost, and reproducibility of the CAS cost estimates.

The appraisal-level analysis is most pertinent in the context of facility re-sizing, which is integral to the SPA and separable cost analysis required for SCRB. In an appraisal-level analysis, a minimum of roughly 85 percent of the total costs to be estimated should be identified. For the CAS, costs are assigned to the identified line items. The remaining 15 percent of costs are allocated to unlisted items or contingencies for the facilities that required re-sizing. Historical documentation of the costs to construct each of the facilities are used to establish the appropriate number of line items.

9.1.2 Cost Indexing

The CVP has been under construction for over 70 years; therefore the plant-in-service costs[22] in the financial statements have widely varying cost bases. In order to compare costs of the CVP that occur at different points in time, nominal costs of project facilities are converted to a common price level corresponding to the CAS base year of 2013 using the Building Costs Index (BCI).

9.2 Cost Categories

9.2.1 Construction Costs

Construction costs are the costs of labor, land, materials, and financing to plan, design, and construct a project facility or feature for the purpose of providing new or additional benefits. Construction costs of a project feature include both contract costs and non-contract costs, such as direct labor, direct materials, and indirect costs through the point the facility is placed into plant-in-service. Construction costs exclude IDC.[23] Project construction costs are estimated using information from several different data sources, mainly existing financial records and contract administration records.

9.2.2 Interest During Construction Costs

IDC represents the cost to finance the construction of projects.[24] IDC is reimbursable by certain project purposes (or beneficiaries), namely M&I and commercial power. As such, only those facilities that serve M&I and commercial power include IDC for repayment in Schedule 1 of the CVP financial statements. For example, facilities that solely serve irrigation do not include IDC in Schedule 1. To ensure that all facilities are evaluated consistently in the SCRB analysis, estimates for IDC are required for each facility based on the total cost of the facility.

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[22] In order to index nominal costs to the base year, the date when each project facility began to provide beneficial use is documented. This is referred to as the plant-in-service date.

[23] Plant-in-service values presented in Schedule 1 of the CVP financial statements include both construction costs and interest during construction, which required that IDC be deducted from the plant-in-service values to derive construction-only costs.

[24] Specifically, IDC represents interest accumulated during the construction period. This interest is added to the cost of the long-term asset so that the interest is not recognized in the current period as interest expense. Instead, the interest becomes a fixed asset and is included in the depreciation of the long-term asset.

To ensure that IDC is not double counted in certain facilities, actual IDC is first deducted from facilities that have it recorded in the 2013 Financial Statements, then IDC is estimated for all facilities using annual compound interest. For consistency with Reclamation Policy, IDC is not included for facilities constructed prior to 1955 and simple interest calculations are used for construction that occurred between 1955 and 1982. The CAS discount rate of 3.25 percent is used in calculating estimated IDC.

9.2.3 Operation, Maintenance, and Replacement Costs

OM&R cost estimates are required for each facility for the SCRB analysis. Due to the large number of facilities and data gaps for individual facilities, the OM&R cost analysis is conducted based on representative facility types (or categories). The six categories of facilities included (1) canals, (2) dams and reservoirs with subcategories of embankment and concrete dams, (3) pumping plants and power plants, (4) switchyards, (5) general project soft costs, and (6) WAPA facilities.

Annual OM&R expenses are estimated for each representative facility using a two-step process. The first step determines the estimated O&M cost by representative facility. This is accomplished by averaging indexed O&M expenditures for the most recent 10 years of reported costs to arrive at an average annual value. Reclamation's O&M index is used for this purpose (Reclamation 2017). The second step determines the estimated replacement costs for a representative facility in each O&M facility category. The estimates exclude overhead costs that are not attributable to any given facility or purpose. Overhead costs are treated as joint costs of the CVP.

Determining replacement costs is accomplished by estimating the cost and timing of replacement for each item. The expected occurrence cycles are determined from the Reclamation/WAPA Replacement Book (2006). Large scale rehabilitation, maintenance, replacement, and extraordinary maintenance (RAX) activities occur on a predictable schedule. Subsequently, for facilities in each category, estimated replacement costs are calculated by pro-rating replacement costs for the representative facility based on the relative magnitude of construction costs of the representative facility compared to all facilities in the same category. The results from steps one (O&M) and two (replacements) are added together to produce each facility's total OM&R cost. Total OM&R cost estimates are capitalized over the 100-year period of analysis using the project interest rate of 3.25 percent.

9.3 Cost Estimating Methodology

Cost estimates for total facility costs, separable costs, and SPA costs are required from the SCRB analysis. The methods used to develop these cost estimates vary by type of facility. Each facility in the CVP is characterized as either single-purpose or multipurpose. Single-purpose facilities are considered separable to the purpose they serve. For example, the total cost of a single-purpose water supply canal is a separable cost to the water supply purpose. Single-purpose facilities are also assigned in their entirety to each applicable SPA. The cost estimating process for multipurpose facilities requires the hypothetical re-sizing of the facility for each authorized purpose in the separable cost and SPA cost analyses.

9.3.1 Costs Used in the SCRB Process

Total Facility Costs

Total project costs are estimated for all CAS facilities. Total project costs serve as the starting point for facility re-sizing efforts described below. Separate cost estimates are developed for construction, IDC, and OM&R, which together represent total costs. The plant-in-service date of each facility is used to index nominal costs to the base year. Plant additions and RAX costs that occurred after the plant-in-service date are considered construction costs and indexed to the base year from the year in which they occur.

Separable Cost Analysis

Separable costs are project costs that are attributable to a single purpose. Separable costs for each authorized purpose are calculated as the difference between total costs of a multipurpose project and the cost of the project with that purpose excluded.

The cost of single-purpose facilities is separable to the purpose those facilities serve. The separable costs of a multipurpose facility's costs are evaluated by determining if the multipurpose facility can be re-sized as a result of eliminating each authorized purpose from the multipurpose project. Multipurpose facilities that cannot be re-sized by removing any authorized purpose are considered to be non-diminishable. Non-diminishable facilities are treated as joint costs in the SCRB analysis. Multipurpose facilities that could be re-sized based on the removal of authorized purposes are defined as diminishable. Friant Dam and Los Banos Creek Detention Dam are the only multipurpose dams considered diminishable, and which do not include a power purpose. As a result, these dams could be re-sized in the separable cost analysis. It was determined that these facilities should be re-sized and would not incur joint costs. Total costs of Friant Dam are distributed between water supply (58.56 percent) and flood control (41.44 percent), while Los Banos Creek Detention Dam costs are distributed to water supply (24.06 percent), flood control (68.66 percent), and recreation (7.28 percent).

Single-Purpose Alternative Cost Analysis

The SPA is the least cost alternative which would likely be built as a single-purpose Federal project, and that would provide the same benefit to each purpose individually as the multipurpose project provides. For the purpose of the CAS, the following four SPAs are developed: (1) water supply, (2) flood control, (3) water quality, and (4) power. All of the SPAs except for power are based on re-sizing of existing CVP facilities. The power SPA is based on a thermal natural gas-powered facility tying into the existing CVP power transmission grid. The estimation of costs associated with the thermal power SPA is discussed below.

With exception of the power SPA, all single-purpose facilities are assigned to the applicable SPA they serve. Non-diminishable, multipurpose facilities that could not be attributed to any one purpose are included at full scale in all SPA costs. Each diminishable multipurpose facility is re-sized to serve each respective authorized purpose of the CVP.

Multipurpose Facilities – Diminishable

The SCRB process requires that existing facilities be re-sized, if possible, to calculate costs of the SPA for each project purpose and to estimate separable costs of each purpose. Approximately 30 facilities on the CAS Facility List are treated as multipurpose features of the CVP. The multipurpose facilities identified as diminishable facilities are re-sized and corresponding cost estimates are developed. Table 9-1 presents the diminishable facilities considered and treatment in the CAS.

Developing cost estimates for re-sized facilities involved multiple steps. The first step documents the costs required to construct the facility, which identifies the construction contracts and their subcomponents for each facility throughout the facility's life and use of Reclamation's financial reports. Next, estimating the new height of the dam and reservoir was determined using the water volumes needed to provide the same level of benefits for each purpose. This would help determine the volume, square footage, and change of each major cost driver (MCD) (i.e., concrete and other large expenses) from the original construction cost.

Cost estimations are generated by identifying and adjusting the MCD, using AutoCAD and LIDAR surveying models, developing cost curves, and developing engineering and construction inspecting–based assumptions on the re-sized quantities to arrive at total estimated costs. The MCDs for each contract are separated by identifying the line items that produced at least 85 percent of the costs.

Cost curves based on the MCDs for each facility allows for re-sizing of the facilities while accounting for unit cost variations due to economies of scale and regional influences. The proportional cost is determined by comparing the original facility to the scaled facility.

All of the diminishable multipurpose facilities are dams that store water and include power facilities, except for Friant Dam and Los Banos Creek Detention Dam. On further evaluation, for multipurpose facilities with a power purpose, it was found that despite these facilities' original designations as diminishable, it was determined that the facility sizes would not vary in the multipurpose without cost analysis. In other words, eliminating any purpose from these multipurpose facilities would not result in a re-sized facility because the facility would still need to provide the benefits of all remaining purposes. Therefore, regardless of the purpose removed, the facility size could not be diminished without affecting the benefits of one or more of the remaining purposes. Accordingly, there are no separable costs of these facilities.

Additional consideration was required for determining separable costs to the power purpose with respect to specific power features (as opposed to facility sizing discussed below). Power components of multipurpose facilities (primarily power plants and switchyards) are considered to be bolt-on accessories and separable to the power purpose. An adjustment to the multipurpose facility dam cost was considered to account for the material used to replace the bolt-on accessories, and it was determined any cost change would be less than unlisted items and contingencies for the identified dams. Consequently, the cost of removing the power purpose from these multipurpose dams was determined to be negligible. This approach resulted in no separable costs assigned to the power purpose from the multipurpose dams in the SCRB analysis. The only separable costs of the power purpose were the accumulated cost of single-purpose power facilities.

Table 9-1. Diminishable Multipurpose Facilities

Diminishable Facilities	Treatment in CAS Analysis
Shasta Dam	For SPA analysis, these facilities were re-sized based on hydrology. For separable costs, the power purpose necessitated the same size dam.
Folsom Dam	For SPA analysis, these facilities were re-sized based on hydrology. For separable costs, the power purpose necessitated the same size dam.
New Melones Dam	For SPA analysis, these facilities were re-sized based on hydrology. For separable costs, the power purpose necessitated the same size dam.
Trinity Dam	For SPA analysis, these facilities were re-sized based on hydrology. For separable costs, the power purpose necessitated the same size dam.
Friant Dam and Permanent Operating Facilities	For SPA analysis, this facility was re-sized based on hydrology. Because Friant only serves two project purposes, water supply and flood control, all Friant Dam and reservoir costs were allocated as separable costs to these two functions.
Nimbus Dam	For the SPA analysis, this facility was re-sized. There are no separable costs to water supply. There are separable costs to power, which consists of the power generating equipment.
Los Banos Creek Detention Dam	For the SPA analysis, this facility was re-sized based on the separable cost factors. Because Los Banos Dam only serves two project purposes, water supply and flood control, all Los Banos Dam and reservoir costs were allocated as separable costs to these two functions.

Multipurpose Facilities – Non-Diminishable

Non-diminishable facilities are facilities for which the cost of the facility does not change if any authorized purpose is removed from the project. The full cost of non-diminishable facilities is included in each SPA because there are no costs considered separable to any one purpose. Table 9-2 provides the list of non-diminishable facilities and summarizes the reasons for the determinations.

Table 9-2. Non-Diminishable Multipurpose Facilities

Non-Diminishable Facilities	Reason for Non-Diminishable Designation[1]
CVP radio rain gauges	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
Shasta radio rain gauges	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
Trinity radio rain gauges	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
Shasta radio stream gauges	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.

Non-Diminishable Facilities	Reason for Non-Diminishable Designation[1]
Trinity radio stream gauges	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
CVP radio network	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
CVP telemetering equipment	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
Centralized water and power systems control	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
Keswick-Carr Microwave Systems	Provided a function for the entire CVP and the size remained relatively the same no matter the size of the CVP.
Shasta permanent operating facilities	Provided a function for the named facility and the size remained relatively the same regardless of the purpose
Union Hills Reservoir[1]	Land obtained for the facility would not change regardless of size or purpose
Clear Creek Tunnel	Tunnel costs would not significantly change if the tunnel size was reduced because of the custom equipment and complexity of the construction.
Spring Creek Debris Dam and Reservoir	The dam was originally sized and constructed to hold back contaminated water from upstream mining and release as needed to mitigate stream poll. None of the purposes served by this facility could be altered, and therefore the facility could not be re-sized, resulting the total cost of this facility to be joint costs.
Whiskeytown Dam and Reservoir	Costs were not separable to a single purpose due to operational requirements, unclear required volumes of water for specific purposes, and could not be built smaller for water supply, power, or flood control individually based on available data.

1. Although a non-diminishable facility, Folsom Sly Park/Union Hills Reservoir is not included in any SPAs because it does not support the benefits of any project purpose.

9.3.2 Mitigation Costs

Mitigation costs are treated as joint project costs in the CVP CAS. CVPIA facility costs are excluded from the CAS and are being handled through a separate process. For more information on mitigation costs, refer to Section 5.11.

9.3.3 Direct Assigned Costs

Direct assigned costs are costs that have been identified, legislatively or by agreement, as having a clear direction regarding repayment. The costs of direct assigned features are excluded from the SCRB process. Cost estimates for project facilities with direct assigned costs are adjusted to remove direct assigned costs. Generally, the total cost of each project facility is pro-rated based on the proportion of unindexed facility cost that is direct assigned relative to total project cost. Direct

assigned costs are not treated as separable costs to any purpose or included in any of the SPA cost estimates. For more information on direct assigned costs, refer to Section 3.3.

9.4 CAS Cost Estimates

As described above, the cost estimating process for the CAS resulted in three sets of indexed cost estimates: (1) total facility costs, (2) cost estimates for each respective SPA (i.e., water supply, flood control, water quality, and power), and (3) cost estimates of the multipurpose project with each of the individual purposes removed (i.e., the multipurpose without purpose project estimates). For each set of costs, all three cost components are estimated, namely construction, IDC, and OM&R, which are used as inputs to the SCRB analysis.

As shown in Table 9-3, the total cost of the CVP that is used in the SCRB process is approximately $17.0 billion (2013 dollars), which is comprised of construction costs ($11.2 billion), IDC ($476.9 million), and the present value of annual OM&R costs ($5.3 billion). These cost estimates exclude direct assigned costs excluded from the SCRB process.

Table 9-3 also shows the estimate of separable costs by purpose. Separable costs are computed as the difference of total project cost and the omitted-purpose cost for each purpose. Accounting for all three cost components, the total separable costs attributed to each purpose is: water supply ($6.1 billion), power ($4.6 billion), flood control ($171.4 million), recreation ($15.1 million), water quality ($0), fish and wildlife enhancement ($0), and navigation ($0).

Table 9-3. SCRB Total and Separable Cost Estimates (2013 Dollars)

Purpose	Total Cost	Multipurpose Without Cost	Separable Costs
Construction	**$11,183,353,145**		
Water Supply		$6,727,205,449	$4,456,147,695
Power		$9,149,317,479	$2,034,035,666
Flood Control		$11,033,241,465	$150,111,679
Recreation		$11,169,443,333	$13,909,811
Water Quality		$11,183,353,145	$0
Fish and Wildlife Enhancement		$11,183,353,145	$0
Navigation		$11,183,353,145	$0

Purpose	Total Cost	Multipurpose Without Cost	Separable Costs
IDC	**$476,904,929**		
Water Supply		$303,477,679	$173,427,250
Power		$356,116,945	$120,787,985
Flood Control		$469,177,350	$7,727,579
Recreation		$476,725,189	$179,740
Water Quality		$476,904,929	$0
Fish and Wildlife Enhancement		$476,904,929	$0
Navigation		$476,904,929	$0
OM&R	**$5,337,474,656**		
Water Supply		$3,909,489,262	$1,427,985,394
Power		$2,926,261,359	$2,411,213,297
Flood Control		$5,323,898,239	$13,576,417
Recreation		$5,336,423,175	$1,051,481
Water Quality		$5,337,474,656	$0
Fish and Wildlife Enhancement		$5,337,474,656	$0
Navigation		$5,337,474,656	$0
TOTAL CVP	**$16,997,732,730**		
Water Supply		$10,940,172,390	$6,057,560,340
Power		$12,431,695,782	$4,566,036,948

Purpose	Total Cost	Multipurpose Without Cost	Separable Costs
Flood Control		$16,826,317,054	$171,415,676
Recreation		$16,982,591,697	$15,141,033
Water Quality		$16,997,732,730	$0
Fish and Wildlife Enhancement		$16,997,732,730	$0
Navigation		$16,997,732,730	$0

Table 9-4 presents the SPA cost estimates. Accounting for all three cost components, the total SPA cost by purpose: water supply SPA ($11.0 billion), power SPA ($9.4 billion), flood control ($5.3 billion), and water quality ($4.1 billion). No SPA cost estimates were required for fish and wildlife enhancement, recreation, and navigation.

Table 9-4. Total Estimated SPA Costs by Purpose[1] (2013 Dollars)

Type of Cost	Water Supply SPA	Power SPA	Flood Control SPA	Water Quality SPA
Construction	$7,830,971,993	$1,617,562,352	$3,745,324,665	$2,643,732,657
IDC	$310,143,077	$76,621,927	$152,354,756	$106,206,497
OM&R	$2,831,470,890	$7,681,334,972	$1,429,937,241	$1,343,915,357
Total Cost	**$10,972,585,960**	**$9,375,519,251**	**$5,327,616,662**	**$4,093,854,511**

1. SPA cost estimates were not developed for the following purposes: fish and wildlife enhancement, recreation, and navigation.

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Chapter 10. Cost Allocation Results (Period 2)

This chapter presents the Period 2 cost allocation, which reflects expected future operation and benefits of the CVP. The results of the Period 2 allocation are based on the SCRB analysis and related sub-allocation process, as well as the costs, benefits, and assumptions outlined throughout this report. In addition, this chapter also carries the allocation through to the facility level to facilitate the water ratesetting process.

10.1 Application of SCRB to the CAS

The SCRB method is used as the starting point to allocate costs to the authorized purposes of the CVP (see Chapter 4, *Cost Allocation Methodology*). However, allocation of costs at the purpose level does not define repayment responsibilities; therefore, sub-allocation of costs is necessary. SCRB requires estimation of the benefits for each project purpose and the costs for each SPA that provides comparable benefits. The lesser of the benefits estimated for each purpose and SPA cost sets the limit of the amount that can be allocated to a particular project purpose. This is defined as the justifiable expenditure. The next step is to identify the separable costs for each project purpose, which are costs attributed to a single purpose.

Separable costs are calculated as the difference in the total multipurpose project cost and the cost of the project without a particular purpose included. The separable costs for each project purpose are then deducted from the justifiable expenditures for each purpose to derive the remaining justifiable expenditures. The remaining joint costs of the project are the total project costs less the total separable costs. Remaining joint costs are allocated to each project purpose based on the percentage share of the remaining justifiable expenditures (i.e., joint cost factors). The allocation of separable costs and remaining joint costs for each project purpose are added together to derive the total cost allocated to each purpose.

The SCRB analysis excludes direct assigned costs where repayment responsibilities have been set either through legislation and/or agreement (see Section 3.3). Specifically, where Congress has provided clear direction regarding the reimbursement of specific project features, or where Reclamation has entered into agreements regarding repayment, the costs of such features are deducted prior to implementing the SCRB analysis. After the SCRB analysis is completed, direct assigned costs are added back to the appropriate repayment category based on the provisions in the associated legislation or agreement.

The results of the SCRB analysis are shown in Table 10-1 (2013 dollars). The total SCRB costs subject to the cost allocation is approximately $17.0 billion. Based on the comparison of economic benefits and SPA costs, the driver of justifiable expenditure for each project purpose is as follows:[25]

[25] The purposes not listed below (i.e., recreation, navigation, and fish and wildlife enhancement) do not share in joint costs, so they are not considered in determining justifiable expenditure across project purposes.

- Water Supply: SPA costs ($11.0 billion)
- Power: Benefits ($5.7 billion)
- Flood Control: SPA costs ($5.3 billion)
- Water Quality: Benefits ($1.5 billion)

The separable costs across project purposes are as follows:

- Water Supply: $6.1 billion
- Power: $4.6 billion
- Flood Control: $171.4 million
- Water Quality: $0
- Recreation: $15.1 million
- Navigation: $0
- Fish and Wildlife Enhancement: $0

The joint cost factors[26] (shown under the row titled "Remaining Justifiable Expenditure Percentage by Purpose" in Table 10-1) are calculated by dividing the remaining justifiable expenditures for each purpose by the total remaining justifiable expenditure. These factors are applied to the joint cost pool totaling approximately $6.2 billion (2013 dollars) and are the only numbers from the SCRB process that are used in the facility-level allocation presented in Section 10.2.

- Water Supply: 38.74 percent
- Power: 9.12 percent
- Flood Control: 40.64 percent
- Water Quality: 11.49 percent
- Recreation: NA
- Navigation: NA
- Fish and Wildlife Enhancement: NA

The total allocation of costs represents the sum of separable and joint costs. The total allocated costs across project purposes is as follows (2013 dollars):

- Water Supply: $8.4 billion
- Power: $5.1 billion
- Flood Control: $2.7 billion
- Water Quality: $710.9 million

[26] Total may not sum to 100 percent due to rounding.

- Recreation: $15.1 million
- Navigation: $0
- Fish and Wildlife Enhancement: $0

Table 10-1. SCRB Results – Period 2 (2013 Dollars)

SCRB Component	Water Supply	Power	Flood Control	Fish & Wildlife Enhance-ment	Recrea-tion	Navigation	Water Quality	Total
Total Costs to Be Allocated								
Construction								$11,183,353,145
IDC								$476,904,929
OM&R								$5,337,474,656
Total								$16,997,732,730
Economic Benefits								
Benefits by Purpose	$22,702,486,987	$5,723,645,968	$37,992,213,836	$0	$0	$0	$1,457,558,518	$67,875,905,309
SPA Costs								
Construction	$7,830,971,993	$1,617,562,352	$3,745,324,665	$0	$0	$0	$2,643,732,657	$15,837,591,667
IDC	$310,143,077	$76,621,927	$152,354,756	$0	$0	$0	$106,206,497	$645,326,257
OM&R	$2,831,470,890	$7,681,334,972	$1,429,937,241	$0	$0	$0	$1,343,915,357	$13,286,658,460
Total	$10,972,585,960	$9,375,519,251	$5,327,616,662	$0	$0	$0	$4,093,854,511	$29,769,576,384
Justifiable Expenditure [1]								
Justifiable Expenditure by Purpose	$10,972,585,960	$5,723,645,968	$5,327,616,662	$0	$0	$0	$1,457,558,518	$23,481,407,108
Separable Costs [2]								
Construction	$4,456,147,695	$2,034,035,666	$150,111,679	$0	$13,909,811	$0	$0	$6,654,204,851
IDC	$173,427,250	$120,787,985	$7,727,579	$0	$179,740	$0	$0	$302,122,554
OM&R	$1,427,985,394	$2,411,213,297	$13,576,417	$0	$1,051,481	$0	$0	$3,853,826,589
Total	$6,057,560,339	$4,566,036,948	$171,415,675	$0	$15,141,032	$0	$0	$10,810,153,994
Remaining Justifiable Expenditure [3]								
Remaining Justifiable Expenditure, by Purpose	$4,915,025,621	$1,157,609,020	$5,156,200,987	$0	$0	$0	$1,457,558,518	$12,686,394,146
Remaining Justifiable Expenditure Percentage [4]								

SCRB Component	Water Supply	Power	Flood Control	Fish & Wildlife Enhance-ment	Recrea-tion	Navigation	Water Quality	Total
Remaining Justifiable Expenditure Percentage, by Purpose	38.74%	9.12%	40.64%	0.00%	0.00%	0.00%	11.49%	100.00%
Allocation of Joint Costs								
Construction	$1,754,705,278	$413,276,176	$1,840,806,651	$0	$0	$0	$520,360,641	$4,529,148,294
IDC	$67,715,062	$15,948,560	$71,037,762	$0	$0	$0	$20,081,009	$174,782,375
OM&R	$574,802,352	$135,380,067	$603,007,244	$0	$0	$0	$170,458,552	$1,483,648,067
Total	$2,397,222,692	$564,604,803	$2,514,851,657	$0	$0	$0	$710,900,202	$6,187,578,736
Allocation of Total Costs								
Construction	$6,210,852,973	$2,447,311,842	$1,990,918,330	$0	$13,909,811	$0	$520,360,641	$11,183,353,597
IDC	$241,142,312	$136,736,545	$78,765,341	$0	$179,740	$0	$20,081,009	$476,904,947
OM&R	$2,002,787,746	$2,546,593,364	$616,583,661	$0	$1,051,481	$0	$170,458,552	$5,337,474,804
Total	$8,454,783,031	$5,130,641,751	$2,686,267,332	$0	$15,141,032	$0	$710,900,202	$16,997,733,348

1. Lesser of Benefits or SPA Costs
2. Total Multipurpose Cost minus Multipurpose w/o each purpose
3. Justifiable Expenditure minus Separable Costs
4. Also referred to as joint cost allocation factors

10.2 Facility-Level Cost Allocation

To accommodate Reclamation's ratesetting process, the costs in Period 2 are allocated separately by facility. Facility-level cost allocation factors are estimated for each project feature based on separable costs for each facility and the allocation of joint costs using the joint cost factors derived from the SCRB process. The composite allocation factors (incorporating both separable and joint costs) are used to allocate total cost to the authorized purposes for each facility. Costs allocated to the water supply and power purposes are then sub-allocated to the applicable sub-purposes for repayment. Lastly, the direct assigned costs are allocated to the appropriate repayment category. The *Cost Allocation Spreadsheet Appendix* to this report presents the summary tables that represent the facility-level allocation for Period 2.

The development of facility-level cost allocation factors involved several steps. First, the remaining joint costs by facility are estimated by subtracting the sum of the separable costs from the total cost to be allocated for each facility (*Cost Allocation Spreadsheet Appendix*, Table 1). The remaining joint costs are then allocated to the authorized purposes using the joint cost allocation factors which are calculated in the SCRB process (*Cost Allocation Spreadsheet Appendix*, Table 1). Next, the total allocated costs by authorized purposes are estimated for each facility by summing the separable costs and that portion of joint costs allocated to the purpose (*Cost Allocation Spreadsheet Appendix*, Table 2).

Finally, the composite cost allocation factors are derived by dividing the total cost allocated to each purpose by the total cost of the feature (*Cost Allocation Spreadsheet Appendix*, Table 2). These composite factors remain constant for the Period 2 allocation.

10.3 Sub-Allocation of Costs

The sub-allocation of water and power costs is necessary to assign costs to the applicable repayment category for water ratesetting purposes. Because the ratesetting calculations are based on nominal costs, the sub-allocation process uses unindexed costs (*Cost Allocation Spreadsheet Appendix*, Tables 3, 4, and 5). To accommodate the sub-allocation process, total unindexed cost for each facility are multiplied by the facility-level composite cost allocation factors to distribute the cost among authorized purposes (*Cost Allocation Spreadsheet Appendix*, Tables 6, 7, and 8). Repayment responsibilities for costs allocated to the water supply and power purposes are determined through the sub-allocation process described below.

10.3.1 Water Supply Cost Sub-Allocation

For the Period 2 cost allocation, water supply costs are sub-allocated to the following sub-purposes: irrigation, M&I, wildlife refuge, and CVPIA functions.[27] The water supply sub-allocation is performed on the basis of water use (measured in acre feet). Water supply sub-allocation factors

[27] The inclusion of B2 water supply as a water supply sub-purpose is a new concept. B2 releases that were included in the water supply purpose relate to releases under excess conditions that could not be recaptured for other purposes, such as water quality. In other words, only those B2 releases that flow to the ocean because they could not be used for any other purpose were included as part of the water supply purpose.

representing water use distributions are estimated for 15 different delivery areas and operational contexts (*Cost Allocation Spreadsheet Appendix*, Table 9). Because Period 2 represents a prospective analysis, the water use data is based primarily on CalSim 2 modeling, which reflects current/projected operations and regulatory constraints.

Information on B2 water supplies are derived from CVPIA water accounting records reported by the Central Valley Operations (CVO) office. The various water supply sub-allocation distributions are assigned to each CVP facility that has a water supply allocation based on location and operational considerations. The sub-allocation of water supply costs (construction, IDC, and OM&R) by facility are shown in *Cost Allocation Spreadsheet Appendix*, Tables 10, 11, and 12.

10.3.1.1 Sub-allocation of Wildlife Refuge and B2 Water Supply Costs

The water supply sub-allocation involves additional sub-allocation of costs assigned to the wildlife refuge and B2 sub-purposes due to differing repayment requirements. Specifically, refuge water supply costs are sub-allocated to Level 2 and Incremental Level 4 refuge deliveries. CalSim 2 provides projected delivery quantities for Level 2 refuge water supplies. Projected Incremental Level 4 refuge deliveries are estimated based on a 10-year average of historic refuge delivery data.

Additional consideration of Incremental Level 4 deliveries in the water supply sub-allocation is required in order to allocate costs to applicable facilities and to avoid double-counting of water across water supply sub-purposes. Incremental Level 4 water delivered by Reclamation is derived from non-CVP sources, including project water that was originally allocated to CVP water users but subsequently permanently or temporarily assigned or transferred to the refuge program. In cases where reimbursable project water is transferred for the purposes of meeting non-reimbursable Incremental Level 4 demands, these water supplies are modeled as irrigation and/or M&I deliveries in CalSim and the water supply sub-allocation process. This modeling is appropriate because the water users are charged and compensated for that water, and it should not be sub-allocated to Incremental Level 4. There is non-CVP derived water that utilizes south-of-Delta CVP conveyance facilities to meet Incremental Level 4 demands, namely the Delta-Mendota Canal, which is accounted for in the water supply sub-allocation process.[28] Specifically, it is estimated that 10 percent of Incremental Level 4 south-of-Delta refuge deliveries are derived from non-CVP sources and are conveyed through the Delta-Mendota Canal, which is reflected in the water supply sub-allocation distributions.

Costs allocated to Incremental Level 4 refuge water supplies are non-reimbursable and are sub-allocated 75 percent to the Federal government and 25 percent to the State of California. Costs allocated to Level 2 refuge water and B2 water are considered reimbursable in the Period 2 allocation, thereby assigned to water and power users only. These costs are sub-allocated to irrigation, M&I, and commercial power based on the proportion of reimbursable costs across the three sub-purposes as shown in Section 10.5, Table 10-2, and the *Cost Allocation Spreadsheet Appendix*, Table 16. The *Cost Allocation Spreadsheet Appendix* Tables 17, 18, and 19 present the sub-allocation of reimbursable refuge and B2 water supply costs.

[28] Incremental Level 4 water that comes from north-of-Delta sources does not utilize CVP conveyance facilities.

10.3.2 Power Cost Sub-Allocation

For Period 2, costs allocated to the power purpose are sub-allocated between commercial power and project use energy. Power costs that are sub-allocated to the PUE function are subject to the water supply sub-allocation process described above in Section 10.3.1. The power sub-allocation in Period 2 is based on LTGEN modeling results which are derived from CalSim 2 output, accounting for adjustments for the San Luis Unit.[29]

The power sub-allocation utilizes one uniform sub-allocation distribution across all power facilities based on system-wide power generation and use with one exception.[30] Specifically, average annual project use energy consumption (minus San Luis Unit generation) is estimated to be 1,033.71 GWh, and average annual CVP power generation is estimated to be 4,514.60 GWh resulting in the following power sub-allocation factors: commercial power (77.103%) and PUE (22.897%).[31] The average annual PUE is the total energy use at the pumping plant minus the generation of the San Luis Unit. The average annual CVP power generation is the at-plant generation minus regeneration by the San Luis Unit and estimated transmission losses. The sub-allocation factors are calculated using the following equations:

$$\boldsymbol{PUE\ Sub\text{–}allocation\ Factor = \frac{Total\ Use\ at\ Pumping\ Plant - San\ Luis\ Unit\ Generation}{Total\ CVP\ Generation - Transmission\ Losses}}$$

$$\boldsymbol{Commercial\ Power\ Sub\text{–}allocation\ Factor = 1 - PUE\ Sub\text{–}allocation\ Factor}$$

The sub-allocation of power costs by facility is shown in *Cost Allocation Spreadsheet Appendix* Tables 13, 14, and 15.

10.4 Allocation of Direct Assigned Costs

Direct assigned costs are incorporated into the cost allocation after the water supply and power sub-allocation is completed. Only direct assigned costs that are plant-in-service (i.e., construction) are assigned to sub-purposes. Estimates of IDC and OM&R are not developed for direct assigned costs. Direct assigned costs are designated as either reimbursable or non-reimbursable based on legislation and/or agreements (see Section 3.3). The sub-allocation of direct assigned costs by facility is shown in *Cost Allocation Spreadsheet Appendix* Table 20. Direct assigned costs categorized as reimbursable are further sub-allocated to the reimbursable sub-purposes based on the distribution of reimbursable construction costs shown in Section 10.5 (Table 10-2).

[29] For the purposes of the Period 2 allocation, power generation at O'Neill and Giannelli pump-generation facilities in the San Luis Unit (117.038 GWh annually) was removed from power sub-allocation calculations because these facilities serve the water supply purpose only.
[30] The costs associated with the Pacific Alternating Current Intertie (PACI) transmission system is sub-allocated 100 percent to commercial power.
[31] The calculated sub-allocation factors will be replaced during the implementation phase using real-time data. LTGEN results are not adjusted by the process described in Chapter 7.7.1.2 and the *Economic Benefits Analysis Appendix* for the calculation of CVP energy generation economic benefits.

10.5 Sub-Allocation of Reimbursable Costs

Reimbursable costs are allocated only to the three reimbursable sub-purposes (i.e., irrigation, M&I, and commercial power). In these cases, the sub-allocation follows the distribution of costs across the three sub-purposes through the water supply and power sub-allocation process. Separate distributions of reimbursable costs for construction, IDC, and OM&R costs are shown in Table 10-2.

Table 10-2. Reimbursable Purpose Allocation Percentages (Nominal Dollars)

Sub-Purpose	Construction ($)	Construction (%)	IDC ($)	IDC (%)	OM&R ($)	OM&R (%)
Irrigation	$990,835,007	58.7%	$71,523,621	57.2%	$2,007,374,630	46.4%
M&I	$131,817,462	7.8%	$8,045,878	6.4%	$319,563,407	7.4%
Commercial Power	$566,051,934	33.5%	$45,491,632	36.4%	$1,997,332,755	46.2%
Total	**$1,688,704,403**	**100.0%**	**$125,061,131**	**100.0%**	**$4,324,270,792**	**100.0%**

10.5.1 Allocation of Reimbursable SOD Costs

The allocation of SOD costs is defined by legislation. Specifically, 85 percent of SOD costs are non-reimbursable and 15 percent are reimbursable. Reimbursable SOD costs in Period 2 do not follow reimbursable cost distributions in Table 10-2. Instead, these costs follow the cost allocation factors for the appurtenant facility from the existing Period 1 allocation to distribute costs among the water supply and power purposes (see Section 5.10 for more information). Water supply costs are further sub-allocated using the Period 2 water supply sub-allocation factors (*Cost Allocation Spreadsheet Appendix*, Table 9) and all power costs are allocated to commercial power. The allocation of reimbursable SOD costs is presented in *Cost Allocation Spreadsheet Appendix*, Table 21.

10.6 Cost Allocation Summary (Period 2)

The results of the Period 2 cost allocation, including the water supply and power sub-allocation and assignment of direct assigned costs and repayment contracts is presented in Table 10-3. Table 10-3 focuses on the allocation of construction costs only. The allocation of estimated IDC and OM&R costs at the facility level are presented in the appendix; however, these costs are not presented here because they have been estimated for the purpose of the SCRB analysis only and do not represent actual costs subject to repayment.[32]

[32] Reimbursable IDC will be re-calculated for Period 2 based on the results on the Period 2 construction allocation (see Section 12.3.2). OM&R costs that are included in water rates are projected costs that are estimated annually; these costs will be allocated pursuant to the CAS results (refer to Section 12.4).

Table 10-3. Cost Allocation Summary – Period 2 (Nominal Dollars)[1]

Cost Category	Construction
Irrigation Water Supply	
Water Supply Sub-Allocation	$870,012,164
Project Use Energy – Power Sub-Allocation	$120,822,843
Refuge Water Supply (Level 2) – Water Supply Sub-Allocation	$54,759,215
B2 Water Supply – Water Supply Sub-Allocation	$2,930,463
Refuge Water Supply (Level 2) – PUE Sub-Allocation	$8,251,601
SCRB Allocation & Sub-Allocation Sub-Total	*$1,056,776,286*
Direct Assigned Cost – Safety of Dams	$3,017,064
Direct Assigned Cost – Other	$8,724,372
Direct Assigned Cost Sub-Total	*$11,741,436*
Irrigation Total	$1,068,517,722
Municipal and Industrial Water Supply	
Water Supply Sub-Allocation	$108,329,815
Project Use Energy – Power Sub-Allocation	$23,487,647
Refuge Water Supply (Level 2) – Water Supply Sub-Allocation	$7,284,986
B2 Water Supply – Water Supply Sub-Allocation	$389,859
Refuge Water Supply (Level 2) – PUE Sub-Allocation	$1,097,765
SCRB Allocation & Sub-Allocation Sub-Total	*$140,590,072*
Direct Assigned Cost – Safety of Dams	$570,349
Direct Assigned Cost - Other	$1,160,662
Direct Assigned Cost Sub-Total	*$1,731,011*
M&I Total	$142,321,083

Cost Category	Construction
Refuge Water Supply (Non-Reimbursable)	
Refuge Water Supply (Incremental Level 4) – Water Supply Sub-Allocation	$539,800
Refuge Water Supply (Incremental Level 4) – PUE Sub-Allocation	$229,974
Non-Reimbursable Refuge Water Supply Total	$769,774
Commercial Power	
Power Sub-Allocation	$566,051,934
Refuge Water Supply (Level 2) – Water Supply Sub-Allocation	$31,283,269
B2 Water Supply – Water Supply Sub-Allocation	$1,674,137
Refuge Water Supply (Level 2) – PUE Sub-Allocation	$4,714,040
SCRB Allocation & Sub-Allocation Sub-Total	*$603,723,380*
Direct Assigned Cost – Safety of Dams	$1,184,217
Direct Assigned Cost - Other	$4,984,127
Direct Assigned Cost Sub-Total	*$6,168,344*
Commercial Power Total	$609,891,724
Flood Control	
Flood Control Total	**$331,281,759**
Fish and Wildlife Enhancement	
Fish and Wildlife Enhancement Total	**$0**
Recreation	
Recreation Total	**$5,742,471**
Navigation	
Navigation Total	**$0**
Water Quality	
Water Quality Total	**$89,358,743**

Cost Category	Construction
Direct Assigned Costs (Non-Reimbursable)	
Federal – Safety of Dams	$27,039,235
Federal - Other	$170,655,307
Direct Assigned Cost – Federal Sub-Total	***$197,694,542***
State	$248,310,255
Direct Assigned Cost – State Sub-Total	***$248,310,255***
State & Local	$4,467,386
Direct Assigned Cost – State & Local Sub-Total	***$4,467,386***
Repayment Contracts	
Irrigation	$361,392,079
M&I	$227,656,572
Commercial Power	$8,568,500
Total Allocated Costs (SCRB)	**$2,228,242,485**
Total Direct Assigned Costs [2]	**$470,112,974**
Total Repayment Contracts	**$597,617,151**
Total Costs for Repayment	**$3,295,972,610**

1. The table excludes additional repayment obligations and costs not allocated discussed in Section 3.5 and Section 3.6, respectively.
2. Direct assigned costs reflect construction costs only and therefore do not match the values reported in Section 3.3.

NA = Not Applicable

Chapter 11. Final Cost Allocation (Two-Period Merge)

This chapter presents the results of the final CVP cost allocation which represents the merger of the Period 1 allocation (historic allocation) and Period 2 allocation (prospective allocation). The two periods are merged based on an equal weighting as outlined in the two cost allocation and two-period repayment approach (see Section 5.1). The information presented in this chapter for the final cost allocation focuses on the allocation of CVP construction cost and the resultant assignment of costs for repayment purposes, which will be incorporated into the water ratesetting process.

The Period 1 allocation is based on the 1975 cost allocation factors and current sub-allocation process. Reclamation prepares an annual update to the interim allocation of the CVP for plant-in-service (construction) and O&M costs. The 2013 annual plant-in-service allocation is the basis for the allocation of costs associated with construction and IDC for Period 1.[33] The Period 2 allocation is based on the prospective analysis of CVP costs and benefits described in this report. The final cost allocation is a merge of the Period 1 and Period 2 allocations as described in Chapter 5, *Key Concepts and Assumptions*.

11.1 Final Cost Allocation Results

11.1.1 Construction Allocation

The results of the two-cost allocation and two-period repayment merge of construction costs are shown in Table 11-1. The table shows the total allocation for both Period 1 and Period 2, the weighted allocation for both periods, and the merger of the two periods that represents the final cost allocation. The total costs allocated in each period are equal; however, the costs are distributed differently based on different allocation of costs in Period 1 and Period 2. The total of the allocated costs in the two cost allocation two-period repayment merger is $3,900,200,339.

Table 11-1 includes plant-in-service costs that are included in the CAS Facility List as well as other costs that are part of the annual CVP cost allocation that are assigned to water and power users for repayment. Repayment contracts and additional repayment obligations are not affected by the Period 2 allocation, and therefore, these costs are fixed across the two periods. Costs not allocated, including CVPIA, authorized deferred use and recent Folsom SOD costs, are shown separately in Table 11-1.

[33] The 2013 plant-in-service allocation is used for consistency with the base year (2013) used in the CAS.

Table 11-1. Final Cost Allocation (Merge) – Construction (Nominal Dollars)

Type of Cost	Period 1	Period 2	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
Authorized Purposes & Sub-Purposes					
Water Supply – Irrigation	$1,178,115,286	$1,068,517,722	$589,057,643	$534,258,861	$1,123,316,504
Water Supply – M&I	$106,873,582	$142,321,083	$53,436,791	$71,160,542	$124,597,333
Power – Commercial	$674,248,511	$609,891,724	$337,124,256	$304,945,862	$642,070,118
Flood Control	$139,282,872	$331,281,759	$69,641,436	$165,640,880	$235,282,316
Water Quality	$5,607,545	$89,358,743	$2,803,773	$44,679,372	$47,483,145
Recreation	$74,998,433	$5,742,471	$37,499,217	$2,871,236	$40,370,453
Navigation	$6,423,948	$0	$3,211,974	$0	$3,211,974
Fish & Wildlife Enhancement [1]	–	–	–	–	–
Non-Reimbursable (Other)					
Federal	$258,046,528	$198,271,873	$129,023,264	$99,135,936	$228,159,200
State	$250,429,656	$248,502,699	$125,214,828	$124,251,349	$249,466,177
State & Local	$4,329,037	$4,467,386	$2,164,519	$2,233,693	$4,398,212
Repayment Contracts					
Irrigation	$361,392,079	$361,392,079	$180,696,040	$180,696,040	$361,392,079
M&I	$227,656,572	$227,656,572	$113,828,286	$113,828,286	$227,656,572

Type of Cost	Period 1	Period 2	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
Commercial Power	$8,568,500	$8,568,500	$4,274,250	$4,274,250	$8,568,500
Facility List Sub-Total	***$3,295,972,549***	***$3,295,972,610***	***$1,647,986,277***	***$1,647,986,307***	***$3,295,972,584***
Additional Repayment Obligations					
Repayment Obligations – USACE					
Irrigation	$19,686,165	$19,686,165	$9,843,083	$9,843,083	$19,686,166
M&I	$447,937	$447,937	$223,969	$223,969	$447,938
WAPA Retired Assets					
Irrigation	$8,464,815	$8,464,815	$4,232,408	$4,232,408	$8,464,816
M&I	$1,207,155	$1,207,155	$603,578	$603,578	$1,207,156
Commercial Power	$35,649,679	$35,649,679	$17,824,840	$17,824,840	$35,649,680
Non-Reimbursable (Federal)	$213,468	$213,468	$106,734	$106,734	$213,468
Non-Reimbursable (State)	$16,115	$16,115	$8,058	$8,058	$16,116
CA-OR Transmission Project	$20,282,786	$20,282,786	$10,141,393	$10,141,393	$20,282,786
Additional Repayment Obligations Sub-Total	***$85,968,120***	***$85,968,120***	***$42,984,063***	***$42,984,063***	***$85,968,126***
Costs Not Allocated					
Authorized Deferred Use	$56,875,000	$56,875,000	$28,437,500	$28,437,500	$56,875,000

Type of Cost	Period 1	Period 2	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
CVPIA	$340,872,120	$340,872,120	$170,436,060	$170,436,060	$340,872,120
Folsom SOD – Not in Repayment	$120,512,509	$120,512,509	$60,256,255	$60,256,255	$120,512,510
Costs Not Allocated Sub-Total	***$518,259,629***	***$518,259,629***	***$259,129,815***	***$259,129,815***	***$518,259,629***
Total Cost	**$3,900,200,298**	**$3,900,200,359**	**$1,950,100,154**	**$1,950,100,185**	**$3,900,200,339**

1. Fish and wildlife mitigation costs are allocated to applicable categories for repayment, including non-reimbursable costs

11.1.2 IDC Allocation

The merge of IDC costs for repayment purposes is shown in Table 11-2. IDC subject to repayment is different than estimated IDC used in the SCRB analysis and reflects actual IDC in the CVP financial records. IDC estimated for the CAS and SCRB analysis is at the appraisal level, and IDC for repayment in Period 2 will be calculated during implementation in accordance with Reclamation accounting guidelines. The merger of IDC costs will be completed after the final cost allocation is complete and IDC is calculated for Period 2 based on the methodology presented in Section 12.3.2.

The values presented in Table 11-2 includes non-reimbursable IDC costs. Non-reimbursable IDC is associated with the New Melones Unit ($27.0 million) and the San Felipe Division ($4.1 million). For the New Melones Unit, these costs are direct assigned as non-reimbursable because Reclamation does not charge IDC on irrigation costs; and for the San Felipe Division, these costs are direct assigned as non-reimbursable pursuant to an agreement between Reclamation and water contractors. Additional information on non-reimbursable IDC costs is presented in Section 3.3. Non-reimbursable IDC costs will remain fixed across Period 1 and Period 2 and are not subject to repayment.

Table 11-2. Final Cost Allocation (Merge) – IDC[1,2]

Category	Period 1 (Total)	Period 2 (Total)	Period 1 (50%)	Period 2 (50%)	Final Cost Allocation (Merge)
M&I	$5,606,224	TBD	$2,803,112	TBD	TBD
Commercial Power	$54,755,940	TBD	$27,377,970	TBD	TBD
Non-Reimbursable [3]	$31,114,589	$31,114,589	$15,557,295	$15,557,295	$31,114,589
Repayment Contracts – M&I [4]	$35,778,896	$35,778,896	$17,889,448	$17,889,448	$35,778,896
Repayment Contracts – Commercial Power [4]	$411,801	$411,801	$205,901	$205,901	$411,801
Total	**$127,255,650**	**TBD**	**$63,627,825**	**TBD**	**TBD**

1. Includes IDC for both Reclamation and WAPA facilities
2. Excludes IDC associated with CVPIA facilities and Folsom SOD (Not in Repayment)
3. This value represents IDC that is included in the CVP Financial Statements but has been direct assigned as non-reimbursable based on legislation and/or agreement.
4. IDC associated with repayment contracts will remain fixed across Period 1 and Period 2.
   TBD = To be determined

11.1.3 OM&R Allocation

The allocation of OM&R costs is not subject to the two-period merger because they reflect prospective costs only. Reclamation will continue to allocate OM&R costs annually using the results of the Period 2 allocation only. Additional information related to the methodology that will be used to allocate projected OM&R costs is presented in Section 12.4.

11.1.4 Summary of Repayment Obligations

The summary of repayment obligations for construction costs is presented in Table 11-3. Repayment obligations shown in Table 11-4 reflect the costs allocated (and sub-allocated) to reimbursable and non-reimbursable purposes in Period 1, Period 2, and the final cost allocation. The breakdown of construction costs allocated across reimbursable sub-purposes is shown in Table 11-4.

Table 11-3. Summary of Repayment Obligations – Construction (Excludes IDC and OM&R)

Category	Period 1 ($)	Period 1 (%)	Period 2 ($)	Period 2 (%)	Period 2 (Change from P1)	Final Cost Allocation ($)	Final Cost Allocation (%)	Final Cost Allocation (Change from P1)
Irrigation	$1,206,266,266	30.93%	$1,096,668,702	28.12%	($109,597,564)	$1,151,467,486	29.52%	($54,798,780)
M&I	$108,528,674	2.78%	$143,976,175	3.69%	$35,447,501	$126,252,427	3.24%	$17,723,753
Commercial Power	$730,180,976	18.72%	$665,824,189	17.07%	($64,356,787)	$698,002,584	17.90%	($32,178,392)
Repayment Contracts	$597,617,151	15.32%	$597,617,151	15.32%	$0	$597,617,152	15.32%	$0
Non-reimbursable	$739,347,602	18.96%	$877,854,513	22.51%	$138,506,911	$808,601,061	20.73%	$69,253,459
CVPIA	$340,872,120	8.74%	$340,872,120	8.74%	$0	$340,872,120	8.74%	$0
Authorized Deferred Use	$56,875,000	1.46%	$56,875,000	1.46%	$0	$56,875,000	1.46%	$0
SOD – Not in Repayment	$120,512,509	3.09%	$120,512,509	3.09%	$0	$120,512,509	3.09%	$0
Total	$3,900,200,298	100.00%	$3,900,200,359	100.00%	NA	$3,900,200,339	100.00%	NA

P1 = Period 1
SOD = Safety of Dams

Table 11-4. Reimbursable Cost Distribution – Construction (Excludes IDC and OM&R)

Category[1]	Period 1 ($)	Period 1 (%)	Period 2 ($)	Period 2 (%)	Final Cost Allocation ($)	Final Cost Allocation (%)
Irrigation	$1,206,266,266	58.99%	$1,096,668,702	57.52%	$1,151,467,486	58.28%
M&I	$108,528,674	5.31%	$143,976,175	7.55%	$126,252,427	6.39%
Commercial Power	$730,180,976	35.71%	$665,824,189	34.92%	$698,002,584	35.33%
Total	**$2,044,975,916**	**100.00%**	**$1,906,469,066**	**100.00%**	**$1,975,722,497**	**100.00%**

1. Values presented in this table do not include repayment contracts.

Chapter 12. Implementation of the Final Cost Allocation

This chapter presents the proposed approach for implementing the final cost allocation in the context of the CVP water ratesetting and power repayment processes.

12.1 Cost Allocation and Repayment

The primary purpose of cost allocation is to determine the assignment of costs to project beneficiaries for repayment. As repayment requirements differ by law among the authorized purposes served by a project, a systematic and impartial process of allocation is required to quantify and assign those costs that are clearly associated with a particular purpose, and to equitably apportion the remaining joint costs that serve multiple purposes. The cost allocation process is the basis for assigning costs to project beneficiaries for repayment.

Allocated costs and estimated repayment must be determined independently. Costs are not to be allocated to a particular purpose based on the ability (or inability) of certain beneficiaries to repay allocated costs. All project purposes are to receive an equitable share of the efficiencies (and cost savings) provided of a multipurpose project. Therefore, all purposes should receive comparable treatment in the cost allocation process.

Project costs have been allocated to reimbursable and non-reimbursable purposes as presented in Chapter 11, *Final Cost Allocation (Two Period Merge)* (see Table 11-4). The reimbursable costs in the final cost allocation serve as the foundation for assigning water costs for repayment through the CVP water ratesetting process and establishing power repayment obligations.

12.2 CVP Water Ratesetting Policy

The water ratesetting process is used to calculate water service rates that recover the Federal investment in constructing and operating and maintaining the CVP. The legislation guiding the recovery of the Federal investment through water service rates is the Reclamation Project Act of 1939 (Act). Water service contracts are authorized under Sections 9c(2) and 9e of the Act for M&I and irrigation water, respectively. Water service contracts are used in cases like the CVP where there are a wide range of multipurpose facilities serving different purposes and beneficiaries (contractors). For water contractors, costs are allocated to and recovered from beneficiaries based on the amount of water received (i.e., water service). The basic unit of measurement for water deliveries, and thus cost recovery, is acre-feet of water.

For water service contracts, the Act requires the Secretary of the Interior to establish water rates for the sale of water to "produce revenue at least sufficient to cover annual O&M costs and the

appropriate share of fixed charges (construction costs) of the project." Reclamation has broad discretion under the Act for developing and implementing ratesetting policies. Formal water ratesetting policies are in place for the CVP. Specifically, Reclamation has the following two ratesetting policies which together apply to over 200 water service contractors within the CVP:

- The CVP Irrigation Ratesetting Policy (Reclamation 1988)
- The Interim CVP M&I Ratesetting Policy (Reclamation 1993)

To facilitate the CVP water ratesetting process, an allocation of construction (plant-in-service) cost is performed annually, which assigns costs to the water supply sub-purposes of irrigation and M&I. Generally, construction costs are to be recovered over 50 years. The majority of CVP facilities currently in place have costs that are recoverable through 2030. Costs are recovered through water rates based on cost pools. The following cost pools are used in the CVP: storage, conveyance, conveyance pumping, and CVP-wide costs.

There are also facility costs attributed to PUE which is allocated further to storage, conveyance pumping, and direct pumping cost pools based on the energy utilized over a 50-year period. Each cost pool is pro-rated across water contractors that benefit from the service based on chargeable water over the 50-year period.

Generally, O&M water rates are also based on cost pools. For O&M, the two main cost pools are storage and water marketing. Similar to construction, an annual O&M allocation is prepared that assigns costs to project purposes, and costs allocated to irrigation and M&I are ultimately assigned to cost pools and divided by the estimated water deliveries to develop an estimated water rate ($/AF) for that year. Subsequently, the estimated costs are trued up to determine the allocation of actual O&M costs in each cost pool. The total reimbursable cost in each cost pool is pro-rated among the water contractors required to pay for that service based on actual chargeable water.

12.3 Project Repayment (Construction & IDC Costs)

12.3.1 Construction Costs

The CVP plant-in-service (construction) allocation is prepared annually to reflect changes in CVP construction costs and sub-allocation processes that vary year to year. The results of the final cost allocation presented in Chapter 11 is representative of 2013 plant-in-service (construction) costs and water supply and power sub-allocation distributions developed as part of this study that are based on modeled conditions. However, when the final cost allocation is implemented annually, Reclamation will apply the final cost allocation results to current costs and operational conditions that are in effect at the time the annual plant-in-service allocation is prepared taking into consideration applicable ratesetting and Reclamation policy.

12.3.2 IDC Costs

IDC subject to repayment will be re-calculated for the Period 2 allocation[34]. The re-calculation of IDC in Period 2 is required to reflect the new cost allocation factors, specifically the allocation of costs to M&I and commercial power, which are the only two sub-purposes that are assigned reimbursable IDC. The process that will be used to re-calculate IDC in Period 2 will take into consideration applicable ratesetting and Reclamation policy. Once IDC is re-calculated for Period 2, it will be merged with the IDC in Period 1 (which is fixed) for inclusion in CVP water rates and power repayment obligations.

12.4 Cost Recovery (OM&R Costs)

For the purposes of the SCRB analysis, estimated OM&R costs were developed; however, these costs are not used in the ratesetting process. For ratesetting purposes, the annual CVP OM&R allocation is prepared separately from the plant-in-service (construction) allocation and represents a prospective analysis that covers projected OM&R costs for the subsequent fiscal year. The annual OM&R cost projections are derived from the budget prepared for the MP Region annually. Projected OM&R costs are ultimately reconciled to actual OM&R expenses after they become available

The structure of the OM&R cost allocation is different than the plant-in-service allocation. The plant-in-service allocation is based primarily on CVP facility costs, while the OM&R allocation not only covers ongoing costs associated with CVP facilities, it also covers more generalized OM&R costs.

After the final cost allocation is implemented, the allocation of annual OM&R costs will be based on the Period 2 allocation to the extent practicable. The allocation is intended to represent current operating conditions of the CVP. Specifically, the facility-level cost allocation factors from the Period 2 allocation will be applied to facility-level OM&R costs where applicable. For more generalized OM&R costs, appropriate cost allocation factors will be developed consistent with cost allocation principles, Reclamation policy, and applicable laws and regulations.

12.5 Future CVP Investments

Future investments in the CVP, such as CALFED projects, are currently being considered under the WIIN Act (PL 114-322). In the event that a future investment will be accompanied with outstanding repayment obligations, the feasibility report for such investment will provide a cost allocation for repayment of such investments. OM&R costs accompanying future investments will be incorporated into the OM&R allocation directly or through the cost allocation that accompanies such an investment (see CMP 09-04).

[34] Reclamation will proportionately change IDC when allocated construction amounts change and proportional adjustments are appropriate. Otherwise, IDC will be either based on those computed for the period 2 allocation or estimated per IDC policy (FIN 07-21).

12.6 Allocation of CVPIA Costs

Concurrent with the CVP CAS, a reconciliation of CVPIA expenditures is being conducted to determine whether CVPIA revenues are sufficient to recover CVPIA expenditures. Section 3406(b)(4) states that the reimbursable share "shall be allocated among project water and power users in accordance with existing project cost allocation procedures." The allocation of CVPIA costs is specified in the BPG.

CAS Facility List

CVP Cost Allocation Study Facility List (FY 2013) [1,2]

In the table below, direct assigned costs (DAC) and costs not allocated[3] (CNA) are excluded from SCRB cost allocation.

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
CVP (General)									
Centralized Water and Power System Control	$32,473,924	$0	$0	$0	$0	$0	$0	$32,473,924	$0
CVP Radio Network	$2,506,417	$0	$0	$0	$0	$0	$0	$2,506,417	$0
Telemetering Equipment	$130,180	$0	$0	$0	$0	$0	$0	$130,180	$0
American River Division									
Carrier Current Equipment - Folsom	$32,139	$0	$0	$0	$0	$0	$0	$32,139	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Folsom Dam & Reservoir, Safety of Dams (in Repayment)	$26,385,404	$0	$26,385,404	$0	$0	$0	$0	$0	$0
Folsom Dam & Reservoir	$103,754,844	$0	$0	$0	$0	$0	$0	$103,754,844	$0
Folsom Dam Pumping Plant - Enhancement	$3,144,844	$0	$0	$0	$0	$0	$0	$3,144,844	$0
Folsom Powerplant	$26,598,010	$0	$0	$0	$0	$0	$0	$26,598,010	$0
Folsom Switchyard (American River Division)	$1,396,335	$0	$0	$0	$0	$0	$0	$1,396,335	$0
Nimbus Dam & Reservoir	$6,809,933	$0	$0	$40,000	$0	$0	$0	$6,769,933	$0
Nimbus Fish Protection Facility	$1,239,913	$1,239,913	$0	$0	$0	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Nimbus Power Plant	$6,517,250	$0	$0	$0	$0	$0	$0	$6,517,250	$0
Nimbus Switchyard	$147,460	$0	$0	$0	$0	$0	$0	$147,460	$0
Permanent Operating Facilities - Folsom	$11,635,054	$0	$0	$0	$0	$0	$0	$11,635,054	$0
Replace 4160 Feeder Cable - Folsom Pumps	$351,247	$0	$0	$0	$0	$0	$0	$351,247	$0
Replace Transformer K3A - Folsom	$1,435,519	$0	$0	$0	$0	$0	$0	$1,435,519	$0
Security Improvements - Folsom	$15,399,932	$0	$0	$15,399,932	$0	$0	$0	$0	$0
Union Hills Reservoir	$80,000	$0	$0	$0	$0	$0	$0	$80,000	$0
Auburn-Folsom South Unit									

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
American River Pumping Station	$3,589,560	$0	$0	$3,589,560	$0	$0	$0	$0	$0
Folsom-South Canal	$6,696,654	$0	$0	$0	$0	$0	$2,425,000	$4,271,654	$0
Folsom-South Canal - Recreation Facilities	$334,213	$0	$0	$0	$0	$0	$0	$334,213	$0
No Hands Bridge	$1,192,567	$0	$0	$0	$0	$0	$0	$1,192,567	$0
Permanent Operating Facilities - Auburn-Folsom South	$10,142	$0	$0	$0	$0	$0	$0	$10,142	$0
Delta Division									
Automated Meters	$678,598	$0	$0	$0	$0	$0	$0	$678,598	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Carrier Current Equipment - Tracy	$189,212	$0	$0	$0	$0	$0	$0	$189,212	$0
Clayton Canal	$473,804	$0	$0	$0	$0	$0	$0	$473,804	$0
Colombia Mowry	$911,474	$0	$0	$0	$0	$0	$0	$911,474	$0
Contra Costa Canal	$5,581,989	$0	$0	$0	$0	$0	$0	$5,581,989	$0
Contra Costa Canal System - Deferred Maintenance	$542,664	$0	$0	$0	$0	$0	$0	$542,664	$0
Contra Costa Water District - Distribution System	$1,166,455	$0	$0	$0	$0	$1,166,455	$0	$0	$0
Contra Costa Fish Screen [PL 102-575, Sec. 3406(b)(5)]	$30,062,388	$0	$0	$0	$30,062,388	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Contra Costa Pumping Plant	$748,821	$0	$0	$0	$0	$0	$0	$748,821	$0
Contra Loma Dam & Reservoir	$4,514,442	$0	$0	$0	$0	$0	$0	$4,514,442	$0
Contra Loma Dam & Reservoir - Recreation Facilities	$205,367	$0	$0	$0	$0	$0	$0	$205,367	$0
Delta Cross Channel	$2,990,960	$0	$0	$0	$0	$0	$0	$2,990,960	$0
Delta-Mendota Canal	$80,251,070	$0	$0	$0	$0	$0	$0	$80,251,070	$0
Delta-Mendota Intake	$1,931,474	$0	$0	$0	$0	$0	$0	$1,931,474	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Delta-Mendota Canal-California Aqueduct Intertie	$24,399,087	$0	$0	$0	$0	$0	$0	$24,399,087	$0
Martinez Reservoir	$617,604	$0	$0	$0	$0	$0	$0	$617,604	$0
Permanent Operating Facilities - Tracy	$1,209,979	$0	$0	$0	$0	$0	$0	$1,209,979	$0
Plain View Water District - Distribution System	$544,760	$0	$0	$0	$0	$544,760	$0	$0	$0
Shortcut Pipeline	$4,725,196	$0	$0	$0	$0	$0	$0	$4,725,196	$0
Tracy Fish Collection Facility - Replace Transformers	$18,716	$0	$0	$0	$0	$0	$0	$18,716	$18,716

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Tracy Fish Protection Facility	$6,114,254	$6,114,254	$0	$0	$0	$0	$0	$0	$0
Tracy (Jones) Pumping Plant	$25,930,750	$0	$0	$0	$0	$0	$0	$25,930,750	$0
Tracy Switchyard	$2,561,553	$0	$0	$0	$0	$0	$0	$2,561,553	$0
Ygnacio Canal	$373,012	$0	$0	$0	$0	$0	$0	$373,012	$0
Ygnacio Pumping Plant	$51,194	$0	$0	$0	$0	$0	$0	$51,194	$0
Friant Division							$0		
Delano-Earlimart Irrigation District - Distribution System	$10,560,037	$0	$0	$0	$0	$10,560,037	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Exeter Irrigation District - Distribution System	$3,485,126	$0	$0	$0	$0	$3,485,126	$0	$0	$0
Friant Dam & Reservoir	$30,115,010	$0	$0	$0	$0	$0	$0	$30,115,010	$0
Friant-Kern Canal	$98,534,937	$0	$0	$0	$0	$0	$0	$98,534,937	$0
Ivanhoe Irrigation District - Distribution System	$2,150,984	$0	$0	$0	$0	$2,150,984	$0	$0	$0
Lake Woollomes - Recreation Facilities	$54,500	$0	$0	$27,250	$0	$0	$0	$27,250	$0
Lindmore Irrigation District - Distribution System	$4,991,841	$0	$0	$0	$0	$4,991,841	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Lindsay-Strathmore Irrigation District - Distribution System	$2,248,038	$0	$0	$0	$0	$2,248,038	$0	$0	$0
Madera Canal	$3,780,702	$0	$0	$0	$0	$0	$0	$3,780,702	$0
Madera Irrigation District - Distribution System	$13,496,356	$0	$0	$0	$0	$13,496,356	$0	$0	$0
Permanent Operating Facilities - Friant	$318,852	$0	$0	$0	$0	$0	$0	$318,852	$0
San Joaquin River Restoration Program	$452,788	$452,788	$0	$0	$0	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Shafter-Wasco Irrigation District - Distribution System	$8,366,979	$0	$0	$0	$0	$8,366,979	$0	$0	$0
South San Joaquin Municipal Utility District - Distribution System	$9,227,718	$0	$0	$0	$0	$9,227,718	$0	$0	$0
Stone Corral Irrigation District - Distribution System	$1,888,000	$0	$0	$0	$0	$1,888,000	$0	$0	$0
Tea Pot Dome Water District - Distribution System	$1,665,816	$0	$0	$0	$0	$1,665,816	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Sacramento River Division									
4-M Water District - Turnout	$266,546	$0	$0	$0	$0	$0	$0	$266,546	$0
Colusa County Water District - Distribution System	$17,077,314	$0	$0	$0	$0	$17,077,314	$0	$0	$0
Colusa County Water District - Relift Pumping Plant	$12,633,482	$0	$0	$0	$0	$0	$0	$12,633,482	$0
Colusa Service Area - Cortina - Relift Pumping Plant	$141,792	$0	$0	$0	$0	$0	$0	$141,792	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Colusa Service Area - Davis - Relift Pumping Plant	$180,305	$0	$0	$0	$0	$0	$0	$180,305	$0
Colusa Service Area - Other - Relift Pumping Plant	$1,949	$0	$0	$0	$0	$0	$0	$1,949	$0
Corning Canal	$5,762,097	$0	$0	$10,805	$0	$0	$0	$5,751,292	$0
Corning Canal Pumping Plant	$2,529,063	$0	$0	$0	$0	$0	$0	$2,529,063	$0
Corning Water District - Relift Pumping Plant	$2,779,835	$0	$0	$0	$0	$0	$0	$2,779,835	$0
Corning Water District - Distribution System	$3,866,292	$0	$0	$0	$0	$3,866,292	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Dunnigan Water District - Distribution System	$6,822,123	$0	$0	$0	$0	$6,822,123	$0	$0	$0
Dunnigan Water District - Relift Pumping Plant	$1,700,384	$0	$0	$0	$0	$0	$0	$1,700,384	$0
Glenn Valley Water District - Relift Pumping Plant	$1,048,845	$0	$0	$0	$0	$0	$0	$1,048,845	$0
Glide Irrigation District - Relift Pumping Plant	$1,077,496	$0	$0	$0	$0	$0	$0	$1,077,496	$0
Kanawha Water District - Relift Pumping Plant	$2,753,824	$0	$0	$0	$0	$0	$0	$2,753,824	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
La Grande Water District - Turnout	$244,897	$0	$0	$0	$0	$0	$0	$244,897	$0
Orland-Artois Water District - Distribution System	$23,702,915	$0	$0	$0	$0	$23,702,915	$0	$0	$0
Orland-Artois Water District - Relift Pumping Plant	$7,496,789	$0	$0	$0	$0	$0	$0	$7,496,789	$0
Permanent Operating Facilities - Arbuckle	$1,775,258	$0	$0	$0	$0	$0	$0	$1,775,258	$0
Permanent Operating Facilities - Red Bluff	$59,410	$0	$0	$0	$0	$0	$0	$59,410	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Permanent Operating Facilities - Red Bluff Suboffice	$3,802,995	$0	$0	$0	$0	$0	$0	$3,802,995	$0
Permanent Operating Facilities - Willows	$390,730	$0	$0	$0	$0	$0	$0	$390,730	$0
Permanent Operating Facilities - Willows Suboffice	$966,294	$0	$0	$0	$0	$0	$0	$966,294	$0
Pilot Research Pumping Plant [PL 102-575, Sec. 3406(b)(10)]	$20,858,214	$0	$0	$0	$19,809,945	$0	$0	$1,048,269	$0
Proberta Water District - Relift Pumping Plant	$172,158	$0	$0	$0	$0	$0	$0	$172,158	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Red Bluff Diversion Dam	$10,718,478	$1,759,344	$0	$0	$0	$0	$0	$8,959,134	$1,631,189
Red Bluff Pumping Plant	$178,174,932	$0	$0	$0	$178,174,932	$0	$0	$0	$0
Tehama-Colusa Canal	$205,461,879	$39,298,924	$0	$3,500	$0	$0	$54,450,000	$111,709,455	$26,510,321
Westside Water District - Relift Pumping Plant	$7,002,377	$0	$0	$0	$0	$0	$0	$7,002,377	$0
San Felipe Division									
Archeological Studies	$104,509	$0	$0	$104,509	$0	$0	$0	$0	$0
Coyote Pumping Plant	$18,167,013	$0	$0	$1,816,701	$0	$16,350,312	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Coyote Pumping Plant - 115 kv line	$2,146,829	$0	$0	$214,683	$0	$1,932,146	$0	$0	$0
Fish & Wildlife Facility - San Felipe	$334,939	$0	$0	$33,494	$0	$301,445	$0	$0	$0
Hollister Canal and Conduit	$28,830,368	$0	$0	$2,883,037	$0	$25,947,331	$0	$0	$0
Pacheco Conduit	$33,024,632	$0	$0	$3,302,463	$0	$29,722,169	$0	$0	$0
Pacheco Pumping Plant	$33,400,837	$0	$0	$3,340,084	$0	$30,060,753	$0	$0	$0
Pacheco Substation	$266,383	$0	$0	$26,638	$0	$239,745	$0	$0	$0
Pacheco Tunnel	$83,664,404	$0	$0	$8,366,440	$0	$75,297,964	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Permanent Operating Facilities - San Felipe	$260,247	$0	$0	$26,025	$0	$234,222	$0	$0	$0
San Benito County Recreation Facilities	$257,568	$0	$0	$128,784	$0	$0	$0	$128,784	$0
San Justo Dam & Reservoir	$48,102,786	$0	$0	$4,810,279	$0	$43,292,507	$0	$0	$0
Santa Clara Tunnel & Conduit	$75,398,296	$0	$0	$7,539,830	$0	$67,858,467	$0	$0	$0
Security Improvements - San Felipe	$247,305	$0	$0	$247,305	$0	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
San Joaquin Division									
San Luis Unit - Land Retirement [PL 102-575, Sec. 3408(h)(1)]	$2,365,332	$0	$0	$0	$2,365,332	$0	$0	$0	$0
SJBAP Open Lateral & Newman Canal [PL 102-575, Sec. 3406(d)]	$5,263,176	$0	$0	$0	$5,263,176	$0	$0	$0	$0
SJBAP-Bear Creek [PL 102-575, Sec. 3406(d)]	$13,083,844	$0	$0	$0	$13,083,844	$0	$0	$0	$0
SJBAP-IL4 [PL 102-575, Sec. 3406(d)]	$2,674,866	$0	$0	$0	$2,674,866	$0	$0	$0	$0
San Luis Unit									

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Arroyo Pasajero	$373,273	$0	$0	$205,300	$0	$0	$0	$167,973	$0
City of Huron - Distribution System	$76,012	$0	$0	$0	$0	$76,012	$0	$0	$0
Coalinga Canal	$8,670,356	$0	$0	$0	$0	$0	$0	$8,670,356	$0
Dos Amigos Pumping Plant	$31,878,063	$0	$0	$17,485,606	$0	$0	$0	$14,392,457	$0
Dos Amigos Switchyard	$594,700	$0	$0	$323,883	$0	$0	$0	$270,817	$0
Fish & Wildlife Facility - San Luis	$48,900	$0	$0	$26,895	$0	$0	$0	$22,005	$22,005
Lemoore NAS - Distribution System	$1,139,037	$0	$0	$0	$0	$1,139,037	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Little Panoche Creek Detention Dam & Reservoir	$3,789,791	$0	$0	$2,075,795	$0	$0	$0	$1,713,997	$0
Little Panoche Creek Detention Dam & Reservoir (Safety of Dams)	$14,524	$0	$6,536	$7,988	$0	$0	$0	$0	$0
Los Banos Creek Detention Dam & Reservoir	$5,144,073	$0	$0	$1,419,032	$0	$0	$0	$3,725,041	$0
Los Banos Creek Detention Dam & Reservoir (Safety of Dams)	$23,964	$0	$10,784	$13,180	$0	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Los Banos Creek Detention Dam & Reservoir - Recreation Facilities	$17,074	$0	$0	$9,391	$0	$0	$0	$7,683	$0
Los Banos Substation - 70 kv Breaker	$428,450	$0	$0	$0	$0	$0	$0	$428,450	$0
O'Neill Dam, Forebay & Wasteway	$8,424,155	$0	$0	$4,620,058	$0	$0	$0	$3,804,097	$0
O'Neill Dam, Forebay & Wasteway (Safety of Dams)	$12,018,091	$0	$5,408,141	$6,609,950	$0	$0	$0	$0	$0
O'Neill Dam, Forebay & Wasteway - Recreation Facilities	$3,632,540	$0	$0	$1,997,897	$0	$0	$0	$1,634,643	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
O'Neill Pumping Plant	$11,345,364	$0	$0	$0	$0	$0	$0	$11,345,364	$0
O'Neill Pumping Plant Intake Channel	$1,591,809	$0	$0	$0	$0	$0	$0	$1,591,809	$0
O'Neill Pumping Plant Switchyard	$212,474	$0	$0	$0	$0	$0	$0	$212,474	$0
Permanent Operating Facilities - San Luis	$230,708	$0	$0	$0	$0	$0	$0	$230,708	$0
Permanent Operating Facilities - State-Federal	$8,717,720	$0	$0	$4,794,746	$0	$0	$0	$3,922,974	$0
Pleasant Valley Pumping Plant	$9,638,101	$0	$0	$0	$0	$0	$0	$9,638,101	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
San Luis Canal	$199,421,183	$0	$0	$109,305,678	$0	$0	$0	$90,115,505	$0
San Luis Canal - Recreation Facilities	$561	$0	$0	$308	$0	$0	$0	$252	$0
San Luis Canal Turnouts	$18,232,186	$0	$0	$0	$0	$0	$0	$18,232,186	$0
San Luis Drain	$59,188,403	$0	$0	$6,806,851	$0	$0	$0	$52,381,552	$0
San Luis Relift Pumping Plant (Pleasant Valley Water District)	$1,362,467	$0	$0	$0	$0	$0	$0	$1,362,467	$0
San Luis Relift Pumping Plant (Westlands Water District)	$36,874,636	$0	$0	$0	$0	$0	$0	$36,874,636	$0
San Luis Dam & Reservoir	$109,409,653	$0	$0	$61,425,431	$0	$0	$0	$47,984,222	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
San Luis Dam & Reservoir - Recreation Facilities	$3,469,879	$0	$0	$1,908,433	$0	$0	$0	$1,561,446	$0
San Luis Switchyard	$1,056,316	$0	$0	$574,993	$0	$0	$0	$481,323	$0
Security Improvements - San Luis	$1,380,761	$0	$0	$1,380,761	$0	$0	$0	$0	$0
W. R. Gianelli Pump-Generating Plant	$67,274,969	$0	$0	$36,889,008	$0	$0	$0	$30,385,961	$0
Westlands Water District - Distribution System	$179,157,197	$0	$0	$0	$0	$179,157,197	$0	$0	$0
Shasta Division									
Carrier Current Equipment - Shasta	$133,697	$0	$0	$0	$0	$0	$0	$133,697	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Keswick Dam [PL 102-575, Sec. 3406(b)(11)] [5]	$13,429,968	$0	$0	$0	$2,581,549	$0	$0	$10,848,418	$0
Keswick Powerplant	$22,025,521	$0	$0	$0	$0	$0	$0	$22,025,521	$0
Keswick-Carr Microwave System	$3,445	$0	$0	$0	$0	$0	$0	$3,445	$0
Permanent Operating Facilities - Shasta	$924,586	$0	$0	$0	$0	$0	$0	$924,586	$0
Radio Rain Gauges	$643,302	$0	$0	$0	$0	$0	$0	$643,302	$0
Radio Stream Gauges	$11,145	$0	$0	$0	$0	$0	$0	$11,145	$0
Security Improvements - Shasta	$8,448,434	$0	$0	$8,448,434	$0	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Service Line to PCI Warehouse - Shasta	$2,251	$0	$0	$0	$0	$0	$0	$2,251	$0
Shasta - Toyon 13.8 KV Line	$40,404	$0	$0	$0	$0	$0	$0	$40,404	$0
Shasta - Tracy 230-kv Lines - General	$48,191	$0	$0	$0	$0	$0	$0	$48,191	$0
Shasta 230-kv Switchyard (Shasta Division)	$9,364,583	$0	$0	$0	$0	$0	$0	$9,364,583	$0
Shasta Dam & Reservoir [PL 102-575, Sec. 3406(b)(6)] [6]	$210,811,334	$0	$0	$0	$86,738,188	$0	$0	$124,073,145	$0
Shasta Powerplant	$81,833,782	$0	$0	$0	$0	$0	$0	$81,833,782	$0
Toyon Pipeline	$189,751	$0	$0	$0	$0	$0		$189,751	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Stanislaus (East Side) Division									
New Melones Dam & Reservoir	$320,010,647	$0	$0	$17,400,000	$0	$0	$0	$302,610,647	$0
New Melones Powerplant	$64,211,307	$0	$0	$0	$0	$0	$0	$64,211,307	$0
New Melones RSRCS - Roof Adm/Vhl St	$378,917	$0	$0	$0	$0	$0	$0	$378,917	$0
Trinity River Division									
Bella Vista Water District - Distribution System	$3,332,757	$0	$0	$0	$0	$3,332,757	$0	$0	$0
Buckhorn Dam PL [PL 102-575, Sec. 3406(b)(23)]	$36,993,699	$36,875,799	$0	$0	$117,900	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Clear Creek Conveyance System	$4,740,196	$0	$0	$0	$0	$0	$0	$4,740,196	$0
Clear Creek Powerplant 12-kv Standby	$16,065	$0	$0	$0	$0	$0	$0	$16,065	$0
Clear Creek Switchyard	$430,572	$0	$0	$0	$0	$0	$0	$430,572	$0
Clear Creek Tunnel	$49,952,739	$0	$0	$0	$0	$0	$0	$49,952,739	$0
Cow Creek Conveyance System	$2,700,306	$0	$0	$0	$0	$0	$0	$2,700,306	$0
CVP Radio Network - Trinity Division	$54,642	$0	$0	$0	$0	$0	$0	$54,642	$0
Folsom Switchyard (Trinity River Division)	$25,500	$0	$0	$0	$0	$0	$0	$25,500	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Judge Francis Carr Powerhouse	$42,238,196	$0	$0	$0	$0	$0	$0	$42,238,196	$0
Lewiston Diversion Dam	$3,818,709	$0	$0	$0	$0	$0	$0	$3,818,709	$0
Lewiston Fish Hatchery	$3,315,736	$3,315,736	$0	$0	$0	$0	$0	$0	$0
Lewiston Powerplant	$440,687	$0	$0	$0	$0	$0	$0	$440,687	$0
Lewiston Temperature Curtain	$955,214	$955,214	$0	$0	$0	$0	$0	$0	$0
Permanent Operating Facilities - Trinity	$355,261	$0	$0	$0	$0	$0	$0	$355,261	$0
Restoration - Lewiston Fish Hatchery	$1,258,074	$1,258,074	$0	$0	$0	$0	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Shasta 230-kv Switchyard (Trinity River Division)	$290,001	$0	$0	$0	$0	$0	$0	$290,001	$0
Spring Creek Debris Dam & Reservoir	$3,710,490	$0	$0	$0	$0	$0	$0	$3,710,490	$0
Spring Creek Powerplant	$14,472,195	$0	$0	$0	$0	$0	$0	$14,472,195	$0
Spring Creek Powerplant 13.8-kv Standby	$28,098	$0	$0	$0	$0	$0	$0	$28,098	$0
Spring Creek Switchyard	$554,367	$0	$0	$0	$0	$0	$0	$554,367	$0
Spring Creek Tunnel	$15,155,527	$0	$0	$0	$0	$0	$0	$15,155,527	$0
Tracy Switchyard	$1,017,640	$0	$0	$0	$0	$0	$0	$1,017,640	$0
Trinity Dam & Reservoir	$92,703,186	$0	$0	$0	$0	$0	$0	$92,703,186	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Trinity Powerplant	$11,987,121	$0	$0	$0	$0	$0	$0	$11,987,121	$0
Trinity River Basin Action Program	$8,073,092	$8,073,092	$0	$0	$0	$0	$0	$0	$0
Trinity River Restoration Project	$313,445	$0	$0	$0	$0	$0	$0	$313,445	$313,445
Trinity Switchyard	$384,174	$0	$0	$0	$0	$0	$0	$384,174	$0
Whiskeytown Dam & Reservoir	$17,733,127	$0	$0	$0	$0	$0	$0	$17,733,127	$0
Whiskeytown Temperature Curtain	$2,601,457	$2,601,457	$0	$0	$0	$0	$0	$0	$0
Wintu Pumping Plant	$1,159,763	$0	$0	$0	$0	$0	$0	$1,159,763	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Leased to State of California									
Los Banos Waterfowl	$40,767	$40,767	$0	$0	$0	$0	$0	$0	$0
Mendota Waterfowl	$86,147	$86,147	$0	$0	$0	$0	$0	$0	$0
Merced National Wildlife	$185,225	$185,225	$0	$0	$0	$0	$0	$0	$0
San Luis Waste Way	$88,236	$88,236	$0	$0	$0	$0	$0	$0	$0
Western Facilities									
Pacheco Pumping Plant Substation	$1,337,677	$0	$0	$133,768	$0	$1,203,910	$0	$0	$0
Coyote Pumping Plant Substation	$1,824,360	$0	$0	$182,436	$0	$1,641,924	$0	$0	$0

Facility	Plant-in-Service (Total)	Fish & Wildlife Activities (DAC)	Safety of Dams (DAC)	Other (DAC)	CVPIA (CNA)	Repayment Contracts (CNA)	Authorized Deferred Use (CNA)	Net Costs (SCRB)	Mitigation Cost[4]
Tracy Substation 69 kv to Delta-Mendota Canal	$2,464,394	$0	$0	$0	$0	$0	$0	$2,464,394	$0
Western - Other	$342,476,124	$0	$0	$0	$0	$8,568,500	$0	$333,907,624	$0
Grand Total	$3,693,719,669	$102,344,970	$31,810,865	$335,957,141	$340,872,120	$597,617,151	$56,875,000	$2,228,242,422	$28,495,676

1. The Cost Allocation Study represents the final cost allocation for CVP facilities subject to the 2030 repayment requirement. It also includes water service contracts, repayment contracts, and CVPIA facilities that have post-2030 repayment obligations. Costs for these facilities would be incorporated in the updated allocation resulting from the final CVP Cost Allocation Study but would continue to have separate repayment terms.
2. Excludes interest during construction (IDC).
3. Excludes Folsom safety-of-dams costs not in repayment ($120,755,310).
4. Mitigation costs are included as part of the net costs allocated in SCRB.
5. Includes Keswick Fish Trap – CVPIA ($2,581,549).
6. Includes Shasta Temperature Control Device - CVPIA ($86,738,188).

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Key Terms

- Amortization: Pay off gradually over time by periodic payments of principal and interest.
- Ancillary services: Energy products used to help maintain grid stability and reliability. These services are ordinarily thought of as being transmission-related and not power-related products for the purposes of ratesetting and repayment.
- Appraisal level: A level of accuracy and effort associated with an engineering cost estimating technique to estimate the cost of constructing facilities. The estimate is generally acceptable to determine the overall magnitude of costs but would not be used to estimate costs for entering into contracts. Per Reclamation Directives and Standards FAC 09-01, appraisal level cost estimates are used in appraisal reports or the like to determine whether more detailed investigations of a potential project are justified. These estimates may be prepared from cost graphs, simple sketches, or rough general designs which use the available site-specific design data.
- Authorized purpose: A project purpose authorized by an act of Congress.
- Base year: The starting point year used to measure relative changes in an economic variable such as a general price index.
- Biological opinion (BO): An opinion issued by a Federal agency whether a proposed action may endanger listed species or destroy critical habitat.
- Capitalization: Converting a schedule of periodic values into a single (annualized) value by dividing the payments by a factor which is dependent on the interest rate selected.
- Capitalized value: The single value developed through the capitalization process.
- Climate change: A change in the state of the climate identified by using statistical tests, by changes in the mean and/or other statistical properties, measured over an extended period, typically decades or longer.
- Construction costs: Costs of constructing physical project features including contract (direct) costs, land and land rights, relocation of existing property, clearing and restoring lands, service facilities, designs, investigations, project management, and other general project-specific expenses.
- Construction in abeyance: Reclamation construction costs associated with temporarily suspended construction activities that Congress has not de-authorized.

- Cost allocation: The process of distributing the costs of a multipurpose project among its authorized purposes in order to determine actual reimbursable and non-reimbursable costs and the basis for assignment of costs to beneficiaries for repayment.

- Cost sharing: The value of non-Federal partners' monetary or in-kind contributions and that portion of the costs of a federally assisted project or program that is not borne by the Federal Government.

- CVP yield: Water from the Central Valley Project that is available for use.

- Deferred costs: Costs already incurred but not yet assigned to an authorized project beneficiary for repayment because of operation of law or policy.

- Diminishable facility: A multipurpose facility that can be diminished in size (resized) for a single-purpose use.

- Direct assigned costs: Costs that have been directly assigned for repayment (or designated as non-reimbursable) based on legislation, policy, and/or agreement and thus not subject to the cost allocation process.

- Economic benefits: The value of project accomplishments measured in monetary terms, which is measured by the amount that most people are willing to pay to use a given quantity of a good or service or the smallest amount that most people are willing to accept to forego the use of a given quantity of a good or service.

- Economic life: The period during which an asset is expected to yield a return.

- Financially integrated: The CVP is financially integrated in that repayment is applied to the total cost of the project and not individual project features.

- Gross Domestic Product (GDP): The total output of goods and services produced within a given country in a particular time period.

- Hydropower: Electric power generated whenever water impounded by a dam is routed through the penstocks and then spun through turbines. It can also be generated in run of the river situations when it flows through in-stream facilities.

- Implicit price deflator (also referred to GDP deflator): A measure of price inflation/deflation with respect to a specific base year calculated as the ratio of nominal GDP relative to real GDP.

- Incremental costs: Costs added to a plan to accommodate the addition of a purpose or objective, or for increasing the scale of service to one or more purposes.

- Incremental Level 4 water: The additional increment of water above Level 2 required for optimal wetland habitat management.

- Joint cost: Costs which serve more than one, and often several purposes or objectives measured as the difference between the total cost of the project and the separable costs across all project purposes.

- Joint cost factors (also referred to as remaining justifiable expenditure factors): The percentage of remaining joint costs distributed among each project purpose.

- Justifiable expenditure: The maximum amount of costs to be allocated to a project purpose and is the lesser of benefits attributable to a purpose and the cost of a hypothetical single-purpose alternative project generating the same level of benefits.

- Land fallowing: Leaving farmland unplanted for a season.

- Least cost alternative: An alternative project that will generate the same level of benefits at the lowest cost possible.

- Level 2 refuge water: The historical average refuge water deliveries specified in the 1989 Report. It is the baseline water deliveries required for wildlife habitat management.

- LIDAR: A surveying device that emits pulsed laser light to measure distance, Light Detection and Ranging.

- Long-term generation (LTGEN): A Reclamation-developed model for estimating power capacity on a monthly time step.

- Major cost driver: The material that causes a large change in a facility's cost.

- Market price: The price users or consumers may expect to pay to a third-party provider for an asset, product, or service.

- Mitigation: Projects, programs, or activities intended to offset or lessen adverse impacts to fish and wildlife resources (and other natural resources) caused by the construction and operation of a project.

- Multipurpose project: A project designed to serve more than one purpose. For example, a dam that supplies water for agricultural and domestic uses, provides flood control, and generates power.

- Non-diminishable facility: A multipurpose facility that cannot be reduced in size when estimating the single-purpose cost.

- Opportunity cost: The value of highest valued alternative use of that resource.

- Optimization model: A method for finding the most cost-effective or highest achievable performance under given constraints by maximizing desired factors and minimizing undesired one.

- Period 1 (first period): Conditions as represented in the 1975 CVP cost allocation update (under the two-period allocation/repayment approach).

- Period 2 (second period): Conditions under current and projected CVP operations and benefits (under the two-period allocation/repayment approach).

- Period of analysis: The period of analysis should be the shorter of (1) the period of time over which the plan, project, or activity being analyzed can reasonably be expected to have beneficial or adverse effects, or (2) a period of time not to exceed 100 years. In the context of the CAS, it represents a prospective 100-year timeframe.

- Plant-in-service: Facilities that have been completed and provide benefits to the project.

- PLEXOS: Energy market modeling software that estimates power benefits on an hourly basis.

- Preference power: The principle that public not-for-profit entities have the "first right" to purchase energy and capacity generated at Federal facilities. Generally such not-for-profit entities have preference to purchase Federal power at Federal water resource projects.

- Preference power customers: The not-for-profit entities that under Reclamation law and policy have preference and priority to power generated at Federal water resource projects. "First preference power customers" are a subset of preference power customers who are entitled to preference power because under Reclamation law they are defined as being within a county of origin (Trinity, Calaveras, and Tuolumne).

- Preference power generation: Generation produced from project facilities that is available to be marketed to the preference power customers.

- Present value: Incorporates the concept of the time value of money and measures in today's dollars what the value of receiving a specific amount at some future date assuming a specified interest rate.

- Profit: Revenue generated by selling a product minus all costs of production; also referred to as net revenue.

- Project beneficiaries: The persons or groups who are legislatively authorized to receive benefits from the project.

- Project-use energy (PUE): Power and energy used for project operations, e.g., main conveyance pumping, designated drainage pumping, and other designated miscellaneous electric loads directly associated with the operation of the project.

- Prospective analysis: An analysis that focuses on projected future (prospective) conditions and outcomes.

- Ratesetting: The process of determining annual CVP water rates for irrigation and M&I purposes provided for in water service contracts.

- Replacement, additions, and extraordinary maintenance (RAX): Major nonrecurring operations or maintenance on a project facility to ensure the continued safe, dependable, and reliable delivery of authorized project benefits.

- Reasonable and prudent alternatives (RPA): Alternative methods of project implementation, offered in a biological opinion reaching a jeopardy or adverse modification conclusion that would avoid the likelihood of jeopardy to the species or adverse modification of critical habitat.

- Remaining joint costs: The costs of joint use facilities that remain after all separable cost have been deducted from total project costs.

- Remaining justifiable expenditure: The justifiable expenditure for a purpose minus the separable costs for that purpose.

- Resource adequacy: Concept used by the California Independent System Operator to ensure that sufficient capacity exists to ensure reliable operation of the grid.

- Safety of Dams (SOD): A Reclamation program to either retrofit or modify dams to reduce or eliminate potential hazards associated with seismic and/or hydrologic risk of failure. It is not a project purpose.

- Separable costs: The costs that result by taking the difference between the cost of the multipurpose project and the cost of the same project with the purpose omitted. A series of cost estimates should be prepared representing the multipurpose project without each purpose. A purpose's separable costs would not only include its specific costs, but also the costs of multipurpose facilities which were needed for the addition of that purpose.

- Separable costs-remaining benefits (SCRB): A method of cost allocation where each purpose in a multipurpose project is assigned the separable costs of including that purpose plus a portion of the remaining joint costs.

- Separable joint costs: The portion of multipurpose facility costs attributed to a single purpose.

- Single-purpose alternative (SPA): The cost of the most economical (least cost) alternative which would likely be built as a single-purpose Federal project, and that would provide equivalent benefits for a single purpose as the multipurpose project provides.

- Single-purpose facility: Costs of the most economical alternative which would likely be built as a Federal project to provide equivalent benefits for a single purpose.

- Specific costs: Costs of individual physical facilities and other costs that serve only a single purpose.

- Sub-allocation: Separating an authorized project purpose or function into smaller constituent components (e.g., sub-purposes) for the purposes of a cost allocation.
- Sub-purpose: Individual component that comprises a project purpose.
- Thermal power: Power sourced from heat energy, historically steam, but can also include natural gas or nuclear-fueled generators.
- Time value of money: The concept that money available at the present time is worth more than the same amount in the future due to its potential earning capacity.
- Two cost allocation and two-period repayment approach: A modified cost allocation/repayment approach used in the CVP CAS to recognize both the historical and prospective benefits of the project.
- Water rights: The right to use water from a river, stream, body of water, or source of groundwater.
- Water year type: The hydrologic classification of individual water years; for the CAS, five water year types were used: wet, above average, below average, dry, and critical.
- Weighted average: An average resulting from multiplying each component by a factor reflecting its importance.
- Wildlife refuge: A Federal area administered for the protection of fish and wildlife as well as wildlife management areas administered by the State of California and the Grasslands Resource Conservation District.

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