Executive Summary

The purpose of this Shasta Lake Water Resources Investigation (SLWRI) Feasibility Report is to document the U.S. Department of Interior (Interior), Bureau of Reclamation (Reclamation) and cooperating agencies' evaluation of the potential enlargement of Shasta Dam and Reservoir to (1) improve anadromous fish survival in the upper Sacramento River, (2) increase water supply reliability in the Central Valley of California, and (3) address related water resource problems, needs, and opportunities.

This Final Feasibility Report presents the results of planning, engineering, environmental, social, economic, and financial studies and potential benefits and effects of alternative plans, and is a companion document to the Final Environmental Impact Statement (EIS), published under separate cover. This Final Feasibility Report, along with the Final EIS, will be used by the U.S. Congress to determine the type and extent of Federal interest in enlarging Shasta Dam and Reservoir.

The SLWRI is a feasibility study that was authorized by Congress in 1980 in Public Law 96-375 and is being conducted by Reclamation, in coordination with cooperating agencies, other resource agencies, stakeholders, and the public. The SLWRI is being conducted consistent with the 1983 U.S. Water Resources Council *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G), Reclamation directives and standards, National Environmental Policy Act (NEPA), and other pertinent Federal, State of California (State), and local laws and policies.

The SLWRI is one of five surface water storage studies recommended in the July 2000 CALFED Bay-Delta Program (CALFED) Programmatic Environmental Impact Statement/Report (PEIS/R) and August 2000 Programmatic Record of Decision (ROD). Preliminary studies in support of the CALFED PEIS/R considered more than 50 surface water storage sites throughout California and recommended more detailed study of the five sites identified in the CALFED Programmatic ROD. The Final EIS, accompanying this Final Feasibility Report, tiers to the CALFED PEIS/R.

Key Updates Since Draft Feasibility Report

Reclamation completed the SLWRI Draft Feasibility Report, accompanying Preliminary Draft EIS (DEIS), and related appendices in November 2011. These documents were released to the public in February 2012 to share information generated since the completion of the SLWRI Plan Formulation Report in December 2007 and to provide additional opportunity for public and stakeholder input. Following the release of the Draft Feasibility Report and Preliminary DEIS, alternatives and evaluations were refined for the DEIS based on several factors, including updates to Central Valley Project (CVP) and State Water Project (SWP) water operations and stakeholder input. The DEIS was released for a 90-day public review and comment period in July 2013.

This Final Feasibility Report includes the following key updates since the release of the Draft Feasibility Report:

- Updated water operations modeling and related analyses for the No-Action Alternative and comprehensive plans, including operational constraints in the:
  - The U.S. Department of the Interior, Fish and Wildlife Service (USFWS) 2008 *Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the CVP and SWP* (2008 USFWS Biological Opinion (BO))
  - The National Marine Fisheries Service (NMFS) 2009 *BO and Conference Opinion on the Long-Term Operations of the CVP and SWP* (2009 NMFS BO)
- Refinement of comprehensive plans, including refined water operations, construction features, environmental commitments, and mitigation measures
- Refinement of operational scenarios focused on anadromous fish survival, and the development, evaluation, and incorporation of Comprehensive Plan 4A (CP4A)
- Refinement of a construction funding/repayment approach where a non-Federal cost-share is provided up-front and used to reduce the need for Federal appropriations. A final recommendation cannot be made until such a cost-share agreement and other relevant considerations are addressed.

Based on the above refinements and updated evaluations and comparisons of comprehensive plans, CP4A was identified as the National Economic Development (NED) Plan, consistent with guidance in the P&G. Nonetheless, as noted in the bullet above, no formal recommendation is being made at this time.

Background

Reclamation completed constructing Shasta Dam and Reservoir in 1945. Reclamation operates Shasta Dam and Reservoir, in conjunction with other CVP facilities, to provide for the management of floodwater, storage of surplus winter runoff for irrigation and municipal and industrial (M&I) water supply, maintenance of navigation flows, protection of fish in the Sacramento River and the Sacramento-San Joaquin Delta (Delta), and hydropower generation. The Central Valley Project Improvement Act (CVPIA), enacted in 1992, added "fish and wildlife mitigation, protection, and restoration" as a priority equal to water supply, and added "fish and wildlife enhancement" as a priority equal to hydropower generation. Major modifications to Shasta Dam include construction of a temperature control device (TCD) in 1997 for improved management of water temperatures in the upper Sacramento River.

Shasta Dam and Reservoir were constructed as an integral element of the CVP, with Shasta Reservoir representing about 40 percent of the total reservoir storage capacity of the CVP. The 602-foot-tall Shasta Dam (533 feet above the streambed) and 4.55-million-acre-foot (MAF) Shasta Reservoir are located on the upper Sacramento River in Northern California (see Figure ES-1) within the Whiskeytown-Shasta-Trinity National Recreation Area (NRA). The dam and entire reservoir are within Shasta County. Shasta Lake supports extensive water-oriented recreation. Recreation within these lands is managed by the U.S. Forest Service (USFS).

In 2000, as a result of the CALFED Programmatic ROD, increasing demands for water supplies, and growing concerns over declines in ecosystem resources in the Central Valley of California, Reclamation reinitiated a feasibility investigation to evaluate the potential for enlarging Shasta Dam and Reservoir. The SLWRI is being conducted under the authority of Public Law 96-375, which was reaffirmed under Public Law 108-361, also known as the CALFED Bay-Delta Authorization Act.

Major existing projects that influence and could be influenced by modifications to Shasta Dam and Reservoir include the CVP and the SWP. In addition, several programs in the Central Valley significantly influence the SLWRI, including the CVPIA. Other programs and projects currently in the planning phase could influence future potential implementation of Shasta Dam and Reservoir enlargement. A prominent example includes the Bay Delta Conservation Plan (BDCP). This and similar projects and programs have not

been included in the evaluation of the alternative plans for this Feasibility Report because there has not been a specific decision to implement them at this time.

Figure ES-1. Location of Shasta Dam and Reservoir

Study Area

Shasta Dam and Reservoir are located on the upper Sacramento River in Northern California, about 9 miles northwest of the City of Redding. The SLWRI includes both a primary and extended study area because of the potential influence of the proposed modification of Shasta Dam and Reservoir, and subsequent system operations and water deliveries over a large geographic area.

As shown in Figure ES-2, the primary study area encompasses Shasta Dam and Lake; lower reaches of three primary tributaries flowing into Shasta Lake (Sacramento, McCloud, and Pit rivers) and all smaller tributaries flowing into the lake; Trinity and Lewiston reservoirs; and the Sacramento River downstream from Shasta Dam to about the Red Bluff Pumping Plant (RBPP) facilities, including tributaries at their confluence. The extended study area encompasses the Sacramento River downstream from RBPP, including portions of the lower American and Feather river basins, the Delta, parts of the lower San Joaquin River basin; and CVP and SWP facilities and water service areas (shown in Figure ES-3).

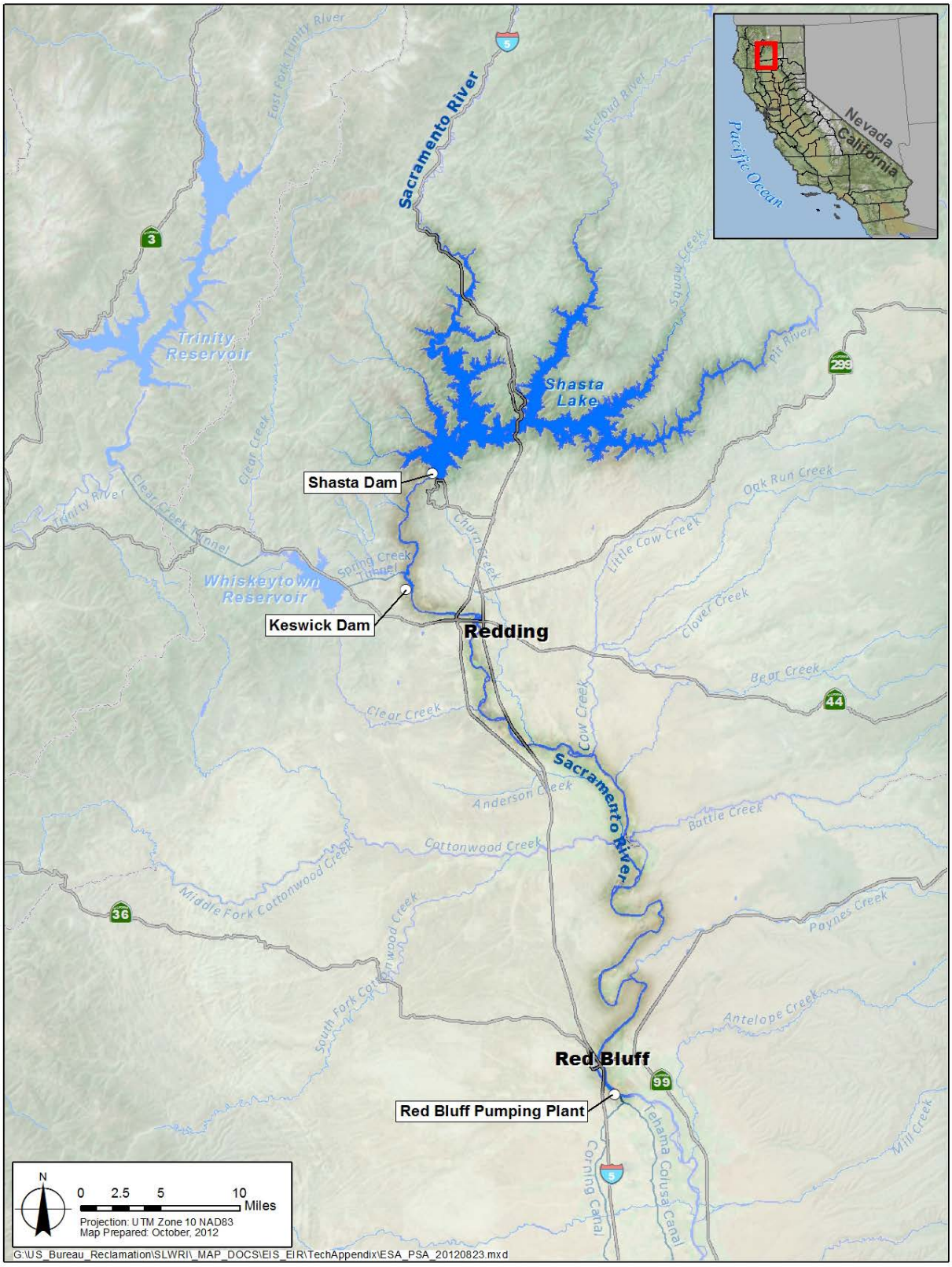


Figure ES-2. Primary Study Area—Shasta Lake Area and Sacramento River from Shasta Dam to Red Bluff Pumping Plant

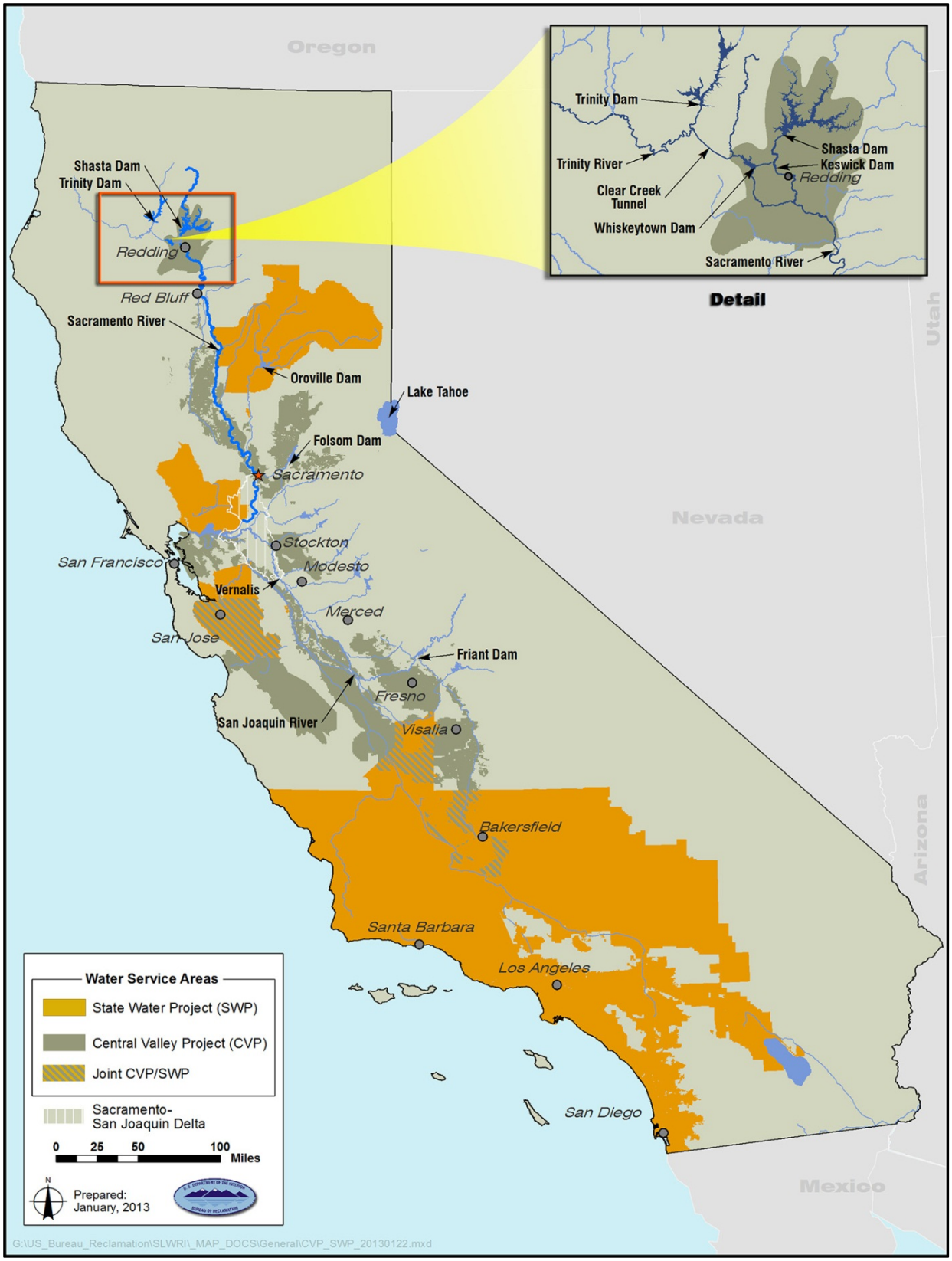


Figure ES-3. Central Valley Project and State Water Project Water Service Areas

Problems, Needs, and Opportunities

Major identified water and related resources problems, needs, and opportunities in the primary study area include anadromous fish survival, water supply reliability, and other resource needs, as described below.

Anadromous Fish Survival

A number of environmental factors have led to considerable declines in the populations of Chinook salmon and steelhead in the Sacramento River. One of the most significant factors contributing to the declines is unsuitable water temperature in the upper Sacramento River, especially in dry and critically dry years. Releases of cold water stored behind Shasta Dam can improve water temperatures in the Sacramento River for anadromous fish during critical periods.

The NMFS 2014 *Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead* states that prolonged droughts depleting the cold-water stored in Shasta Reservoir, or some related failure to manage cold-water storage, could put populations of anadromous fish at risk of severe population decline or extirpation in the long-term. Various actions ranging from minimum instream flow requirements to structural changes at Shasta Dam have been undertaken to address this problem. Despite these steps, there is still a need for additional effective actions to address anadromous fish survival in the Sacramento River, particularly upstream from the RBPP facilities.

Water Supply Reliability

Demands for water in California exceed available supplies. Reclamation's 2008 *Water Supply and Yield Study* describes dramatic increases in statewide population, land use changes, regulatory requirements, and limitations on storage and conveyance facilities, resulting in unmet water demands and subsequent increases in competition for water supplies among urban, agricultural, and environmental uses. The California Department of Water Resources (DWR) *California Water Plan Update 2013* concludes that California is facing one of the most significant water crises in its history: drought impacts are growing and climate change is affecting statewide hydrology. Challenges are greatest during drought years when water supplies are less available. Despite significant physical improvements in water resource systems and in system management over the past few decades, California still faces unreliable water supplies, continued depletion and degradation of groundwater resources, habitat and species declines, and unacceptable risks from flooding.

As the population of California grows, and the demand for adequate water supplies becomes more acute, the ability to maintain a healthy and viable industrial and agricultural economy while protecting aquatic species will be

increasingly difficult. Compounding these issues, potential effects of climate change such as changes in precipitation patterns, decreases in snowfall, and earlier snowmelt may further increase the demands on available water supplies in the future. As owner and operator of the CVP, one of the largest water storage and conveyance systems in the world, Reclamation has identified the need to increase the reliability of CVP water deliveries to its water contractors, particularly during dry and critically dry water years. Similar needs and challenges are faced by the SWP and other water projects throughout the State. The SLWRI is being conducted as one of many efforts to improve the reliability of California's water supply.

Other Resources

Other identified problems, needs, and opportunities include the need for restoring ecosystem resources in the Shasta Lake area and downstream along the Sacramento River; the need for additional flood management along the upper Sacramento River; the need for new energy generation, especially from renewable sources such as hydropower; the need for additional recreation opportunities in the north Sacramento Valley; and the need for improving water quality conditions in the Sacramento River downstream from Shasta Dam and in the Delta.

Public Involvement and Outreach and Study Management

Public outreach, involvement, and support for development of the Feasibility Report and EIS included a wide range of activities. These activities were designed, in part, to meet requirements of NEPA, Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations), and President Clinton's April 29, 1994, memorandum regarding the engagement of Federally recognized tribal governments. Reclamation and the cooperating agencies achieve these objectives through continued implementation of the 2003 Reclamation *SLWRI Strategic Agency and Public Involvement Plan*, providing multiple opportunities for the public, stakeholders, and tribes to participate in development of the SLWRI.

Overall management of the SLWRI and regular engagement of cooperating agencies and other stakeholders occurred through a Project Coordination Team (PCT). Cooperating agencies for the SLWRI, pursuant to NEPA, include the USFS, Colusa Indian Community Council of the Cachil Dehe Band of Wintun Indians, U.S. Army Corps of Engineers (USACE), and U.S. Department of the Interior, Bureau of Indian Affairs. Other participants in the PCT include USFWS, NMFS, U.S. Bureau of Land Management, and other Federal and State agencies. The Study Management Team (SMT) consisted of key policy and decision makers with direct influence over policy guidance for the study. The SMT provided overall guidance, suggestions, and comments for the study, representing viewpoints from all participating agencies.

The 2003 Reclamation *SLWRI Strategic Agency and Public Involvement Plan* was designed to assist communication between the PCT and stakeholders. This plan addresses four objectives, including (1) stakeholder identification, (2) project transparency, (3) issues and concerns resolution, and (4) project implementation. The plan has five main outreach elements: (1) stakeholder and public meetings and workshops, (2) tribal coordination, (3) environmental justice, (4) Technical Working Group coordination, and (5) PCT and SMT activities.

Outreach and public involvement included Reclamation representatives attending public meetings at the request of agencies and stakeholder groups, including the California Water Commission, McCloud River Coordinated Resource Management Plan signatories, Shasta Lake Business Owners Association, City of Redding, and Lakehead Community Development Association.

As part of the public involvement plan, briefings and workshops were held in fall 2003 and summer and fall 2004. The 2003 and 2004 briefings and workshops were held primarily to discuss the study and the study objectives, management measures, and plans identified for further development. Public scoping meetings were held in fall 2005, and the *SLWRI Environmental Scoping Report* was completed in February 2006.

Reclamation released the Draft Feasibility Report and Preliminary DEIS in February 2012. This February 2012 release was followed by an October 2012 Reclamation news release requesting additional public comment on the Draft Feasibility Report for input on potential cost, benefits, and impacts of enlarging Shasta Dam and Reservoir. The SLWRI DEIS was released for public and agency review and comment on July 1, 2013 for a 90-day review period. Written and verbal comments on the DEIS were accepted at three public hearings, and written comments were accepted at three public workshops and throughout the comment period. The Feasibility Report and accompanying Final EIS have been revised in consideration of public and agency comments.

A Notice of Availability (NOA) has been released for the Final EIS. Elected officials and representatives, government agencies, private organizations, businesses, and individual members of the public on the mailing list have received a copy of this document or a notification of document availability.

Planning Objectives, Constraints, and Considerations

The following sections describe national planning objectives and planning objectives, constraints, and considerations specific to the SLWRI.

National Planning Objectives

The Federal objectives are guided by the 1983 U.S. Water Resources Council *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* and are consistent with the 2013 Council on Environmental Quality *Principles and Requirements for Federal Investments in Water Resources*.

SLWRI-Specific Planning Objectives

Two primary and five secondary planning objectives were developed for the SLWRI on the basis of the identified water resources problems, needs, and opportunities; study authorities; and other pertinent direction, including information contained in the CALFED PEIS/R and Programmatic ROD. Primary planning objectives are those which specific alternatives are formulated to address. Secondary planning objectives are actions, operations, and/or features that should be considered in the plan formulation process, but only to the extent possible through pursuit of the primary planning objectives.

Primary Planning Objectives

- Increase the survival of anadromous fish populations in the Sacramento River, primarily upstream from the RBPP.

- Increase water supply and water supply reliability for agricultural, M&I, and environmental purposes, to help meet current and future water demands, with a focus on enlarging Shasta Dam and Reservoir.

Secondary Planning Objectives

- Conserve, restore, and enhance ecosystem resources in the Shasta Lake area and along the upper Sacramento River.

- Reduce flood damage along the Sacramento River.

- Develop additional hydropower generation capabilities at Shasta Dam.

- Maintain and increase recreation opportunities at Shasta Lake.

- Maintain or improve water quality conditions in the Sacramento River downstream from Shasta Dam and in the Delta.

Planning Constraints

Planning constraints help guide the direction and scope of the feasibility study and the formulation and evaluation of alternatives plans. Some planning constraints can also assist in defining existing and likely future resource conditions. Some planning constraints are more rigid than others. Examples of more rigid constraints include congressional direction in study authorizations; other current applicable laws, regulations, and policies; and physical conditions (e.g., topography, hydrology). Other planning constraints are less restrictive but

are still influential in guiding the process. Several key constraints identified for the SLWRI are as follows:

- **Study Authorization** – On August 30, 1935, in the Rivers and Harbors Bill, an initial amount of Federal funds was authorized for constructing Kennett (now Shasta) Dam. Initial authorization for the SLWRI derives from Public Law 96-375, and additional guidance is contained in Public Law 108-361. These legislative actions authorized an investigation of the potential benefits and costs of enlarging or replacing Shasta Dam and Reservoir.

- **CALFED PEIS/R and Programmatic ROD** – CALFED was established to "develop and implement a long-term comprehensive plan that would restore ecological health and improve water management for beneficial uses of the Bay-Delta system." The 2000 CALFED PEIS/R and Programmatic ROD include program goals, objectives, and projects primarily to benefit the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) system. The objectives of the SLWRI are consistent with the CALFED Programmatic ROD for Shasta Dam enlargement, as follows:

  Expand CVP storage in Shasta Lake by approximately 300 TAF. Such an expansion will increase the pool of cold water available to maintain lower Sacramento River temperatures needed by certain fish and provide other water management benefits, such as water supply reliability.

- **Laws, Regulations, and Policies** – Numerous laws, regulations, executive orders, and policies were considered, among them the P&G, NEPA, Fish and Wildlife Coordination Act, Clean Air Act, Clean Water Act, National Historic Preservation Act, California Public Resources Code (PRC), Federal and State Endangered Species Acts, California Environmental Quality Act (CEQA), and CVPIA. The CVPIA, including the associated Anadromous Fish Restoration Program, is pertinent because it identified specific actions for fish and wildlife mitigation, protection, restoration, and enhancement which influence water supply deliveries, river flows, and related environmental conditions in the primary and extended study areas.

Statewide Water Operation Considerations

Reclamation and DWR use CalSim-II, a specific application of the Water Resources Integrated Modeling System to Central Valley water operations, to study operations, benefits, and effects of new facilities and operational parameters for the CVP and SWP. Operational assumptions for refinement, modeling, and evaluation of potential effects of alternatives in this Final Feasibility Report and accompanying EIS were derived from the following:

- The Reclamation 2008 *Biological Assessment on the Continued Long-Term Operations of the CVP and SWP* (2008 Long-Term Operation Biological Assessment (BA))
- The 2008 USFWS BO
- The 2009 NMFS BO
- The Coordinated Operations Agreement (COA) between Reclamation and DWR for the CVP and SWP, as ratified by Congress

Ongoing consultation processes related to the 2008 USFWS and 2009 NMFS BOs have resulted in some uncertainty in future CVP and SWP operational constraints. In response to lawsuits challenging the 2008 and 2009 BOs, the District Court for the Eastern District of California remanded the BOs to USFWS and NMFS and ordered preparation of new BOs. These legal challenges may result in changes to CVP and SWP operational constraints if the revised USFWS and NMFS BOs contain new or amended reasonable and prudent alternatives (RPA). Despite this uncertainty, the 2008 USFWS and 2009 NMFS BOs contain the most recent estimate of potential changes in water operations that could occur in the near future.

Other Planning Considerations

Other planning considerations were specifically identified to help formulate, evaluate, and compare initial plans and, later, detailed alternatives, including items such as coordination with other Federal and State agencies, consistency with planning objectives, avoidance of adverse effects to environmental and cultural resources, consideration of existing projects and programs, and a 100-year period of analysis.

Formulation of Alternative Plans

Over the course of the feasibility study, consistent with P&G and NEPA, the plan formulation and evaluation process for the SLWRI was accomplished in multiple phases, as shown in Figure ES-4. All phases were conducted in coordination and collaboration with stakeholders, cooperating agencies, affected communities, and decision makers and consistent with study authorizations. All phases were also completed in consideration of Reclamation and other pertinent Federal planning procedures, requirements, directives, standards, policy, laws, and executive orders.

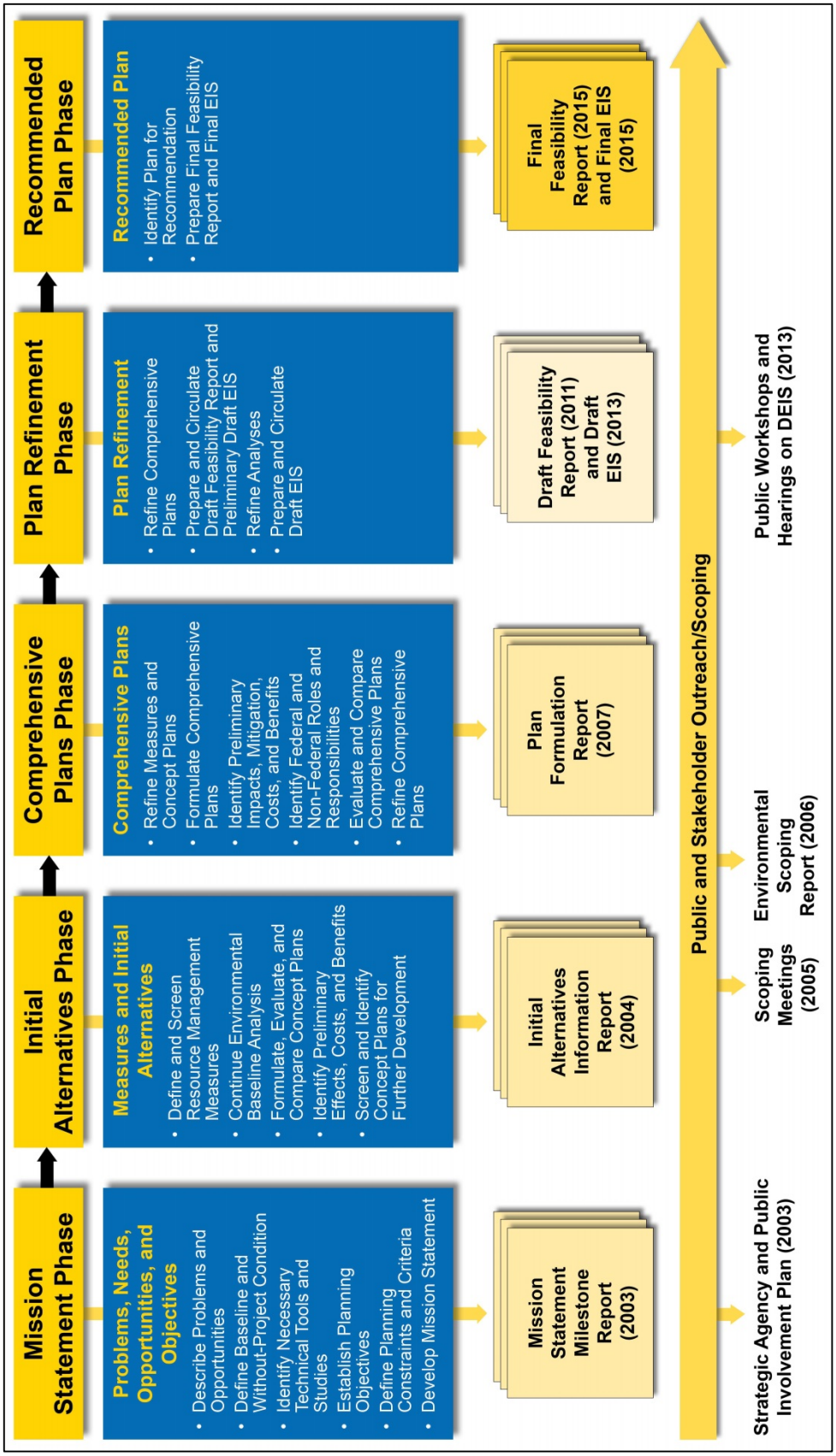


Figure ES-4. Plan Formulation Phases

Plans were developed based on two initial deliberative and iterative steps. First, problems, needs, opportunities, and constraints were specified. Second, a variety management measures were identified that could be combined into alternative plans. A management measure is a project action or feature that addresses a specific planning objective. Numerous management measures were identified for each planning objective of the SLWRI. Of the management measures considered, eight measures addressing primary planning objectives were identified for further consideration and potential inclusion in alternative plans. Additionally, eight measures addressing the secondary planning objectives were identified for further consideration and inclusion, to the extent possible, in alternative plans. Table ES-1 summarizes the 16 management measures carried forward to address the SLWRI primary and secondary planning objectives.

Concept plans (plans that are conceptual in scope) were formulated from the management measures carried forward. The purpose of this phase of the formulation process was to (1) explore an array of different strategies to address the primary planning objectives, constraints, and considerations, and (2) identify concepts that warranted possible further development. The concept plans were intended to promote discussion and provide a background for the formulation of comprehensive plans in the remainder of the feasibility study, with input from participating agencies, stakeholders, and the public.

The next step in the plan formulation process was development of comprehensive plans through combining and continuing to refine management measures and concept plans carried forward. Five comprehensive plans and a No-Action Alternative were developed for the Draft Feasibility Report and Preliminary DEIS. These comprehensive plans were further refined for the DEIS, Final Feasibility Report and Final EIS based on several factors, including updates to CVP and SWP water operations and stakeholder input. Based on comments on the Draft Feasibility Report and DEIS, a refined operational scenario (CP4A) was developed for the anadromous fish focused plan and included in the Final Feasibility Report and Final EIS.

Alternatives Considered and Eliminated from Detailed Study

Formulation of a range of alternatives for evaluation in this feasibility study began with a review of problems, needs, and opportunities, study authorities, and other pertinent direction, followed by development of primary and secondary planning objectives, and, finally, development of comprehensive plans (action alternatives) to meet the project objectives. Some project alternatives suggested during this process (e.g., raising Shasta Dam by up to 200 feet) were not retained because they did not adequately meet, or were beyond the scope of, the purpose and need statement, did not contribute to both primary planning objectives, had extremely high costs, had high social or environmental impacts, or were previously analyzed in or rejected from consideration by the CALFED agencies in the CALFED PEIS/R.

Table ES-1. Retained Management Measures to Address Planning Objectives

Planning Objective	Resources Management Measure	
	Feature/Activity	**Description**
Primary Planning Objectives		
Increase Anadromous Fish Survival	Construct Instream Aquatic Habitat	Construct instream aquatic habitat downstream from Keswick Dam
	Replenish Spawning Gravel	Replenish spawning gravel in the Sacramento River
	Modify Temperature Control Device	Make additional modifications to Shasta Dam for temperature control
	Enlarge Shasta Lake Cold-Water Pool	Enlarge Shasta Dam and Reservoir to increase the cold-water pool in the lake to benefit anadromous fish
	Modify Storage and Release Operations at Shasta Dam	Modify storage and release operations at Shasta Dam to increase anadromous fish survival
Increase Water Supply and Water Supply Reliability	Increase Conservation Storage	Increase conservation storage space in Shasta Reservoir by raising Shasta Dam
	Reoperate Shasta Dam	Increase the effective conservation storage space in Shasta Reservoir by increasing the efficiency of reservoir operation for water supply reliability
	Reduce Demand	Identify and implement, to the extent possible, water use efficiency methods
Secondary Planning Objectives		
Conserve, Restore, and Enhance Ecosystem Resources	Restore Shoreline Aquatic Habitat	Construct shoreline fish habitat around Shasta Lake
	Restore Tributary Aquatic Habitat	Construct instream fish habitat on tributaries to Shasta Lake
	Restore Riparian Habitat	Restore riparian and floodplain habitat along the upper Sacramento River
Reduce Flood Damage	Modify Flood Operations Guidelines	Update Shasta Dam and Reservoir flood management operations to improve system-wide reliability and public health and safety, and system-wide reliability
Develop Additional Hydropower Generation	Modify Hydropower Facilities	Modify existing/construct new generation facilities at Shasta Dam to take advantage of increased head
Maintain and Increase Recreation	Maintain and Enhance Recreation Facilities	Maintain and enhance recreation capacity, facilities, and opportunities
	Reoperate Reservoir	Increase recreation use by stabilizing early season filling in Shasta Lake
Maintain or Improve Water Quality	Maintain or Improve Water Quality	Improve operational flexibility for Delta water quality by increasing storage in Shasta Reservoir

Key:
Delta = Sacramento-San Joaquin Delta

No-Action Alternative and Comprehensive Plans

The No-Action Alternative and the comprehensive plans are described briefly below.

No-Action Alternative (No Additional Federal Action)

Under the No-Action Alternative, the Federal Government would continue to implement reasonably foreseeable actions, but would not take additional actions toward implementing a plan to raise Shasta Dam to help increase anadromous fish survival in the upper Sacramento River; help address water supply reliability issues in California; or help restore ecosystem resources, develop additional hydropower generation, reduce flood damage, increase recreation opportunities at Shasta Lake, or improve water quality in the Sacramento River and the Delta. Reasonably foreseeable actions include actions with current authorization, secured funding for design and construction, and environmental permitting and compliance activities that are substantially complete. The No-Action Alternative provides a basis for comparing the potential benefits and effects of the comprehensive plans.

Comprehensive Plans

Each of the comprehensive plans includes enlarging Shasta Dam and Reservoir and a variety of management measures to address, in varying degrees, all of the SLWRI planning objectives. All of the comprehensive plans include eight common management measures:

- Enlarge the Shasta Lake cold-water pool by raising Shasta Dam to enlarge Shasta Reservoir.
- Modify the Shasta Dam temperature control device by raising the existing structure and modifying the shutter control.
- Increase conservation storage by raising Shasta Dam.
- Reduce demand through a water conservation program to augment current water use efficiency practices.
- Modify Shasta Dam flood operations by adjusting the existing flood operation guidelines, or rule curves, to reflect physical modifications, such as an increase in dam/spillway elevation; the rule curves would be revised with the goal of reducing flood damage and enhancing other objectives to the extent possible.
- Modify hydropower facilities to enable their continued efficient use.
- Maintain and increase recreation opportunities at Shasta Lake.

- Maintain or improve water quality by increasing Delta outflow during drought years and reducing salinity during critical periods, providing additional operational flexibility for responses to Delta emergencies.

In addition, Reclamation has incorporated environmental commitments into each of the comprehensive plans to avoid or minimize potential impacts. Each comprehensive plan also includes mitigation measures where feasible to avoid, minimize, rectify, reduce, or compensate for significant and potentially significant impacts.

Comprehensive Plan 1 (CP1) – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

	CP1
Dam Raise	*6.5 feet*
Increased Storage	*256,000 acre-feet*
Focus	*Anadromous Fish Survival & Water Supply Reliability*
Major Components	*Dam Modifications & Reservoir Area Relocations*
	Environmental Commitments & Mitigation Measures

CP1 focuses on both anadromous fish survival and water supply reliability. This alternative primarily consists of enlarging Shasta Dam by raising the crest 6.5 feet and implementing the eight common management measures described above. CP1 also includes implementing environmental commitments and mitigation measures. Raising Shasta Dam by 6.5 feet, in conjunction with spillway modifications, would result in an increase in full pool depth of 8.5 feet and an additional 256,000 acre-feet of storage capacity in Shasta Reservoir. Operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations, except during dry and critical years when a portion of the increased storage in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. Enlarging Shasta Reservoir would increase the depth and volume of the cold-water pool, increasing the ability of Reclamation to release cold water from Shasta Dam and regulate seasonal water temperatures and flows for fish in the upper Sacramento River during critical periods. CP1 would also help reduce future water shortages through increasing water supply reliability for irrigation and M&I deliveries primarily during drought periods.

Comprehensive Plan 2 (CP2) – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

	CP2
Dam Raise	*12.5 feet*
Increased Storage	*443,000 acre-feet*
Focus	*Anadromous Fish Survival & Water Supply Reliability*
Major Components	*Dam Modifications & Reservoir Area Relocations*
	Environmental Commitments & Mitigation Measures

CP2 focuses on both anadromous fish survival and water supply reliability. This alternative primarily consists of enlarging Shasta Dam by raising the crest 12.5 feet and implementing the eight common management measures described above. CP2 also includes implementing environmental commitments and mitigation measures. Raising Shasta Dam by 12.5 feet, in conjunction with spillway modifications, would result in an increase in full pool depth of 14.5 feet and an additional 443,000 acre-feet of storage capacity in Shasta Reservoir. Operations for water supply, hydropower, and environmental and other regulatory requirements, would be similar to existing operations, except during dry and critical years when a portion of the increased storage in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP2 would increase the ability of Shasta Dam to regulate seasonal water temperatures and flows for fish, primarily during critical periods, and would help reduce future water shortages through increasing water supply reliability for irrigation and M&I deliveries.

Comprehensive Plan 3 (CP3) – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

	CP3
Dam Raise	*18.5 feet*
Increased Storage	*634,000 acre-feet*
Focus	*Agricultural Water Supply Reliability & Anadromous Fish Survival*
Major Components	*Dam Modifications & Reservoir Area Relocations*
	Environmental Commitments & Mitigation Measures

CP3 focuses on both agricultural water supply reliability and anadromous fish survival. This alternative primarily consists of enlarging Shasta Dam by raising the dam crest 18.5 feet and implementing the eight common management measures described above. CP3 also includes implementing environmental commitments and mitigation measures. Although higher dam raises are technically feasible, 18.5 feet is the largest dam raise that would not require extensive and costly reservoir area relocations, such as relocating the Pit River Bridge, Interstate 5, and the Union Pacific Railroad tunnels. Raising Shasta Dam by 18.5 feet, in conjunction with spillway modifications, would

result in an increase in full pool depth of 20.5 feet and an additional 634,000 acre-feet of storage capacity in Shasta Reservoir. Because CP3 focuses on increasing agricultural water supply reliability and anadromous fish survival, none of the increased storage capacity in Shasta Reservoir would be reserved for increasing M&I deliveries. Operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations. CP3 would increase the ability of Shasta Dam to regulate seasonal water temperatures and flows for fish, primarily during critical periods, and would help reduce future water shortages through increasing water supply reliability for irrigation deliveries.

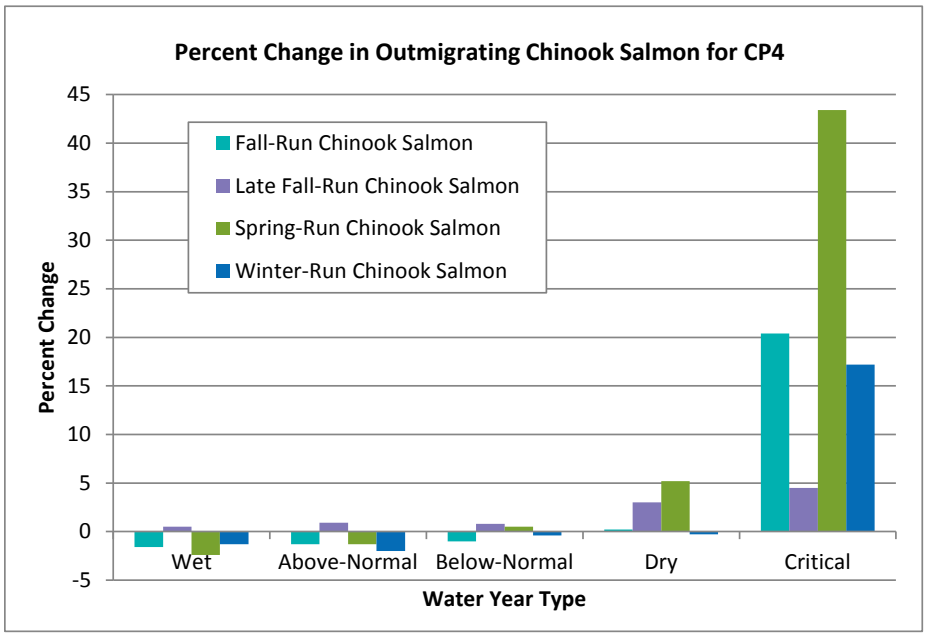
Comprehensive Plan 4 (CP4) and CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

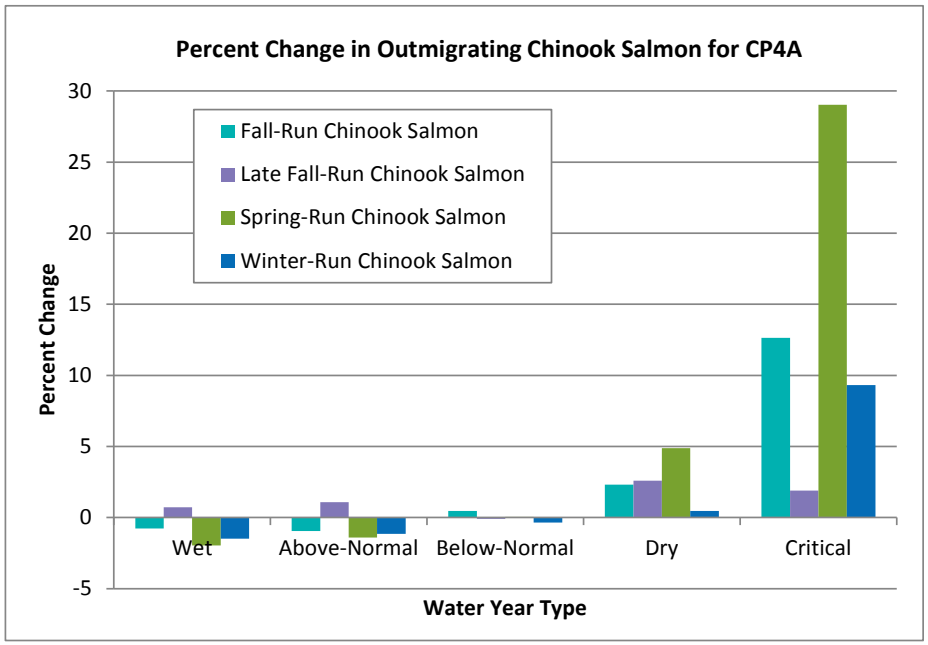
CP4 and CP4A focus on increasing anadromous fish survival, while also increasing water supply reliability. CP4 and CP4A are identical except for Shasta Dam and reservoir operations. CP4 and CP4A have similar reservoir operations in that they each dedicate a portion of the new storage in Shasta Lake for fisheries purposes, however, the portion of this dedicated storage varies.

	CP4 and CP4A
Dam Raise	*18.5 feet*
Increased Storage	*634,000 acre-feet*
Focus	*Anadromous Fish Survival with Water Supply Reliability*
Major Components	*Dam Modifications & Reservoir Area Relocations*
	Adaptive Management *CP4 – Reserving 378,000 acre-feet of Storage for Cold-Water Pool* *CP4A – Reserving 191,000 acre-feet of Storage for Cold-Water Pool*
	Augment Spawning Gravel
	Restore Riparian, Floodplain, & Side Channel Habitat
	Environmental Commitments & Mitigation Measures

CP4 and CP4A primarily consist of enlarging Shasta Dam by raising the dam crest 18.5 feet and implementing the eight common management measures. CP4 and CP4A also include implementing environmental commitments and mitigation measures. As with CP3, this raise would increase the full pool depth by 20.5 feet and enlarge total reservoir storage capacity by 634,000 acre-feet. The additional storage created by the dam raise would be used to improve the ability to meet water temperature objectives and habitat requirements for anadromous fish during drought years (see Figure ES-5) and increase water supply reliability. Of the increased reservoir storage space, about 378,000 acre-feet would be dedicated to increasing the supply of cold water for anadromous fish survival in CP4; about 191,000 acre-feet would be dedicated in CP4A. For CP4, operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as for CP1. For CP4A, operations for the

remaining portion of increased storage (approximately 443,000 acre-feet) would be the same as for CP2. Similar to CP1 and CP2, the remaining 256,000 acre-feet and 443,000 acre-feet of storage capacity for CP4 and CP4A, respectively, would further increase the ability of Shasta Dam to regulate seasonal water temperature and flow conditions for fish, and help reduce future water shortages through increasing water supply reliability for irrigation and M&I deliveries. CP4 and CP4A also include augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River.





Note: Changes in outmigrating Chinook salmon simulated using SALMOD; Water Year types based on the Sacramento Valley Water Year Hydrologic Classification

Figure ES-5. Percent Change in Outmigrating Chinook Salmon for CP4 and CP4A

Comprehensive Plan 5 (CP5) – 18.5-Foot Dam Raise, Combination Plan

	CP5
Dam Raise	*18.5 feet*
Increased Storage	*634,000 acre-feet*
Focus	*Water Supply Reliability, Anadromous Fish Survival, Ecosystem Restoration, and Recreation*
Major Components	*Dam Modifications & Reservoir Area Relocations*
	Construct Resident Fish Habitat at Shasta Lake & along Tributaries
	Augment Spawning Gravel
	Restore Riparian, Floodplain, & Side Channel Habitat
	Increase Recreation Opportunities
	Environmental Commitments & Mitigation Measures

CP5 focuses on anadromous fish survival, increased water supply reliability, ecosystem enhancements in the Shasta Lake area and the upper Sacramento River upstream from the RBPP, and increased recreation opportunities around Shasta Lake. This alternative primarily consists of raising Shasta Dam by 18.5 feet; implementing the eight common management measures; constructing additional resident fish habitat in Shasta Lake and along the lower reaches of its tributaries (the Sacramento River, the McCloud River, and Squaw Creek); constructing shoreline fish habitat around Shasta Lake; augmenting spawning gravel in the upper Sacramento River; restoring riparian, floodplain, and side channel habitat in the upper Sacramento River; and increasing recreation opportunities at Shasta Lake. CP5 also includes implementing environmental commitments and mitigation measures. Operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations, except during dry and critical years when a portion of the increased storage in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP5 would increase the ability of Shasta Dam to regulate seasonal water temperatures and flows for fish, primarily during critical periods, and would help reduce future water shortages through increasing water supply reliability for irrigation and M&I deliveries.

Major Components of Comprehensive Plans

Each of the comprehensive plans involves raising Shasta Dam by 6.5 feet to 18.5 feet, increasing the storage capacity in Shasta Reservoir by 256,000 acre-feet to 634,000 acre-feet, and constructing a common set of features, as shown in Table ES-2. Features and related construction activities under all comprehensive plans would include the following:

- Clearing vegetation from portions of the inundated reservoir area
- Constructing the dam raise, appurtenant structures, reservoir area dikes, and railroad embankments

- Relocating vehicular and railroad bridges, roadways, recreation facilities, utilities, and other infrastructure

CP4, CP4A, and CP5 would also include features and related construction activities associated with gravel augmentation and restoring riparian, floodplain, and side channel habitat along the upper Sacramento River. Additional features and related construction activities associated with Shasta Lake and tributary shoreline enhancements and features to increase Shasta Lake recreation opportunities are included under CP5. Figure ES-6 illustrates major features in the Shasta Lake area common to all comprehensive plans.

Table ES-2. Summary of Physical Features of Comprehensive Plans

	Comprehensive Plans					
Main Features	**CP1**	**CP2**	**CP3**	**CP4**	**CP4A**	**CP5**
Dam and Appurtenant Structures						
Shasta Dam						
Crest Raise (feet)	6.5	12.5	18.5	18.5	18.5	18.5
Full Pool Height Increase (feet)	8.5	14.5	20.5	20.5	20.5	20.5
Elevation of Dam Crest (feet)[1]	1,084.0	1,090.0	1,096.0	1,096.0	1,096.0	1,096.0
Elevation of Full Pool (feet)[2]	1,078.2	1,084.2	1,090.2	1,090.2	1,090.2	1,090.2
Capacity Increase (acre-feet)	256,000	443,000	634,000	634,000	634,000	634,000
Main Dam	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.
Wing Dams	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.
Spillway	Raise crest and extend piers. Replace 3 drum gates with 6 sloping fixed-wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping fixed-wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping fixed-wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping fixed-wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping fixed-wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping fixed-wheel gates.
River Outlets	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.
Temperature Control Device	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.
Shasta Powerplant/ Penstocks	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.
Pit 7 Dam/Powerhouse	Increase height of training walls on dam spillway. Install a tailwater depression system. Modify other Pit 7 ancillary facilities.	Increase height of training walls on dam spillway. Install a tailwater depression system. Modify other Pit 7 ancillary facilities.	Increase height of training walls on dam spillway. Install a tailwater depression system. Modify other Pit 7 ancillary facilities.	Increase height of training walls on dam spillway. Install a tailwater depression system. Modify other Pit 7 ancillary facilities.	Increase height of training walls on dam spillway. Install a tailwater depression system. Modify other Pit 7 ancillary facilities.	Increase height of training walls on dam spillway. Install a tailwater depression system. Modify other Pit 7 ancillary facilities.

Table ES-2. Summary of Physical Features of Comprehensive Plans (contd.)

	Comprehensive Plans					
Main Features	**CP1**	**CP2**	**CP3**	**CP4**	**CP4A**	**CP5**
Reservoir Area Clearing	Clear 150 acres completely and 220 acres with overstory removal.	Clear 240 acres completely and 350 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.
Reservoir Area Dikes and Railroad Embankments	Construct 3 railroad embankments and 2 new dikes.	Construct 3 railroad embankments and 3 new dikes.	Construct 3 railroad embankments and 4 new dikes.	Construct 3 railroad embankments and 4 new dikes.	Construct 3 railroad embankments and 4 new dikes.	Construct 3 railroad embankments and 4 new dikes.
Relocations						
Roadways	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.
Length of Relocated Roadway (linear feet)	16,700	28,400	33,100	33,100	33,100	33,100
Number of Road Segments Affected	10	21	30	30	30	30
Vehicle Bridges	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.
Railroad	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge
Recreation Facilities	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 202 campsites/day-use sites/RV sites, 2 USFS facilities, 8.1 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 261 campsites/ day-use sites/RV sites, 2 USFS facilities, 9.9 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads. Add 6 trailheads and 18 miles of new hiking trails.
Utilities	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.

Table ES-2. Summary of Physical Features of Comprehensive Plans (contd.)

Comprehensive Plans						
Main Features	**CP1**	**CP2**	**CP3**	**CP4**	**CP4A**	**CP5**
Ecosystem Enhancements	None	None	None	Reserve 378 TAF of the additional storage for cold-water supply for anadromous fish. Implement adaptive management plan to benefit anadromous fish. Augment spawning gravel in the upper Sacramento River at the rate of up to 10,000 tons per year. Restore riparian, floodplain, and side channel habitat along the upper Sacramento River.	Reserve 191 TAF of the additional storage for cold-water supply for anadromous fish. Implement adaptive management plan to benefit anadromous fish. Augment spawning gravel in the upper Sacramento River at the rate of up to 10,000 tons per year. Restore riparian, floodplain, and side channel habitat along the upper Sacramento River.	Construct shoreline fish habitat around Shasta Lake. Enhance aquatic habitat in tributaries to Shasta Lake to improve fish passage. Augment spawning gravel in the upper Sacramento River at the rate of up to 10,000 tons per year. Restore riparian, floodplain, and side channel habitat along the upper Sacramento River.

Notes:

[1] Dam crest elevations are based on the National Geodetic Vertical Datum of 1929 (NGVD29). All current feasibility-level designs and figures for Shasta Dam and appurtenant structures are based on NGVD29.

[2] Full pool elevations are based on the North American Vertical Datum of 1988 (NAVD88), which is 2.66 feet higher than NGVD29. All current feasibility-level designs and figures for reservoir area infrastructure modifications and relocations to accommodate increased water levels are based on a 2001 aerial survey of the reservoir using NAVD88.

Key:

CP = comprehensive plan

RV = recreational vehicle

TAF = thousand acre-feet

USFS = U.S. Department of Agriculture, Forest Service

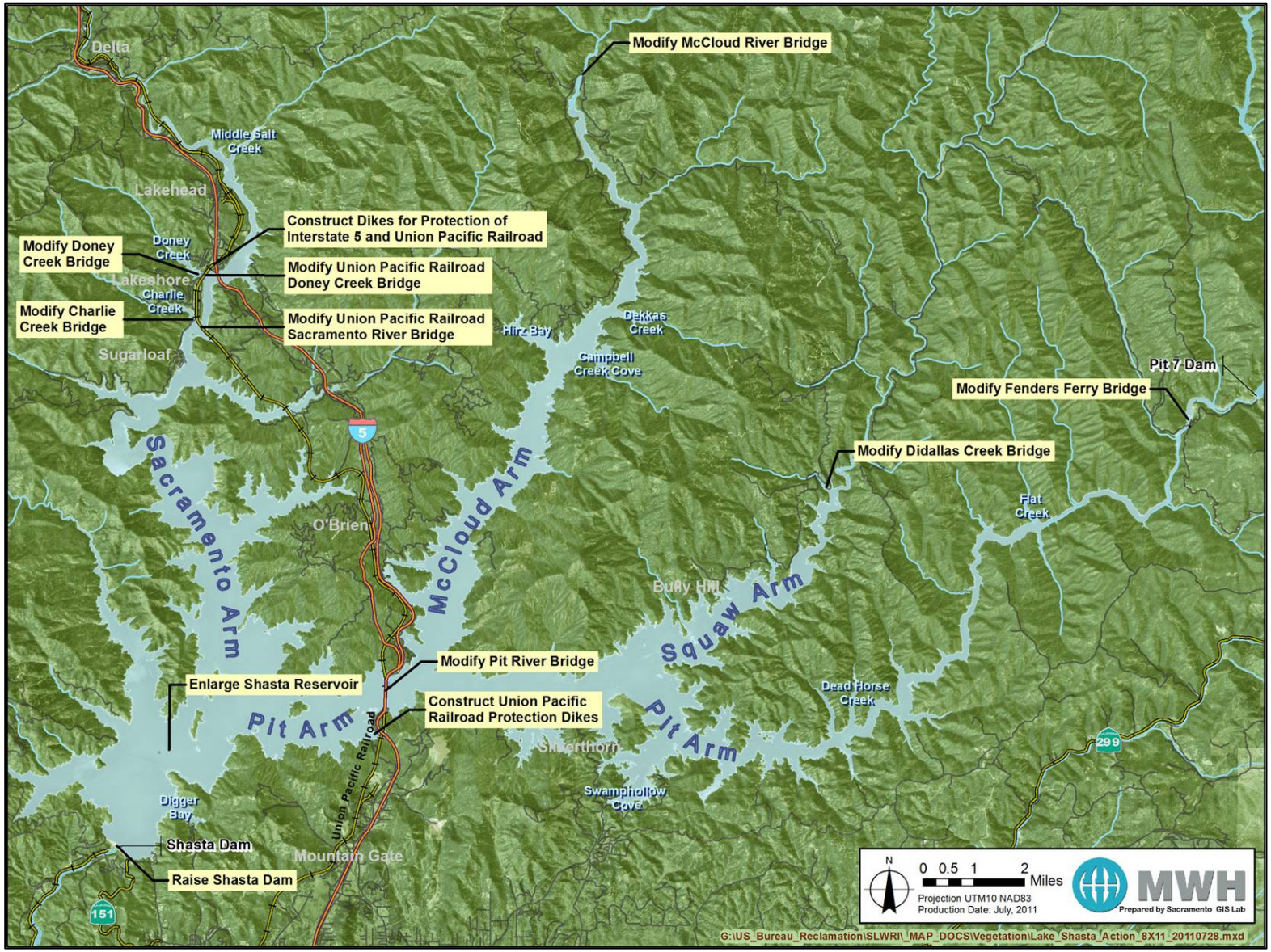
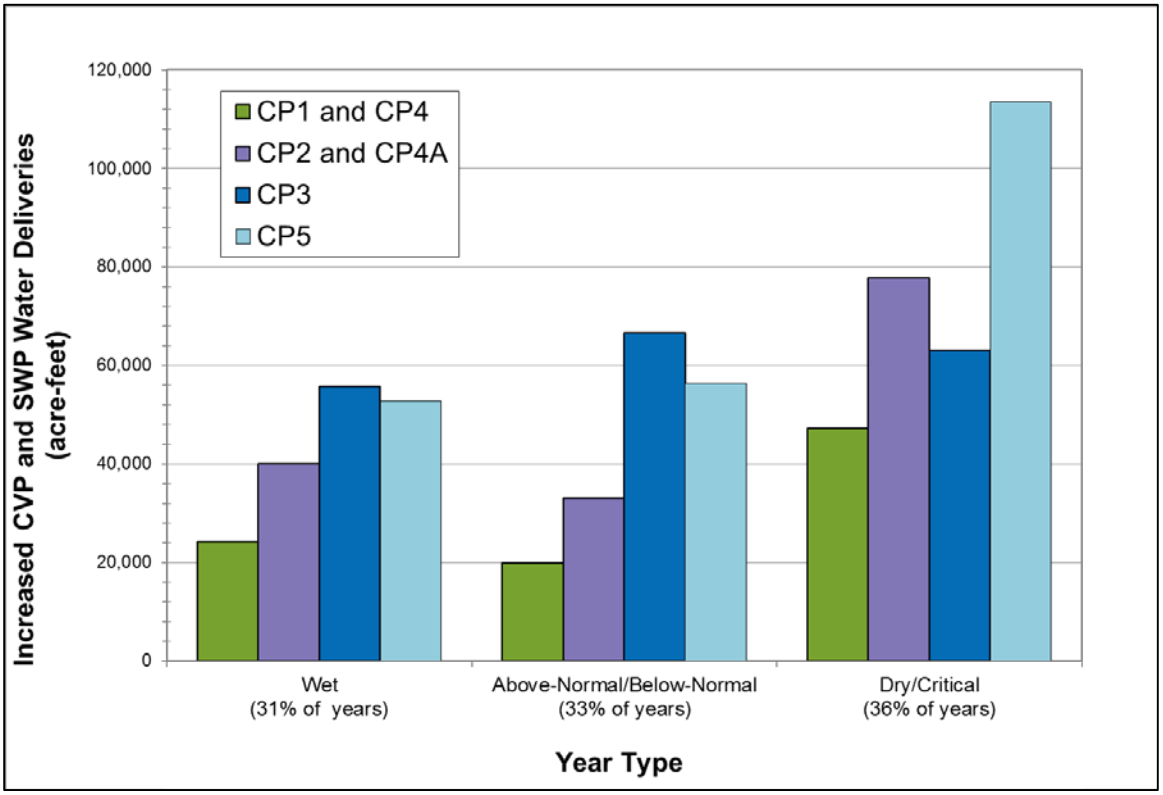


Figure ES-6. Major Features Common to All Comprehensive Plans

Summary of Comprehensive Plan Benefits and Costs

Each of the comprehensive plans would contribute in varying degrees to all of the primary and secondary planning objectives. For all of the comprehensive plans, the additional storage in Shasta Reservoir would be used to increase the ability of Reclamation to regulate water temperatures for anadromous fish and increase water supply reliability (Figure ES-7), primarily in drought periods. Table ES-3 summarizes the potential benefits and costs for each comprehensive plan. All comprehensive plans except CP1 and CP3 would have net economic benefits.



Note: Deliveries were simulated using CalSim-II and water year types were based on the Sacramento Valley Water Year Hydrologic Classification.

Figure ES-7. Comparison of Increased CVP and SWP Water Deliveries by Water Year Type for Comprehensive Plans

Table ES-3. Summary of Potential Benefits and Costs of Comprehensive Plans

Item	CP1	CP2	CP3	CP4	CP4A	CP5
Shasta Dam Raise (feet)	**6.5**	**12.5**	**18.5**	**18.5**	**18.5**	**18.5**
Total Increased Reservoir Storage (TAF)	256	443	634	634	634	634
Benefits						
Increase Anadromous Fish Survival						
Dedicated Reservoir Storage (TAF)	-	-	-	378	191	-
Increase in Outmigrating Chinook Salmon (thousand fish)[1]	61	379	207	813	710	378
Spawning Gravel Augmentation (tons)[2]	-	-	-	10,000	10,000	10,000
Side Channel Rearing Habitat Restoration				Yes	Yes	Yes
Increase Water Supply Reliability						
Total Increased Dry and Critical Year Water Supplies (TAF/year)[3]	47.3	77.8	63.1	47.3	77.8	113.5
Increased NOD Dry and Critical Year Water Supplies NOD (TAF/year)[3]	4.5	10.7	35.2	4.5	10.7	25.2
Increased SOD Dry and Critical Year Water Supplies SOD (TAF/year)[3]	42.7	67.1	28.0	42.7	67.1	88.3
Increased Water Use Efficiency Funding	Yes	Yes	Yes	Yes	Yes	Yes
Increased Emergency Water Supply Response Capability	Yes	Yes	Yes	Yes	Yes	Yes
Reduce Flood Damages						
Increased Reservoir Storage Capacity	Yes	Yes	Yes	Yes	Yes	Yes
Additional Hydropower Generation						
Increased Hydropower Generation (GWh/year)[4]	52 - 54	87 - 90	86 - 90	127 - 133	125 - 130	112 - 117
Ecosystem Restoration						
Shoreline Enhancement (acres)	-	-	-	-	-	130
Tributary Aquatic Habitat Enhancement (miles)[5]	-	-	-	-	-	6
Riparian, Floodplain, and Side Channel Habitat Restoration	-	-	-	Yes	Yes	Yes
Increased Ability to Meet Flow and Temperature Requirements Along Upper Sacramento River	Yes	Yes	Yes	Yes	Yes	Yes
Improve Water Quality						
Improved Delta Water Quality	Yes	Yes	Yes	Yes	Yes	Yes
Increased Delta Emergency Response Capability	Yes	Yes	Yes	Yes	Yes	Yes
Increase Recreation						
Recreation (user days, thousands)[6]	85 - 89	116 - 134	201 - 205	307 - 370	246 - 259	142 - 175
Modernization of Recreation Facilities	Yes	Yes	Yes	Yes	Yes	Yes
Economics						
Cost[7]						
Construction Cost ($ millions)	990	1,089	1,257	1,264	1,265	1,283
Interest During Construction ($ millions)	83	91	105	105	105	108
Total Capital Cost ($ millions)	1,073	1,180	1,362	1,370	1,371	1,391
Annual Cost ($ millions/year)[7]	45.1	51.2	53.8	57.1	59.0	61.0
Annual NED Benefits ($ millions/year) [7,8]						
Estimated Value (at inflation) [9]	29.7	61.6	42.6	86.0	88.9	74.2
Estimated Value (2% above inflation) [10]	48.4	93.3	60.7	111.6	124.1	115.2
Net NED Benefits ($ millions/year)[7,8]						
Estimated Value (at inflation)[9]	-15.4	10.5	-11.2	28.9	29.9	13.2
Estimated Value (2% above inflation)[10]	3.3	42.1	6.9	54.5	65.1	54.2

Table ES-3. Summary of Potential Benefits and Costs of Comprehensive Plans (contd.)

Notes:

[1] Numbers were derived from SALMOD and represent an index of production increase, based on the estimated average annual increase in juvenile Chinook salmon surviving to migrate downstream from the RBPP.

[2] Average amount per year for 10-year period.

[3] Total increased CVP and SWP deliveries during dry and critical years (based on the Sacramento Valley Water Year Hydrologic Water Classification). Does not reflect benefits related to water use efficiency actions included in all comprehensive plans.

[4] Annual increases in hydropower generation were estimated using two methodologies – at load center (accounting for transmission losses) and at-plant (no transmission losses). To provide a more conservative estimate of potential hydropower benefits, load center generation values were used to estimate potential benefits of increased hydropower generation under comprehensive plans. However, increased generation values reported in Chapter 23 of the accompanying EIS are based on at-plant generation values to capture the largest potential effects from changes in hydropower generation and pumping.

[5] Tributary aquatic enhancement provides for the connectivity of native fish species and other aquatic organisms between Shasta Lake and its tributaries. Estimates of benefits reflect only connectivity with perennial streams and do not reflect additional miles of connectivity with intermittent streams.

[6] Annual recreation visitor user days were estimated using two methodologies. The minimum user day value was used to estimate potential recreation benefits to provide a more conservative estimate of the potential benefits of increased recreation under comprehensive plans. However, in the accompanying EIS, the maximum user value was used for direct and indirect effects evaluations in each resource area chapter to capture the largest potential effects from increased visitation. These values do not account for increased visitation due to modernization of recreation facilities associated with all comprehensive plans.

[7] Based on January 2014 price levels, 3-1/2 discount rate, and 100-year period of analysis.

[8] Economic benefits reflect increases in anadromous fish production, water supplies for CVP and SWP deliveries, hydropower generation and ancillary services/capacity benefits, and recreation (increased user days). Does not include monetized annual benefits for ecosystem restoration, flood damage reduction, or water quality.

[9] Assumes the costs of water supplies and hydropower increase at the same rate as inflation.

[10] Includes increase of water supply and hydropower costs at 2 percent above inflation to account for growing scarcity in the future.

[11] All numbers are rounded for display purposes; therefore, line items may not sum to totals.

Key:
- = not applicable
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
EIS = Environmental Impact Statement
GWh/year = gigawatt-hours per year
NED = National Economic Development
NOD = north of Delta
SALMOD = Salmonid Population Model
SOD = south of Delta
SWP = State Water Project
TAF = thousand acre-feet

Summary of Potential Environmental Effects

A thorough evaluation of environmental effects was performed as part of the NEPA process. Potential environmental impacts of the comprehensive plans, the duration and quantification of each impact, the level of significance of each impact before mitigation, recommended mitigation measures, and the level of significance of each impact after mitigation are described in detail in each resource area chapter of the accompanying EIS. The EIS also describes the environmental commitments common to all comprehensive plans, short-term use of the human environment, maintenance and enhancement of long-term productivity, and potential irreversible or irretrievable commitments of resources for the comprehensive plans.

The comprehensive plans would affect environmental resources in the primary and extended study areas. All comprehensive plans are similar in terms of their potential environmental effects, although some adverse effects would be exacerbated by larger dam raises and by the associated scale of the effects, such as expanded construction areas and increased area of inundation around Shasta Lake. Generally, adverse effects would be mitigated to less-than-significant levels with prescribed mitigation measures. Some adverse effects for all of the comprehensive plans would remain unavoidable despite mitigation measures.

Altered flow regimes along the upper Sacramento River, changes to the areas inundated by Shasta Lake, and disturbances associated with construction activities have the potential to affect environmental resources. However, these adverse effects would be mitigated to the extent practicable.

Plan Evaluation and Comparison

The effects of the alternatives are organized and displayed in four categories that are referred to as accounts: (1) NED, (2) Environmental Quality (EQ), (3) Regional Economic Development (RED), and (4) Other Social Effects (OSE). These four accounts can encompass all significant effects of a plan on the human environment, as required by NEPA (Title 42, U.S. Code Section 4321 et seq.).

As shown in Table ES-4, and based on SALMOD and other models, all comprehensive plans except CP1 and CP3 would be cost-efficient, providing net NED benefits. CP4A would generate the maximum net economic benefits, $29.9 million annually, assuming the cost of water supply increases at the same rate as inflation. A sensitivity analysis was also performed assuming that water supply and hydropower costs would increase above the inflation rate, to account for potential growing scarcity of water and energy supplies in the future and increasing demands. Assuming an increase of water supply and hydropower costs at 2 percent above inflation, CP4A would generate $65.1 million in net benefits.

Table ES-4. Summary of Estimated Annual Costs, Annual Benefits, and Net Benefits for Comprehensive Plans[1]

Item	CP1	CP2	CP3	CP4	CP4A	CP5
Annual Cost ($ millions/year)						
Total Annual Cost	45.1	51.2	53.8	57.1	59.0	61.0
Annual Economic Benefits ($ millions/year)						
Estimated Value (at inflation)[2]	29.7	61.6	42.6	86.0	88.9	74.2
Estimated Value (2% above inflation)[3]	48.4	93.3	60.7	111.6	124.1	115.2
Benefit/Cost Ratio						
Estimated Value (at inflation)[2]	0.66	1.20	0.79	1.51	1.51	1.22
Estimated Value (2% above inflation)[3]	1.07	1.82	1.13	1.95	2.10	1.89
Net Economic Benefits ($ millions/year)[4]						
Estimated Value (at inflation)[2]	-15.4	10.5	-11.2	28.9	29.9	13.2
Estimated Value (2% above inflation)[3]	3.3	42.1	6.9	54.5	65.1	54.2

Notes:
[1] Based on January 2014 price levels, 100-year period of analysis, and 3-1/2 percent interest rate.
[2] Assumes the costs of water supplies and hydropower increases at the same rate as inflation.
[3] Includes increase of water supply and hydropower costs at 2 percent above inflation to account for growing scarcity in the future.
[4] All numbers are rounded for display purposes; therefore, line items may not sum to totals.

Key:
CP = comprehensive plan

The comprehensive plans were also compared based on the planning objectives and the four P&G criteria of completeness, effectiveness, efficiency, and acceptability (Table ES-5). Each of the plans is estimated to be complete and each appears to be effective in achieving its intended objectives. Each comprehensive plan also would be consistent with the objectives of the CVPIA, and also would contribute directly and indirectly, to varying degrees, to the four CALFED objectives of water quality, water supply reliability, ecosystem quality, and Delta levee integrity.

Table ES-5. Summary Comparison of No-Action Alternative and Comprehensive Plans

Alternative	Effectiveness	Efficiency	Completeness	Acceptability	Combined Ranking
No-Action Alternative	None	None	Very Low	Very Low	Very Low
CP1	Low	Low	Very High	High	Moderate
CP2	Moderate	Moderate to High	Very High	Moderate to High	Moderate to High
CP3	Moderate	Low	Very High	Moderate to High	Moderate
CP4	High	Very High	High	Moderate to High	High
CP4A	Very High	Very High	High	High	Very High
CP5	High	High	High	Moderate to High	High

Key:
CP = comprehensive plan

Three comprehensive plans with an 18.5-foot dam raise, CP4, CP4A, and CP5, best address the planning objectives, based on benefits and costs derived. This is primarily because of (1) a high certainty (completeness) that the plans could achieve their intended benefits, and (2) relatively high effectiveness and economic efficiency. CP1 and CP2 would have less of an adverse effect on land uses within the dam inundation area than the other comprehensive plans because CP1 and CP2 would raise the dam by 6.5 feet and 12.5 feet, respectively, compared to the 18.5-foot increase proposed for CP3, CP4, CP4A, and CP5. However, a majority of the construction activities, annual costs, and reservoir area relocations would be required under any dam raise. In addition, the smaller Shasta Dam raise alternatives would provide only a portion of the increased storage capacity of an 18.5-foot raise.

Of the three highest ranking plans, CP4A is ranked highest because it is the most effective in meeting both of the primary planning objectives, the most cost-effective, and would likely be ranked the highest in overall acceptability considering a broad range of stakeholders.

Rationale for Plan Selection

At this stage of the Federal planning and NEPA processes, the potential physical accomplishments and the benefits and costs of the alternative plans have been evaluated and compared based on established criteria.

As required by the P&G, the plan with the greatest NED benefits is to be identified as the NED Plan and is usually selected for recommendation to Congress for approval, unless the Secretary of the Interior grants an exception based on overriding considerations and merits of another plan. If another plan is recommended instead of the NED Plan, such as a locally preferred plan, the NED Plan is still presented as a basis of comparison to define the extent of Federal financial interest in the plan for recommendation.

Based on the evaluation of the potential physical accomplishments and the benefits and costs of the alternative plans, CP4A is the alternative that would achieve the highest net NED benefits while protecting the environment and is ranked the highest among the comprehensive plans in meeting the P&G criteria. Consistent with the P&Gs, since CP4A generates maximum net NED benefits, CP4A is identified as the NED Plan. CP4A is also identified as the Preferred Alternative in the Final EIS pursuant to NEPA. In addition, consistent with Department of the Interior climate change policy, CP4A is anticipated to provide benefits under a wide range of future climate scenarios and to provide additional flexibility to adapt to potential changes in hydrology under climate change. However, we are unable to make a final recommendation due to unresolved considerations as discussed in Chapter 9. Specifically, an agreement with project participants must be negotiated that addresses an up-front cost-share consistent with the beneficiary pays principle. There are also potential conflicts with State law, fish and wildlife concerns, and tribal considerations that must also be addressed.

Feasibility Determination for the National Economic Development Plan

Feasibility determination includes the following four elements:

- Technical feasibility, consisting of engineering, operations, and constructability analyses verifying that it is physically and technically possible to construct, operate, and maintain the project

- Environmental feasibility, consisting of analyses verifying that constructing or operating the project will not result in unacceptable environmental consequences to the environment

- Economic feasibility, consisting of analyses verifying that constructing and operating the project would result in net NED benefits

- Financial feasibility, consisting of examining and evaluating the project beneficiaries' ability to repay their allocated portion of the Federal investment in the project over a period of time, consistent with applicable law

The following summarizes the technical, environmental, economic, and financial feasibility of the NED Plan.

Technical Feasibility

The NED Plan is projected to be technically feasible. Designs and cost estimates for CP4A have been developed to a feasibility level. A Design, Estimating, and Construction (DEC) Review was performed in August 2008. Based on recommendations from the DEC review, designs and costs were refined to bring all construction features to a feasibility level. In April 2014, a Special Assessment was performed to verify completion of DEC recommendations.

Environmental Feasibility

The NED Plan is evaluated in the accompanying Final EIS. Environmental effects were evaluated and mitigation measures were identified. CP4A was identified as the Preferred Alternative, consistent with NEPA, in the Final EIS.

The NED Plan would affect environmental resources in the primary and extended study areas. Beneficial effects correspond to the following resource areas: hydrology, hydraulics, and water management; water quality; fisheries and aquatic resources; socioeconomics, population, and housing; recreation and public access; transportation and traffic; and power and energy. Some of the adverse effects anticipated for raising Shasta Dam would be temporary, construction-related effects that would be less than significant or would be reduced to less-than-significant levels through mitigation. Other adverse effects would be long-term, such as effects on botanical, wildlife, and cultural resources, within newly inundated areas of Shasta Lake. Some adverse effects would remain unavoidable despite mitigation measures.

Reclamation will incorporate environmental commitments and best management practices to avoid or minimize potential effects. Reclamation will, contingent on Congressional authorization, coordinate the planning, engineering, design and construction, and operations and maintenance (O&M) phases of the project with applicable resource agencies.

Economic Feasibility

The NED Plan provides the greatest net NED benefits of the alternatives evaluated while protecting the environment. As shown in Table ES-6, the NED Plan is projected to be economically feasible, generating net benefits of $29.9 million annually, assuming water supply and hydropower costs increase at the same rate as inflation. Assuming an increase of water supply and hydropower costs at 2 percent above inflation to account for growing scarcity of water and

energy supplies in the future and increasing demand, the CP4A would generate $65.1 million annually in net benefits.

Table ES-6. Estimated Costs and Benefits for the NED Plan[1]

Item	NED Plan
Costs	
Total Construction Cost ($ millions)	1,265
Interest During Construction ($ millions)	105
Annual Cost ($ millions/year)	59.0
Annual Benefits ($ millions/year)	
Estimated Value (at inflation)[2]	88.9
Estimated Value (2% above inflation)[3]	124.1
Net Economic Benefits ($ millions/year)	
Estimated Value (at inflation)[2]	29.9
Estimated Value (2% above inflation)[3]	65.1
Benefit/Cost Ratio	
Estimated Value (at inflation)[2]	1.51
Estimated Value (2% above inflation)[3]	2.10

Note:
[1] Based on January 2014 price levels, 100-year period of analysis, and 3-1/2 percent interest rate.
[2] Assumes the costs of water supplies and hydropower increases at the same rate as inflation.
[3] Includes increase of water supply and hydropower costs at 2 percent above inflation to account for growing scarcity in the future.
Key:
NED = National Economic Development

Financial Feasibility

Under the traditional Reclamation construction paradigm, where appropriated funds are used to support construction and then repaid over time, a traditional financial feasibility determination during the planning stage consists of (1) allocating costs to project purposes, (2) assigning reimbursable and nonreimbursable costs, (3) identifying potential project beneficiaries, and (4) determining project beneficiaries' potential ability to pay their allocated and assigned costs, including capital and long-term operation, maintenance, and replacement costs. The analysis and financial feasibility of the NED Plan will help inform this discussion.

Initial Cost Allocation

A separable costs-remaining benefits (SC-RB) analysis was performed for the NED Plan. The largest portion of construction costs would be expended to implement plan features required to accomplish the primary planning objectives. The allocation of costs using the SC-RB method and a 100-year period of analysis is summarized in Table ES-7.

Table ES-7. Initial Construction Cost Allocation Summary for CP4A ($ millions)[1, 2]

Item/ Calculation	Irrigation Water Supply	M&I Water Supply	Fish and Wildlife Enhancement	Hydro-power	Total
Allocated Total Annual Costs					
Average Annual Benefits	5.1	21.8	33.3	14.4	74.6
Single-Purpose Projects	43.6	44.5	42.2	14.4	-
Justifiable Expenditure (Lessor of Benefits/Single Purpose Alt Costs)	5.1	21.8	33.3	14.4	74.6
Separable Annual Costs	4.5	7.0	6.5	0.0	18.0
Remaining Benefits/Justifiable Expenditure	0.6	14.8	26.8	14.4	56.6
% Remaining Benefits	1%	26%	47%	25%	100%
Allocated Joint Cost	0.5	10.7	19.4	10.4	41.0
Total Allocated Costs	4.9	17.7	25.9	10.4	59.0
Allocated Construction Costs					
Construction Cost	103.8	303.6	614.5	243.6	1,265.5
% of Total Construction Cost	8%	24%	49%	19%	100%

Notes:
[1] January 2014 price level, 3.5 percent interest rate, and 100-year period of analysis.
[2] All numbers are rounded for display purposes, and therefore line items may not sum to totals.
Key:
- = not applicable
IDC = interest during construction
M&I = municipal and industrial
O&M = operations and maintenance

Cost Assignment

Table ES-8 shows an estimate of costs assigned to reimbursable and nonreimbursable project purposes consistent with existing Federal law for illustrative purposes. The assignment percentages are based on the cost allocation shown in Table ES-7. The final assignment of costs will be negotiated in the up-front cost-share agreement with project participants that must be completed prior to any recommendation being made.

Table ES-8. Initial Construction Cost Assignment for the NED Plan ($millions)[1]

Purpose /Action	Total		Cost Assignment			
			Nonreimbursable		Reimbursable	
	Percent	Cost	Percent	Cost	Percent	Cost
Study Objectives						
Irrigation Water Supply	8%	103.8	0%	0.0	100%	103.8
M&I Water Supply	24%	303.6	0%	0.0	100%	303.6
Fish & Wildlife Enhancement	49%	614.5	100%	614.5	0%	0.0
Hydropower	19%	243.6	0%	0.0	100%	243.6
Total	100%	1,265.5	49%	614.5	51%	651.0

Notes:
[1] All numbers are rounded for display purposes, and therefore line items may not sum to totals.
[2] Final cost allocation and assignment would occur following completion of project construction.
Key:
M&I = municipal and industrial
NED = National Economic Development

Financial Analyses For illustrative purposes, an assessment of the financial repayment capacity of different types of project beneficiaries was conducted. For irrigation water supply, an initial ability to pay analysis was conducted for contractors in four regions of the CVP. Due to the significant level of effort and associated cost to develop district level ability to pay analyses, a representative district was evaluated for each region in lieu of detailed analyses for each of the over 250 current contracting entities within the CVP service area. Based on this analysis, if water supplies and costs are fully integrated into the CVP to meet existing contracts, all four representative contractors would have the ability to pay allocated project costs. Further, increasing crop prices, transition to more valuable permanent crops, and repayment of existing CVP facility capital costs by 2030 indicate that the ability to pay is increasing for irrigation districts with the potential to benefit from the NED Plan. Increases in population and a large average annual payment capacity of municipal users indicate that potential M&I contractors that would benefit from CP4A will be able to repay the allocated project costs. Financial feasibility for hydropower beneficiaries was evaluated based on comparison of historical and projected future CVP power costs relative to market rates in the region. Based on these evaluations, power market rates have and will likely continue to exceeded CVP power costs on a long-term average annual basis, and it is expected that CVP power will remain an attractive component of power contractors' electricity generation portfolios with changes in repayment obligations associated with implementing the NED Plan.

Implementation Considerations

The following sections discuss key considerations related to implementing the NED Plan, including risk and uncertainty, unresolved issues, major topics of interest identified through public outreach, implementation requirements, and Federal and non-Federal responsibilities.

Risk and Uncertainty

Certain assumptions were made for aspects of the feasibility study based on engineering, economic, and scientific judgment. Careful consideration was given to the methodologies and evaluations for hydrology and system operations, biological analyses, economics, and cost estimates. Analyses were developed with advanced modeling and estimating tools using historical data and trends. While this is effective in helping predict outcomes for future operations, biological conditions, benefits, and costs, many uncertainties could affect the findings in this Feasibility Report. Various risks and uncertainties associated with the SLWRI and potential modification of Shasta Dam include the following:

- **Hydrology and Climate Change** – Uncertainty exists regarding the potential for, and magnitude of, climate change affecting temperature, precipitation, and snow levels. The Climate Change Modeling Appendix to the accompanying EIS discusses potential implications of

climate change for California water resources and documents sensitivity analyses of the potential for SLWRI alternatives to address primary project objectives under climate change. These evaluations indicate that the comprehensive plans are robust and would provide benefits under a range of future climate scenarios.

- **Water Supply Reliability and Demands** – Although demands are expected to exceed supplies in the future, predicting the absolute value of future water supplies and/or shortages in California is not possible. Such predictions would depend upon numerous variables, with differing opinions regarding each variable, such as anticipated population growth scenarios, land use patterns, and water use efficiency actions.

- **Anadromous Fish Populations** – Predictions of fish survival require assumptions with various levels of uncertainty, including the future number of spawners returning each year, future habitat conditions outside the project area, and potential effects of climate change. Adaptive management measures can be applied to reduce uncertainty by deliberately and iteratively designing, implementing, monitoring, and adjusting system operations to minimize adverse impacts and increase beneficial effects to fisheries.

- **Water System Operations Analysis** – Predictions of future water system operations depend on assumptions about future facilities, operational constraints, hydrology, and changes in Delta exports based on Federal regulations, including the ongoing consultation process on the long-term operations of the CVP and SWP and planning policies that are subject to change.

- **Cost Estimates** – All cost estimates, even at a feasibility-level, have inherent risks and uncertainties, including labor costs, materials availability, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, and changing regulatory environments. Of primary consideration, varying uncertainties are associated with the material and unit costs used to develop the estimates. In particular, price volatility in the construction market in the last several years, particularly between 2002 and 2009, has resulted in uncertainty in the price of construction materials and labor costs. Trends from the past few years were used to develop cost estimates for materials and labor, but other factors could further influence price changes.

- **Construction Schedule and Funding** – The construction schedule and associated costs for the NED Plan are based on receiving appropriations consistent with the schedule. As noted above and in Chapter 9, a negotiated cost-share agreement with participants,

addressing up-front financing, is necessary prior to a recommendation. Even with such an agreement, it may be difficult to obtain Federal appropriations for the Federal share. Delays in any funding may potentially extend the construction schedule, resulting in increased costs.

- **Monetizing Project Benefits** – Varying uncertainties are associated with each valuation method for the NED benefit categories. For example, uncertainties in projections of future population estimates and cropping patterns could affect estimates of economic benefits for water supply reliability. Further, due to increasing demands on a relatively fixed water supply system, water storage capacity is likely to become increasingly valuable as water shortages become more frequent and severe. To address the risk and uncertainty related to valuation of benefits, alternate valuation methods are presented for each benefit category as a sensitivity analysis for the NED Plan, CP4A. Based on this sensitivity analysis of CP4A, the resulting total economic benefits would be approximately four times higher than the benefits used in the NED analysis. This would result in a benefit/cost ratio for CP4A of approximately 5.74, in comparison to the 1.51 benefit/cost ratio based on the benefits used in the NED analysis. We note, however, that a change in fish production modeling methodology will likely also change the NED analysis.

Major Topics of Interest

Members of the public, stakeholders, other Federal agencies, and State and local agencies identified several areas of concern during the SLWRI planning process. The focus of interest varied among participants, but a common theme centered on potential impacts in the Shasta Lake area that could result from enlargement of the reservoir. Key topics of concern included the following:

- Potential effects on cultural resources in the Shasta Lake area
- Potential effects on recreation and recreation providers in the Whiskeytown-Shasta-Trinity NRA
- Potential effects on special-status species around Shasta Lake, including terrestrial and aquatic species
- Potential effects on the lower McCloud River
- Potential effects on Central Valley hydrology below CVP and SWP reservoirs and related facilities and resulting effects on water supplies for water contractors and other water users

Implementation Requirements

After this Final Feasibility Report is completed, a number of requirements will remain before a project can be implemented. These requirements are described below.

Agreement on Up-Front Cost-Share with Project Participants

A cost-share agreement addressing an up-front cost share must be negotiated prior to any recommendation being made. As noted, current Federal budget conditions and the impacts those conditions have on Reclamation's budgetary resources significantly constrain Reclamation's ability to fully fund new construction activities of the scope and magnitude required by the SLWRI. As a result, the traditional model under Federal reclamation law, with Congress providing funding from annual appropriations to cover all the costs of construction over a relatively short period of time, and a portion of those funds being repaid to the Treasury over 40 – 50 years, is unrealistic for the identified SLWRI NED Plan. Alternative means of financing (primarily non- Federal) for a majority of the construction costs of the NED Plan would have to be identified and secured in order for the Secretary of the Interior to be able to recommend a construction authorization to Congress.

Project Authorization

The proposed project, in light of any potential agreement on up-front cost-share as discussed above, would then be considered for authorization by Congress. Congress may (1) approve the NED Plan or any other plan, with or without further modification; (2) decide not to approve any action alternative; or (3) request additional information from the Secretary. If authorized, Congress may provide further direction through legislation and provide appropriations to implement the authorized project.

Project Funding/Appropriations

If authorized, a separate appropriation authorization would be required. Unless otherwise established by law, funding for construction of an authorized project is typically included in the President's budget based on (1) national priorities, (2) magnitude of the Federal commitment, (3) level of local support, (4) willingness of the non-Federal sponsor to fund its share of the project costs, and (5) budgetary constraints that may exist at the time of construction. The source, availability, appropriation process, and timing may affect the estimated construction schedule included in this Final Feasibility Report, Final EIS and supporting documents.

Regulatory and Related Requirements for Environmental Compliance

Modifications to Shasta Dam and Reservoir would be subject to the requirements of Federal, State, and local laws, policies, and environmental regulations, as described in this Feasibility Report and accompanying Final EIS and/or as supplemented or modified by authorizing legislation. Reclamation or a CEQA lead agency, assuming one is identified in the future, would need to obtain various permits and regulatory authorizations before any project

construction could begin. If Congress authorizes and funds construction to enlarge Shasta Dam and Reservoir, then preconstruction activities will be conducted to refine the designs and costs of project features and mitigation commitments, finalize implementation responsibilities, and complete supplemental documentation before preparing and submitting various permit applications to regulatory agencies for approval. Table ES-9 identifies the likely permits, responsible agencies, and their responsibilities that are required before the start of any physical project implementation activities. After the approval of all required permits, and/or waivers as may be appropriate, then the implementation of mitigation measures may proceed before, or consistent with other physical features, in compliance with NEPA and standard Federal practices.

Advanced Planning and Design Activities

If Congress authorizes and appropriates funds for construction of a project to enlarge Shasta Dam and Reservoir, then Reclamation would initiate activities in coordination with project partners and stakeholders to conduct and complete required advanced planning and design activities before implementation of the project. Several key activities include: (1) developing a post-authorization report to present the results of subsequent advanced planning actions, refinement of designs, cost estimates, updated analyses of potential effects and economics, and related NEPA and/or CEQA analyses and documentation, if necessary; (2) preparing detailed plans, specifications, and bid packages; (3) establishing agreements for reimbursable project purposes; (4) developing and/or revising operations, maintenance, and related plans; and (5) acquiring required lands, easements, and rights-of-way.

Project Construction and Transfer to O&M Status

After the feasibility study and resultant decision making, post-authorization environmental compliance, advanced planning and design efforts described above, then project implementation efforts would transition to the preparing and executing construction contracts, starting implementation of mitigation measures and/or construction activities, completing such construction activities, commissioning new facilities, and, finally, operating and establishing and/or transferring O&M responsibilities.

Table ES-9. Summary of Potential Major Permits and Approvals for Project Implementation

Agency Permit/Approval	Recommended Prerequisites for Submittal[1]
Federal	
USACE Clean Water Act Section 404	• Application • ESA compliance document for submittal to USFWS/NMFS/CDFW • Section 401 Water Quality Certification permit or application • NEPA documentation (environmental compliance documents) • Section 106 compliance documentation • Wetland delineation • Section 404 (b)(1) evaluation and identification of Least Environmentally Damaging Practical Alternative • Mitigation and monitoring plan
USFWS/NMFS Endangered Species Act Section 7 Consultation	• Regular informal technical consultation • ESA compliance document • Draft environmental compliance documents
USFWS/NMFS/CDFW Fish and Wildlife Coordination Act	• Regular informal technical consultation • ESA compliance document • Draft environmental compliance documents
SHPO[2]/ACHP National Historic Preservation Act, Section 106	• Historic Property Inventory Report • Native American consultation
State – PRC 5093.542 (c) and (d), pertaining to the McCloud River, may limit the ability of State agencies to review and process permits and related approvals for modifications of Shasta Dam and Reservoir.	
RWQCB Clean Water Act Section 401	• Application • Fish and Game Code Section 1602 application • CWA Section 404 permit or application • Draft environmental compliance documents • Mitigation and monitoring plan (if needed)
CDFW California Endangered Species Act Section 2081 – Incidental Take Permit or 2080.1 Consistency Determination	• Informal technical consultation • Application, if requesting a 2081 Incidental Take Permit • Biological Opinion and incidental take statement, if requesting a consistency determination (preferred approach)
CDFW Fish and Game Code Section 1600 Streambed Alteration Agreement	• Application • Section 401 Water Quality Certification permit or application • CWA Section 404 permit or application • Draft environmental compliance documents • Mitigation plan
Central Valley Flood Protection Board California Code, Title 23 – Encroachment Permit	• Application
State Lands Commission Land Use Lease	• Application • Draft environmental compliance documents
State of California Department of Transportation Encroachment Permit	• Application • Permit Engineering Evaluation Report
Local	
SCAQMD Authority to Construct and Permit to Operate	• Application • Preapplication meeting (encouraged)

Table ES-9. Summary of Potential Major Permits and Approvals for Project Implementation (contd.)

Notes:
[1] All permit applications require detailed project description information.
[2] PRC 5093.542 (c) and (d), pertaining to the McCloud River, may limit the ability of State agencies to review and process permits and related approvals for modifications of Shasta Dam and Reservoir.

Key:
ACHP = Advisory Council on Historic Preservation
CDFW = California Department of Fish and Wildlife
CWA = Clean Water Act
ESA = Endangered Species Act
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
PRC = Public Resources Code
RWQCB = Regional Water Quality Control Board
SCAQMD = Shasta County Air Quality Management District
SHPO = State Historic Preservation Office
State = State of California
State Water Board = State Water Resources Control Board
USACE = U.S. Army Corps of Engineers
USFWS = U.S. Fish and Wildlife Service

Federal Responsibilities

If recommended for implementation, Reclamation and/or future project partners or beneficiaries would perform preconstruction and design studies for the NED Plan, which may require updated economic and/or environmental analyses and documentation. After project cooperation agreements are signed and non-Federal sponsors have provided any required financial contributions and assurances, the Federal Government would likely construct the project modifications and related mitigation requirements. Reclamation and other Federal agencies (e.g., USFS) would be responsible for various operations and maintenance activities.

Non-Federal Responsibilities

Before implementation, the non-Federal sponsor(s) (i.e., beneficiaries) for reimbursable costs would agree to perform items of local and state cooperation specific to the authorized purposes of the project. One or more non-Federal sponsors needs to be identified for each of the reimbursable project purposes. For most and possibly all of the reimbursable purposes, the non-Federal sponsor would need to share in the cost of the NED Plan.

Potential Implementation Timeline

A timeline of major milestones, documents, and actions to complete the feasibility study, preconstruction planning and design, and construction phases is shown in Figure ES-8. If and when congressional authorization and related appropriations occur, project implementation would take place in two phases. The initial phase would span approximately five years and would include developing detailed project designs, acquiring necessary permits, and acquiring required real estate interests and/or relocating displaced parties according to Public Law 91-646. Once these initial phase activities are complete, construction of major project features would begin. Construction activities would likely span approximately five years. Estimated timelines are based upon availability of sufficient funding on an annual basis.

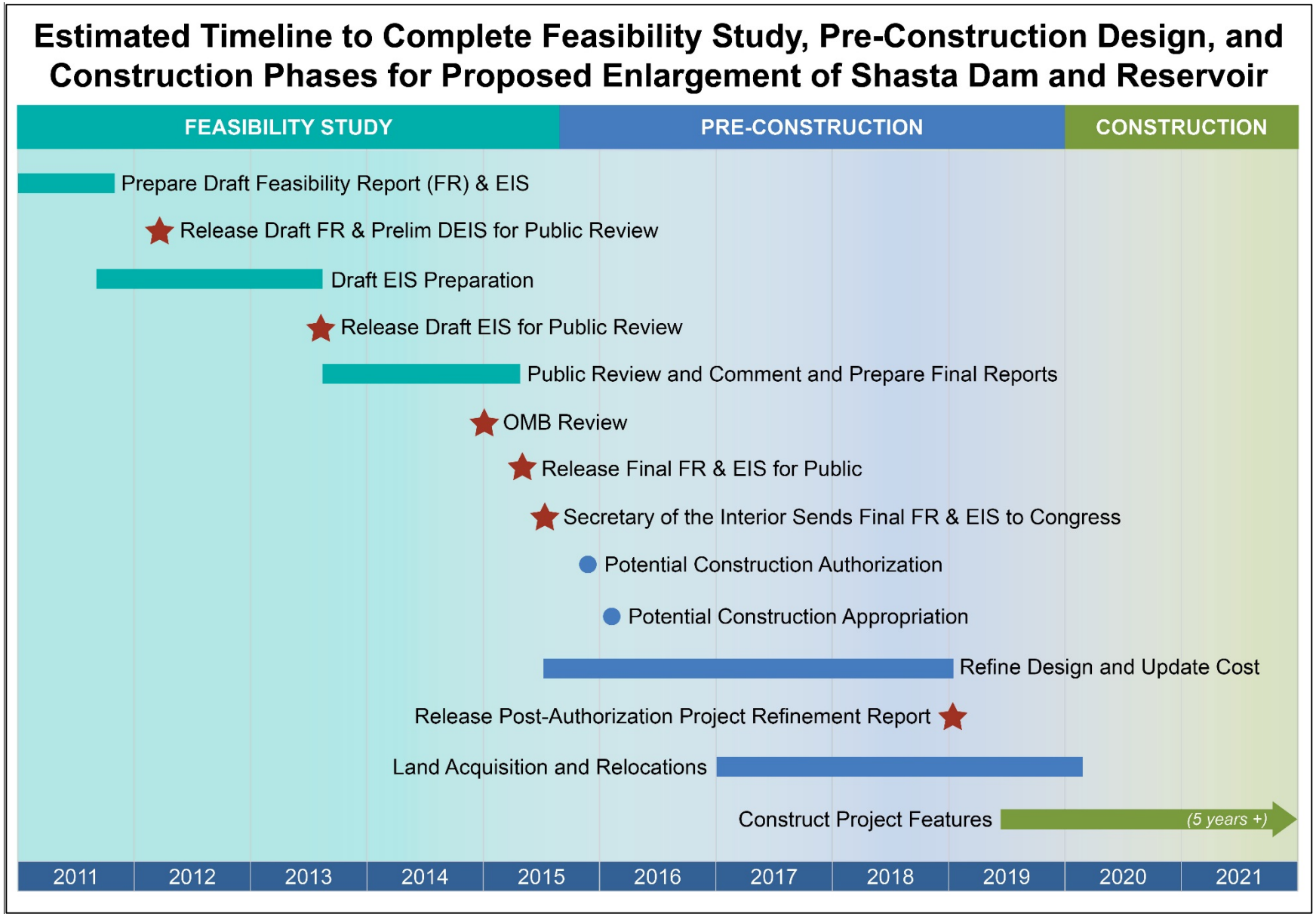


Figure ES-8. Shasta Lake Water Resources Investigation Project Timeline

Considerations and Recommendations

In light of the outstanding considerations articulated below, the Secretary is unable to provide a recommendation for implementation of the SLWRI NED Plan until these considerations are addressed. Although there is no recommendation at this time for Congressional action, all of the alternatives analyzed are feasible from an engineering standpoint. Based on the economic analysis of the alternatives, alternative CP4A has the highest net NED benefits.

Outstanding Considerations

Funding Concerns

Current Federal budget conditions and the impacts those conditions have on Reclamation's budgetary resources significantly constrain Reclamation's ability to fully fund new construction activities of the scope and magnitude required by the SLWRI. As a result, the traditional model under Federal reclamation law, with Congress providing funding from annual appropriations to cover all the costs of construction over a relatively short period of time, and a portion of those funds being repaid to the Treasury over 40 – 50 years, is unrealistic for the identified SLWRI NED Plan. Alternative means of financing (primarily non-Federal) for a majority of the construction costs of the NED Plan would have to be identified and secured in order for the Secretary of the Interior to be able to recommend a construction authorization to Congress. These alternative financing arrangements are being actively explored at a conceptual level.

Significant concerns have been raised by existing CVP water service and repayment contractors regarding water supply benefits from the proposed project being made available to California SWP contractors outside the existing service area of the CVP. In part, their concern emanates from a desire to have water supply developed under any of the alternatives meet existing demands of Federal contractors within the existing CVP service area before being utilized to meet water supply needs of public water agencies that do not currently contract for delivery of CVP water. To address this concern, Reclamation will work with public water agencies that do currently contract for the delivery of CVP water, and other interested governmental and non-governmental organizations to explore alternative, non-traditional methods of financing. The alternative ultimately chosen as the recommended plan will need to include the use of new storage to provide increased cold water protection for anadromous fish in the Sacramento River. Additionally, it should include water supply benefits for those public water agencies that are willing to contribute non-Federal funds for the construction of the project, with preference given to those agencies that are within the existing service area of the CVP.

State of California Support and Participation

Section 103(d)B(i) of Public Law 108-361 makes clear the intent of Congress that the Secretary consult with the State prior submitting the report. From

discussions with the State, it is our understanding there has been a determination that the PRC protecting the McCloud River prohibits State participation in the planning or construction of enlarging Shasta Dam other than participating in technical and economic feasibility studies.

Environmental Considerations

While the Fish and Wildlife Coordination Act process has been completed through the exchange of comments and responses outlined in an appendix to the EIS, there are listed species under both the Federal and State endangered species laws that may be affected by this action. While it is clear that a consultation under Section 7 of the Federal Endangered Species Act will be required prior to implementation of any alternative, until the financing issues are resolved, it is unclear whether California's endangered species laws and other State environmental statutes will apply. Should any State legal requirements apply, the costs of attaining compliance with these State laws shall be the responsibility of the non-Federal participant.

Native American and Cultural Resources

Numerous cultural resources would be significantly affected by all of the action alternatives. Reclamation has invited Federally recognized tribes and non-Federally recognized Native American groups to be consulting parties to the National Historic Preservation Act Section 106 process. No Federally recognized tribes reside in the immediate Shasta Lake area. However, the Winnemem Wintu continue to raise concerns about impacts of the original construction of Shasta Dam and potential impacts of enlarging Shasta Dam on sites they value for historical and cultural significance. The Winnemem Wintu would continue to have the opportunity to participate, and are anticipated to continue to provide input as an invited consulting party, through the Section 106 process.

Process Considerations and Required Authorities

Prior to a recommendation, the Secretary is of the view that there must be resolution of the outstanding considerations raised. In the absence of a Congressional authorization to the contrary, resolution of these issues could be achieved through an agreement between the Secretary and appropriate non-Federal entities on a specific alternative and how the funding will be provided for that specific alternative. Any such agreement must address: total funding, payment up-front by the non-Federal partner, ability to use the non-Federal funds in the construction process, a plan to meet all environmental commitments, and agreement on the operations of the revised facility and conveyance of the associated water to the intended beneficiary. Such an agreement would then be presented to Congress for authorization.

If Congress were to authorize construction based on an agreement that addresses the Secretary's outstanding concerns, additional technical issues would need to be considered and addressed regarding Federal appropriations and the associated ceiling, treatment of additional operations and maintenance

costs, completion of applicable State and Federal permitting actions, and Congressional authorization of required authorities.