

Chapter 3

Plan Formulation

This chapter summarizes the plan formulation process for the Investigation, including an overview of the planning objectives, constraints, principles, and criteria, resources management measures considered; formulation of initial plans; and development of alternative plans. For additional detail, see Appendix A – Plan Formulation.

Plan Formulation Process

Consistent with NEPA, the plan formulation process for Federal water resources studies is identified in the P&G (WRC 1983) and consists of the following deliberative and iterative steps:

- Identifying water resources problems, needs, and opportunities, and developing planning objectives, constraints, and criteria.
- Inventorying and forecasting conditions likely to occur in the study area.
- Evaluating and comparing alternative plans.
- Selecting a plan for recommendation to decision makers for implementation or no action.

For the Investigation, this iterative process was separated into multiple phases, as illustrated in Figure 3-1 and described below:

- **Initial Plans Phase** – The Initial Plans Phase identified future conditions without the project and identified resulting resource problems and opportunities; a specific set of planning objectives; planning criteria and constraints; resources management measures to address the planning objectives; a set of initial plans (also referred to as “concept plans”); and initial plans for further evaluation in the Comprehensive Alternatives Phase. The Initial Plans Phase is summarized in the *Initial Alternatives Information Report* (Reclamation 2005) and the *Initial Economic Evaluation for Plan Formulation Report* (Reclamation 2006).
- **Alternative Plans Phase** – The Alternative Plans Phase included further refinement of the initial plans to develop a set of alternative plans, followed by evaluation and comparison of the alternative plans. This phase included preparing and circulating the 2009 Draft and 2010 Final EIS/EIR (Reclamation and CCWD), which evaluated expansion of Los Vaqueros Reservoir in a two phase approach with an initial expansion to 160 TAF, followed by a later expansion up to 275 TAF. Based on the 2010 Final EIS/EIR and other supplemental evaluations, CCWD implemented the initial expansion of Los Vaqueros Reservoir to 160 TAF without financial assistance from the Federal

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Government. Construction was completed in 2012, but did not preclude opportunities for further expansion of the reservoir.

- Alternative Refinement and Recommended Plan Phase** – This current phase of the plan formulation process focuses on evaluating the feasibility of further expanding Los Vaqueros Reservoir through refinement, evaluation, and comparison of the alternative plans evaluated in the 2010 Final EIS/EIR. These alternatives are refined to reflect (1) the implementation of the 160 TAF dam raise in 2012, (2) updated information about water supply demand and operational preferences from Local Agency Partners and the Refuges that have been identified as potential partners, and (3) changes in regulatory and environmental conditions since 2010. A draft Supplement was released in July of 2017 to address changes since the 2010 Final EIS/EIR was completed. This Feasibility Report summarizes the evaluation of the refined plans and identifies a recommended plan for implementation in Phase 2.



Figure 3-1. Investigation Iterative Planning Process

Planning Objectives, Constraints, Principles, and Criteria

This section discusses the planning objectives, constraints, and other considerations specific to the Investigation.

National Planning Objectives

The Federal objective is defined in the P&G (WRC 1983) as follows:

The Federal objective of water and related resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

Contributions to national economic development (NED) are further defined as “increases in the net value of the national output of goods and services, expressed in monetary units.

Contributions to NED are direct net benefits that accrue in the planning area and the rest of the Nation” (WRC 1983).

The National Water Resources Policy defined in the *Water Resources Development Act of 2007* (Public Law 110-114, Section 2031), also specifies that Federal water resources investments should reflect national priorities, encourage economic development, and protect the environment by doing the following:

- Seek to maximize sustainable economic development.
- Seek to avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case where a floodplain or flood-prone area must be used.
- Protect and restore the functions of natural systems and mitigate any unavoidable damage to natural systems.

In consideration of the many complex water management challenges and competing demands for limited Federal resources, Federal agencies investing in water resources should strive to maximize public benefits, particularly compared to costs. Public benefits encompass environmental, economic, and social goals, including monetary and nonmonetary benefits, and allow for the inclusion of quantified and unquantified benefits. Stakeholders and decision makers expect the formulation and evaluation of a diverse range of alternative solutions, which may produce varying degrees of benefits and/or impacts. As a result, the trade-offs among potential solutions need to be assessed and properly communicated during the decision-making process.

For the Investigation, the approach to evaluating public benefits is consistent with the P&G. In 2015, the Council on Environmental Quality completed an interagency effort to update the 1983 P&G. This effort led to the development of the *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies* (PR&G), and various agency specific guidelines for their application. However, the PR&G apply only to plans or projects that are initiated after the PR&G take effect, therefore the P&G are the primary guidelines used for

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the Investigation. The approach to quantifying and monetizing benefits in the PR&G and the P&G are *not* significantly different (DOI 2015).

Los Vaqueros Expansion-Specific Planning Objectives

The Investigation planning objectives were developed based on identified water resources problems, needs, and opportunities in the study area and specific direction in the study authorization, and are consistent with the P&G and other Reclamation guidance.

The Investigation objectives are to use an expanded Los Vaqueros Reservoir system to:

Primary Objectives

- Develop water supplies for environmental water management that support fish protection, habitat management, and other environmental water needs.
- Increase water supply reliability for water providers within the Bay Area, help meet M&I water demands during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions.

Secondary Objective

- Improve the quality of water deliveries to M&I customers in the Bay Area without impairing the project's ability to meet the environmental and water supply reliability objectives stated above.

Planning Constraints

The P&G provides fundamental guidance for the formulation of Federal water resources projects. In addition, basic constraints specific to the Investigation must be developed and identified.

Some planning constraints are more rigid than others, such as congressional direction in study authorizations; other 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 Investigation are described below.

Study Authorizations

The Secretary of the Interior was authorized to undertake feasibility studies for enlarging Los Vaqueros Reservoir in February 2003 through the Bay-Delta Authorization Act (Public Law 108-7). This act authorized the Secretary of the Interior to conduct feasibility studies for several storage projects identified in the CALFED Programmatic ROD (CALFED 2000a), including the Investigation. Federal authorization was reaffirmed in Public Law 108-361.

Additionally, the CCWD Board adopted a set of principles in April 2000 governing CCWD's participation in an expansion project. On June 25, 2003, the CCWD Board formally adopted the conditions approved by the voters to guide CCWD's participation in any expansion of Los Vaqueros Reservoir. On March 2, 2004, voters in the CCWD service area authorized the CCWD Board to participate with Federal and California state agencies in feasibility studies and environmental review of an expanded Los Vaqueros Reservoir.

CALFED 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/EIR and Programmatic ROD (CALFED 2000b, CALFED 2000c) include program goals, objectives, and projects to benefit the Bay-Delta system. The objectives for the Investigation are consistent with the CALFED Programmatic ROD (CALFED 2000a) for Los Vaqueros enlargement, as follows:

Expand Los Vaqueros Reservoir by up to 400 TAF with local partners as part of a Bay Area water quality and water supply reliability initiative. As part of a Bay Area initiative, an expanded Los Vaqueros Reservoir would provide water quality and water supply reliability benefits to Bay Area water users. As an existing reservoir operated by the Contra Costa Water District (CCWD), the Los Vaqueros Reservoir is subject to a number of mandates and agreements. DWR and Reclamation will work with CCWD and interested stakeholders to assure that previous commitments, including local voter approval required for expansion, are respected.

The CALFED Programmatic ROD has been adopted by various Federal and California state agencies as a framework for further consideration. In addition to objectives for potential enlargement of Los Vaqueros Reservoir, the Preferred Program Alternative in the CALFED PEIS/EIR and Programmatic ROD includes four other potential surface water and various groundwater storage projects to help reduce the gap between water supplies and projected demands. Expanding water storage capacity is critical to the successful implementation of all aspects of the program. Water supply reliability rests on capturing peak flows, especially during wet years. New storage must be strategically located to provide the needed flexibility in the current water system to improve water quality, support fish restoration goals, and meet the needs of a growing population. CALFED Programmatic ROD also includes numerous other projects to help improve the ecosystem functions of the Bay-Delta system. Developed plans should address the goals, objectives, and programs and projects of the CALFED PEIS/EIR and Programmatic ROD (CALFED 2000b, 2000a).

CALFED conducted an initial screening of a list of 52 potential surface water storage sites to reduce the number of sites to a more manageable number for more detailed evaluation during project-specific studies (2000b). CALFED eliminated sites providing less than 200,000 acre-feet storage and those that conflicted with CALFED solution principles, objectives, or policies. Further, based on existing information, CALFED identified some potential surface water storage sites that were more favorable in contributing to CALFED goals and objectives and easier to implement due to relative costs and stakeholder support. Surface water storage sites recommended by CALFED for subsequent evaluation focused on those with the most potential for helping meet CALFED goals and objectives: Shasta Lake enlargement, Los Vaqueros Reservoir Expansion, Sites Reservoir, In-Delta Storage, and development of storage in the upper San Joaquin River Basin (CALFED 2000a) (Figure 3-2). As mentioned in Chapter 1, the Investigation is included in the CALFED Preferred Program Alternative and relies on alternative developments and screening included in the CALFED PEIS/R.

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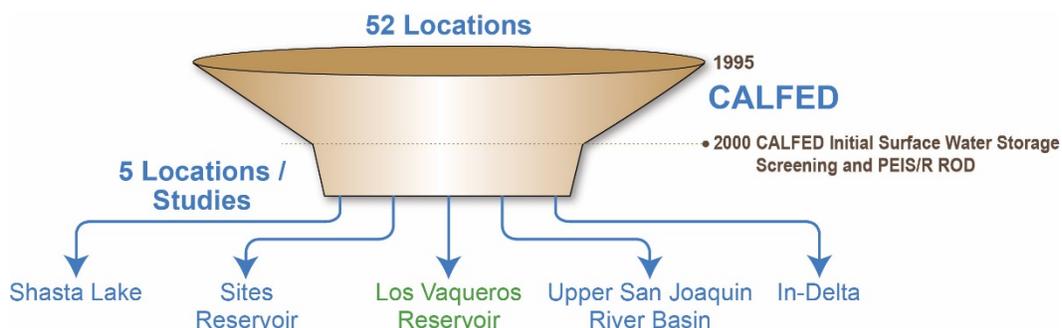


Figure 3-2. CALFED Surface Water Storage Investigations Screening

California Water Quality, Supply, and Infrastructure Improvement Act of 2014

To improve water supply reliability statewide, restore important species and habitat, and manage water infrastructure with more resilience and sustainability, a \$7.12 billion bond was approved by California voters in November 2014. Proposition 1 is a general obligation bond proposal that would provide funding for California water supply infrastructure projects such as public water system improvements, surface and groundwater storage, drinking water protection, water recycling and advanced water treatment technology, water supply management and conveyance, wastewater treatment, drought relief, emergency water supplies, and ecosystem and watershed protection and restoration.

The bond dedicated \$2.7 billion for investments in water storage projects and designated the California Water Commission as the California state agency responsible for appropriately allocating these funds. The California Water Commission, through the Water Storage Investment Program, will fund the public benefits of these projects. Eligible projects must also provide measurable benefits to the Delta ecosystem or its tributaries. Surface storage projects identified in the CALFED ROD are among the projects eligible for cost-sharing under this funding. CCWD submitted a funding application to the Water Storage Investment Program in August 2017 for state funding of the public benefits of the Phase 2 expansion project.

Laws, Regulations, and Policies

Numerous laws, regulations, executive orders, and policies need to be considered, such as:

- P&G
- NEPA
- Fish and Wildlife Coordination Act
- Clean Air Act
- CWA
- National Historic Preservation Act
- California Public Resources Code
- Federal ESA and CESA
- CEQA

- CVPIA
- SECURE Water Act, Secretarial Order No. 3289 (as amended, Interior 2010), and related policies and guidance for the consideration of climate change

The CVPIA of 1992 (Public Law 102-575) is pertinent because of its influence on water supply deliveries, river flows, and related environmental conditions in the primary and extended study areas. Other important laws and regulations are discussed in Appendix A – Plan Formulation.

CCWD Board Principles

The CCWD Board’s 2003 Resolution No. 03-24 and Measure N, approved by the CCWD voters on March 2, 2004, were both considered in developing alternatives. The resolution and measure contain a description of the conditions that must be met for the CCWD Board to consider approval of the reservoir expansion project.

In Resolution No. 03-24, the CCWD Board determined that CCWD would not participate in or support the proposal for expansion of Los Vaqueros Reservoir unless the CCWD Board determined the proposal meets the following conditions:

1. Improves drinking water quality for CCWD customers beyond that available from the existing Los Vaqueros Project.
2. Improves the reliability of water supplies for CCWD customers during droughts.
3. Enhances Delta habitat, protects endangered Delta fisheries and aquatic resources by installing state-of-the-art fish screens on all new intakes, and creates an environmental asset through improved location and timing of Delta diversions and storage of water for environmental purposes.
4. Increases the protected land and managed habitat for terrestrial species in the Los Vaqueros watershed and surrounding region.
5. Improves and increases fishing, boating, hiking, and educational opportunities in the Los Vaqueros watershed, consistent with the protection of water quality and preservation of the watershed and the watershed’s unique features.
6. CCWD continues as owner and manager of the Los Vaqueros watershed.
7. CCWD maintains control over recreation in the Los Vaqueros watershed.
8. CCWD continues as operator of the Los Vaqueros Reservoir system.
9. CCWD will be reimbursed for the value of the existing Los Vaqueros Project assets shared, replaced, rendered unusable or lost with the expansion project and said reimbursement will be used to purchase additional drought supply and water quality benefits or reduce debt on the existing Los Vaqueros Project.
10. Water rates for CCWD customers will not increase as a result of the expansion project.

Other Planning Considerations

In addition to the planning constraints, a series of other planning considerations helps guide plan formulation, not only in formulating the initial plans, but also in determining which alternatives best address the planning objectives. Planning considerations relate to economic justification, environmental compliance, technical standards, etc., and may result from local policies, practices, and conditions. Examples of these planning considerations, used in the Investigation for formulating, evaluating, and comparing initial plans, and later, detailed alternative plans, include the following:

- Alternative plans should incorporate results of coordination with other Federal and California state agencies such as the USFWS; NMFS; U.S. Department of the Interior, Bureau of Indian Affairs; DWR; and CDFW.
- A direct and significant geographical, operational, and/or physical dependency must exist between major components of alternatives.
- Alternative plans should address, at a minimum, each of the identified primary planning objectives and, to the extent possible, the secondary planning objectives.
- Measures to address secondary planning objectives should be either directly or indirectly related to the primary planning objectives (i.e., plan features should not be independent increments).
- Alternatives should avoid potential adverse impacts to hydrologic and/or hydraulic systems such as water supply pumping and conveyance facilities, flood control works, or other significant water resources related impacts in the study area.
- Alternatives should consider and avoid impacting CVP and SWP programs and projects outside the study area.
- Alternatives formulation should consider the potential impacts of climate change.
- Alternatives should strive to first avoid potential adverse effects to environmental resources, or then should include features to mitigate for unavoidable adverse effects through enhanced designs, construction methods, and/or facilities operations.
- Alternatives should strive to first avoid potential adverse effects to significant cultural resources, or then include features to mitigate unavoidable adverse effects.
- Alternatives should not result in significant adverse effects to existing and future water supplies, hydropower generation, or related water resources conditions.
- Alternatives should reflect the purposes, operations, and limitations of existing and without-project future projects and programs.
- Alternatives should not result in a reduction in existing recreation capacity at the existing Los Vaqueros Project.

- Alternatives are to consider the purposes, operations, and limitations of existing projects and programs and be formulated to not adversely impact those projects and programs.
- Alternatives are to be formulated and evaluated based on a 100-year period of analysis.
- Construction costs for alternatives are to reflect current prices and price levels, and annual costs are to include the current Federal discount rate and an allowance for interest during construction.
- Alternatives are to be formulated to neither preclude nor enhance development and implementation of other elements included in the CALFED Programmatic ROD or other water resources programs and projects in the Central Valley.
- Alternatives should have a high certainty for achieving intended benefits and not significantly depend on long-term actions (past the initial construction period) for success. Alternatives that require future and ongoing action specific for success have a higher uncertainty than other plans.

Criteria

The Federal planning process in the P&G includes four specific criteria for consideration in formulating and evaluating alternatives: completeness, effectiveness, efficiency, and acceptability (WRC 1983).

- Completeness is a determination of whether a plan includes all elements necessary to realize planned effects and the degree that intended benefits of the plan depend on the actions of others.
- Effectiveness is the extent to which an alternative alleviates problems and achieves objectives.
- Efficiency is the measure of how efficiently an alternative alleviates identified problems while realizing specified objectives consistent with protecting the Nation's environment.
- Acceptability is the workability and viability of a plan concerning its potential acceptance by other Federal agencies, California state and local governments, and public interest groups and individuals.

These criteria, and how they apply in helping to compare alternative plans, are described in Chapter 5.

Resources Management Measures

A resources management measure is any structural or nonstructural action that could address one or more planning objectives. Detailed information on each resources management measure is provided in the *Initial Alternatives Information Report* (Reclamation 2005). These measures, also referred to as initial concepts, were presented in the 2010 Final EIS/EIR (Reclamation and

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CCWD), but some have been updated to reflect changes in conditions and studies performed post-initial expansion.

Measures Identification and Screening

Over 30 resources management measures were identified as part of previous studies, programs, and projects, and through Investigation study team meetings, field inspections, outreach, and environmental scoping activities. Because the purpose of the Investigation is primarily to address problems and opportunities in the Delta and Bay Area regions, the geographic location of possible measures was limited. Therefore, all measures identified herein could be implemented in the Investigation study area.

Measures were developed to address a specific planning objective. Retained measures were then combined into initial plans that address all of the identified planning objectives. Because measures are not complete alternatives, the screening process for measures was based on their relative ability to contribute to study goals and objectives, and their consistency with study planning constraints, criteria, and other considerations.

Various reasons existed for retaining a measure for possible inclusion in an initial plan or deleting it from further consideration. The following major considerations were used to evaluate the resources management measures:

- Potential to directly address at least one planning objective without adversely impacting the ability to achieve the other objectives. To directly address an Investigation planning objective, measures need to have a geographic, operational, or physical relationship to problems and opportunities in the Investigation study area.
- Potential to contribute to other planning objectives when part of a complete alternative plan. For example, if a measure to address a single objective could be implemented independently, and no benefit would occur in combining it with measures to address other study objectives, it would likely be dropped from further study.
- Engineering (including cost), environmental, political, and institutional constraints relative to other available measures or options that are available to achieve the objective(s).
- Potential to be addressed by other existing ongoing studies or programs. For example, measures being actively pursued by other ongoing CALFED studies were not retained for further evaluation.

A more detailed description of the identified measures and rationale for retaining or deleting from further consideration is included in Appendix A – Plan Formulation.

Measures to Address Primary Planning Objectives

The resources management measures to address the primary planning objectives of Bay Area water supply reliability and environmental supply reliability are summarized below.

Bay Area Water Supply Reliability

Measures to address the primary planning objective of improving drought-period Bay Area water supply reliability are summarized in Table 3-1. These measures were presented in the *Initial Alternatives Information Report* (Reclamation 2005) and 2010 Final EIS/EIR (Reclamation and CCWD), but the status and rationale for some measures have since been updated to reflect changes in conditions and studies performed post-initial expansion. These measures occur in the following categories:

- **Surface water storage** – Build new storage facilities or expand existing storage facilities
- **Reservoir/system reoperation** – Non-structural measures to improve efficiency of existing facilities, such as more effective integrated management of surplus flows in the Delta or modifying prescribed reservoir storage curves
- **Groundwater storage** – Develop additional groundwater banking to improve conjunctive use
- **Conveyance/system modifications** – Build new or enlarge existing facilities, such as constructing interties or increasing pumping plant capacities
- **Source water treatment improvement** – Improve treatment of source water for potable use (e.g., desalination, demineralization of groundwater)
- **Water use efficiency** – Structural and non-structural measures to improve water use efficiency, such as increasing the use of reclaimed wastewater or behavioral changes in how water is used to improve efficiency
- **Water transfers and land retirement** – Non-structural measures to increase water transfers in or outside the study area and encourage long-term retirement of agricultural land

Table 3-1. Measures to Address Bay Area Water Supply Reliability

Resources Management Measure ¹	Potential to Address Planning Objective	Status and Rationale
Surface Water Storage		
I. Enlarge Los Vaqueros Reservoir to increase conservation storage space (new dam - 300 to 500 TAF total storage) ²	High – Could provide up to 340 TAF of new local storage (500 TAF total storage capacity) for water supply reliability and potential to contribute to other Investigation planning objectives	Retained – Specifically authorized for study and could contribute to other Investigation planning objectives
II. Raise Los Vaqueros Dam in-place to increase conservation storage space (115 to 275 TAF total storage) ³	Moderate to High – Could provide up to 115 TAF of new local storage (275 TAF total storage capacity) for water supply reliability and potential to contribute to other Investigation objectives	Retained – Less costly method of providing a smaller increment of storage, and could contribute to other Investigation planning objectives
III. Raise Calaveras Dam to increase conservation storage space	Low – Could provide up to 320 TAF of local storage, but would only benefit agencies with existing SFPUC contracts (ACWD and SCVWD)	Deleted – Low potential to provide regional supply reliability benefits in the Bay Area and project being pursued through separate study
IV. Enlarge San Luis Reservoir to increase conservation storage space	Low – Could provide up to 200 TAF, but would only serve one agency (SCVWD)	Deleted – High unit cost, low potential to contribute to increasing regional Bay Area supply reliability and project being pursued through separate study
V. Raise Pacheco Dam to increase conservation storage space	Low – Could provide up to 120 TAF, but would serve only one agency (SCVWD)	Deleted – High unit cost, low potential to contribute to increasing supply reliability in the study area and limited potential to support other objectives
VI. Construct new conservation storage at Upper Lake Del Valle Dam site	Low – Could capture up to 15 TAF local runoff, but at a high cost	Deleted – Potential for local opposition and low possibility to provide regional benefits and high unit cost compared with other measures
VII. Construct other local area storage facilities considered in lieu of the original Los Vaqueros Project (e.g., Kellogg Reservoir, Round Valley Reservoir)	Moderate – Various sites could provide small to moderate increase in local storage	Deleted – Major site acquisition issues, high likelihood of local opposition, and high unit cost
VIII. Construct new conservation storage in Sacramento River/San Joaquin River watersheds	Low – Various sites could provide small to moderate storage outside the study area	Deleted – Low potential to address Investigation planning objectives, most promising sites evaluated by ongoing CALFED studies
IX. Construct new conservation storage in the Sacramento-San Joaquin Delta	Low – Uncertainty regarding ability to provide water supply reliability benefits to the study area	Deleted – Low potential to address Investigation planning objectives, most promising sites evaluated by ongoing CALFED studies

Table 3-1. Measures to Address Bay Area Water Supply Reliability (contd.)

Resources Management Measure ¹	Potential to Address Planning Objective	Status and Rationale
Reservoir/System Reoperation		
X. Increase effective conservation storage space in existing Lake Del Valle Reservoir	Low – Small potential to provide water supply reliability benefits to study area without affecting other reservoir functions	Deleted – Low potential to provide regional supply reliability benefits and high unit cost compared with other measures
XI. Improve Delta export and conveyance capability through coordinated CVP and SWP operations	Low – Limited potential for additional reoperation benefits beyond current plans	Deleted – System efficiency improvement measures are being actively pursued in other programs; likely without-project condition
Groundwater Storage		
XII. Develop additional groundwater banking in San Joaquin River watershed	Low – Existing banks have sufficient capacity to store unused contract supplies; uncertainty regarding ability to secure additional supplies for banking and withdrawal limitations	Deleted – Existing Bay Area programs sufficient to store unused contract water and limited available capacity in current and planned banks
XIII. Develop additional groundwater banking in Sacramento River watershed	Low – Significant physical limitations to banking in Sacramento River watersheds (e.g., groundwater over drafting is limited to highly urbanized areas where agencies are already actively engaged in conjunctive use programs; other large aquifers in the Sacramento River basin do not appear to have the physical capacity needed for large-scale banking)	Deleted – Low likelihood of developing a reliable conjunctive use program for Bay Area supplies in the Sacramento River basin due to significant physical, groundwater, and other related problems
Conveyance/System Modifications		
XIV. Increase Delta diversion capacity to Bay Area water user facilities	Moderate – Increased export capacity could provide water supply reliability benefits, particularly in combination with storage	Retained – Additional Delta diversion capacity with enlarged capacity at existing site and/or new central Delta diversion likely to be effective when used in combination with reoperation and/or new storage
XV. Construct intertie from SFPUC to SBA	Low – Uncertainty regarding availability of Hetch Hetchy Reservoir water supplies and ability to provide regional benefits	Deleted – Low potential to contribute to overall supply reliability conditions in study area, could be independently implemented, and would have limited contribution to other Investigation planning objectives
XVI. Expand use of Freeport Regional Water Project	Low – Little potential to improve supply reliability because benefits would be limited to surplus project capacity during wet periods	Deleted – Since initial identification in 2005, this measure has been implemented through recent construction of the EBMUD-CCWD intertie
XVII. Increase Banks Pumping Plant capacity to greater than 8,500 cfs	Low – Limited potential to benefit supply reliability in study area due to physical and regulatory constraints on increased exports	Deleted – Limited potential for increased supply reliability in the study area and limited potential to contribute to other Investigation planning objectives

Table 3-1. Measures to Address Bay Area Water Supply Reliability (contd.)

Resources Management Measure¹	Potential to Address Planning Objective	Status and Rationale
XVIII. Construct an intertie from Los Vaqueros Reservoir to the SBA upstream from Dyer Canal	Moderate – Could provide supply reliability benefits to SBA water agencies with reoperation or expansion of Los Vaqueros	Retained – New conveyance from Los Vaqueros Reservoir to the SBA would be an important component of any reservoir expansion action
XIX. Construct intertie from Los Vaqueros Reservoir to SBA via Bethany Reservoir	Low – Although this measure could provide supply reliability benefits to SBA water agencies similar to the previously described SBA intertie, it would be more costly due to increased pumping from Bethany Reservoir	Retained – Despite the increased pumping costs for an SBA interties to connect to Bethany, this measure was retained for plans focused on enhancing environmental water management and possibly for water supply reliability and agricultural water supply to SOD contractors (see Table 2-2)
Source Water Treatment Improvement		
XX. Implement treatment/supply of agricultural drainage water	Low – Uncertain ability to treat agricultural runoff to a quality standard acceptable to the public	Deleted – Very costly, low certainty of success, and likely low acceptability to stakeholders and public
XXI. Construct desalination facility	Moderate – Potential to provide base water supply, but would require storage to provide dry year supply reliability benefits	Retained – Limited application as a dry year supply, high unit cost, and potential environmental impacts from treatment byproducts, but potential to provide benefits in combination with storage
XXII. Demineralize poor quality groundwater	Low – Limited groundwater resources in study area suitable for additional development; highly localized benefits	Deleted – High implementation costs, limited application and benefits, and potential for adverse impacts to groundwater resources
Water Use Efficiency		
XXIII. Implement additional wastewater reclamation	Low – Could provide localized supply reliability benefits, limited by acceptable uses of recycled water	Deleted – Measure being actively pursued by other CALFED programs; most effective elements are likely without-project condition
XXIV. Implement additional demand management facilities	Low – Low potential to significantly address dry year supply reliability over and above existing/planned conservation programs	Deleted – Would not effectively address Investigation planning objectives and constraints/criteria; features being actively pursued by other CALFED programs; most effective elements are likely without-project condition

Table 3-1. Measures to Address Bay Area Water Supply Reliability (contd.)

Resources Management Measure ¹	Potential to Address Planning Objective	Status and Rationale
Water Transfers and Purchases		
XXV. Implement water transfers in study area	Low – Highly unlikely that surplus supplies would be available in the study area during dry years	Deleted – Low potential to effectively address drought period water reliability through transfers in the study area because region is water-deficient (no surplus supplies available)
XXVI. Increase water transfers outside study area	Low – High uncertainty regarding the availability, cost, and reliability of water transfers from outside the study area in the future	Deleted – Would not effectively address Investigation planning objectives and constraints/criteria; high uncertainty of future cost-effectiveness and would likely be implemented with or without development of new water sources, storage, or conveyance
XXVII. Retire agricultural lands	Moderate – Uncertainty regarding ability to redirect agricultural supplies to M&I uses	Deleted – Would not effectively address Investigation planning objectives consistent with criteria/constraints, and has potential for additional negative impacts such as socioeconomic, air quality, and environment. Storage facilities would still be needed regardless.

Notes:

- ¹ The management measures are numbered to facilitate discussion, but neither the numbering nor the order in which the management measures appear is indicative of their rating.
- ² In the 2005 *Initial Alternatives Information Report* (Reclamation 2005) and the 2010 Final EIS/EIR (Reclamation and CCWD), Los Vaqueros Reservoir had a capacity of 100 TAF; the values in this table have been updated to reflect the 160 TAF capacity of the post-initial expansion Los Vaqueros Reservoir.
- ³ Preliminary analyses estimated that the mini dam raise under Initial Plan 1, consisting of a 15-foot in-place dam raise (the largest raise requiring fill to be added only to the top of the existing dam), could increase Los Vaqueros Reservoir storage capacity to about 126,000 acre-feet. This capacity estimate was used in the evaluation and screening of the initial plans described previously in this chapter. However, this estimate was refined through subsequent studies and analyses, which indicated the 15-foot dam raise could only provide about 115,000 acre-feet of total storage capacity. Further, studies also determined that a moderate in-place dam raise enlarging Los Vaqueros Reservoir up to 275 TAF was possible by adding fill to the top, upstream, and downstream sides of the dam.

Key:

- ACWD = Alameda County Water District
- Bay Area = San Francisco Bay Area
- CALFED = CALFED Bay-Delta Program
- CVP = Central Valley Project
- cfs = cubic feet per second
- Investigation = Los Vaqueros Expansion Investigation
- M&I = municipal and industrial
- SFPUC = San Francisco Public Utilities Commission
- SCVWD = Santa Clara Valley Water District
- SBA = South Bay Aqueduct
- SWP = State Water Project
- TAF= thousand acre-feet

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Environmental Water Supply

Four measures were identified with the potential to support development of the other primary planning objective for providing environmental water supplies, as summarized in Table 3-2 and described below. Numbering corresponds to those assigned in Table 3-1. All of the measures were retained for potential inclusion in initial plans.

Table 3-2. Measures to Develop Environmental Water Supplies

Resource Management Measure¹	Potential to Address Planning Objective	Status and Rationale
I. Enlarge Los Vaqueros Reservoir	High – Could store up to 340 TAF of surplus Delta flows or transfer water for environmental supplies (500 TAF total storage capacity)	Retained – High potential to provide water for environmental supplies.
II. Raise Los Vaqueros Dam in-place	High – Could store up to 115 TAF of surplus Delta flows or transfer water for environmental supplies (275 TAF total storage capacity)	Retained – High potential to provide water for environmental supplies.
XIX. Construct an intertie from Los Vaqueros Project to the SBA via Bethany Reservoir	High – Could be used to deliver replacement water supplies for environmental supplies. Most effective when combined with expanded storage in Los Vaqueros Reservoir and/or increased Delta intake capacity	Retained – Connection to the SBA would be an integral component in any enlargement of Los Vaqueros for environmental water purposes; an intertie to Bethany Reservoir could also provide operational flexibility.
XVIII. Construct an intertie from Los Vaqueros Project to the SBA upstream from Dyer Canal	Moderate to High – Could be used to provide replacement supplies for environmental supplies, via delivery to SBA water agencies. Most effective when combined with expanded storage at Los Vaqueros Reservoir	Retained – Connection to the SBA would be an integral component in any enlargement of Los Vaqueros Reservoir. Deliveries via this measure would be limited by the existing capacity of the SBA and demands of its users.

Note:

¹ The management measures are numbered to facilitate discussion, but neither the numbering nor the order in which the management measures appear is indicative of their rating.

Key:

Delta = Sacramento – San Joaquin River Delta

SBA = South Bay Aqueduct

TAF = thousand acre-feet

Measures to Address Secondary Planning Objective

Measures to address the secondary planning objective of improving delivered water quality in the study area are described below and summarized in Table 3-3. Numbering continues from those assigned in Table 3-1 and Table 3-2. Of the five measures identified, one was retained for possible inclusion in initial plans. Note that many of the above measures identified for water supply reliability would result in incidental improvements to water quality. For example, constructing an intertie from Los Vaqueros Reservoir to the SBA would result in minor improvements in the quality of water delivered to SBA water agencies by providing higher quality water from the reservoir instead of the Delta during dry periods and reducing deliveries of water through Clifton Court Forebay.

Table 3-3. Resources Management Measures Addressing Water Quality

Resource Management Measure¹	Potential to Address Planning Objective	Status and Considerations
XXVIII. Implement point-of-use water quality actions	Low – Difficult to implement over entire study area	Deleted – High costs to implement and maintain with marginal benefits
XXIX. Rehabilitate Franks Tract for water quality improvement	Moderate – Some potential to improve water quality during certain periods as at some existing Delta diversions	Deleted – Being pursued by others and unlikely to contribute to other planning objectives
XXX. Cover open channel sections of the SBA	Moderate – Would benefit SBA user agencies during certain periods	Deleted – Low potential to contribute to other study objectives and could be pursued independently
XXXI. Improve Bay Area water treatment plants	High – Potential to significantly improve treatment processes and delivered water quality	Deleted – While technically feasible, could be pursued independently by individual agencies and would have a low potential to contribute to other study objectives
XXXII. Re-operate an enlarged Los Vaqueros Reservoir or other study area systems to improve water quality	High – Potential to improve water quality for CCWD and SBA water agencies, particularly combined with enlarged reservoir and diversion capacity	Retained – High potential to address area water quality conditions and contribute to other Investigation planning objectives

Note:

¹ The management measures are numbered to facilitate discussion, but neither the numbering nor the order in which the management measures appear is indicative of their rating.

Key:

Bay Area = San Francisco Bay Area

CCWD = Contra Costa Water District

Delta = Sacramento-San Joaquin Delta

Investigation = Los Vaqueros Expansion Investigation

SBA = South Bay Aqueduct

Retained Resources Management Measures

Of the 32 resources management measures identified, nine were retained to use as the basis for forming initial plans. The retained management measures and objective(s) each addresses are listed in Table 3-4. As described above, the numbering corresponds to those assigned in Table 3-1 through Table 3-3.

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Table 3-4. Measures Retained to Address Planning Objectives

Retained Management Measures ¹	Description	Objective Addressed			Project Type
		Bay Area Water Supply Reliability	Environmental Water Supply	Bay Area Water Quality	
I. Enlarge Los Vaqueros Reservoir	Increase conservation storage space in Los Vaqueros Reservoir by up to 340 TAF (500 TAF total storage capacity) by removing and replacing the existing dam with a substantially larger facility	✓	✓		Structural
II. Raise Los Vaqueros Dam in-place	Raise the height of the existing Los Vaqueros Dam to increase conservation storage space by up to 115 TAF (275 TAF total storage capacity)	✓	✓		Structural
XIV. Increase Delta diversion capacity to Bay Area water users facilities	Increase the capacity of Delta diversion(s) to Bay Area water users	✓			Structural
XVIII. Construct an intertie from Los Vaqueros Project to the SBA upstream from Dyer Canal	Construct new conveyance to deliver water from Los Vaqueros Reservoir to the SBA upstream from Dyer Canal	✓	✓		Structural
XIX. Construct an intertie from Los Vaqueros Project to the SBA via Bethany Reservoir	Construct a new pipeline to deliver environmental supplies from the Los Vaqueros Project to Bethany Reservoir		✓		Structural
XXI. Construct Desalination Plant	Develop desalination facility, drawing from Bay-Delta Estuary, and associated conveyance facilities	✓			Structural
XXXII. Re-operate an enlarged Los Vaqueros Reservoir or other study area systems to improve water quality	Re-operate an enlarged Los Vaqueros Reservoir and/or delivery system to improve delivered water quality			✓	Nonstructural

Note:

¹ The management measures are numbered to facilitate discussion, but neither the numbering nor the order in which the management measures appear is indicative of their rating.

Key:

Bay-Delta = San Francisco Bay/Sacramento-San Joaquin Delta

SBA = South Bay Aqueduct

TAF = thousand acre feet

Initial Plans

During the Initial Plans Phase, a set of plans that were conceptual in scope (initial plans) were formulated from the retained resource management measures. The purpose of this phase of the formulation process was to (1) explore an array of different strategies to address the planning

objectives, constraints, considerations, and criteria, and (2) identify concepts that warranted further development in the Alternative Plans Phase.

Initial Plans in the 2005 Initial Alternatives Information Report

For the Investigation, eight initial plans were identified and evaluated in the 2005 *Initial Alternatives Information Report* (Reclamation 2005) , as shown in Table 3-5, to (1) explore different strategies to address the planning objectives, constraints, principles, and criteria; and (2) identify initial plans that may warrant further development into alternative plans. Following the release of the 2005 *Initial Alternatives Information Report*, reservoir capacity estimates and cost estimates continued to be refined and two additional initial plans were identified, as described in the 2006 *Initial Economic Evaluation for Plan Formulation* (Reclamation).

Correspondingly, the information describing the initial plans was developed before the initial 60 TAF expansion (160 TAF total storage capacity) was completed in 2012, and does not reflect current conditions (i.e., post-initial expansion and other recent projects, such as the Middle River Intake Project construction, which expanded Delta intake capacity by 250 cfs). Initial plans are described in more detail in Appendix A – Plan Formulation.

Initial Plans Focused on Bay Area Water Supply Reliability

As shown in Table 3-5 and summarized below, three initial plans were formulated from management measures retained to address the primary planning objective of increasing Bay Area water supply reliability.

Initial Plan 1 – Raise Los Vaqueros Dam in Place Focused on Bay Area Water Supply Reliability This initial plan focused on addressing the primary planning objective of Bay Area water supply reliability by raising the existing Los Vaqueros Dam by approximately 15 feet (the largest raise requiring fill to be added only to the top of the existing dam). This initial plan also included increasing diversion and conveyance capacity from the Delta to the enlarged reservoir, which would include maintaining the existing pumping capacity at the Old River of 250 cfs and constructing an additional diversion and pumping facility in the central Delta of about 500 cfs. Additionally, this initial plan included construction of conveyance facilities from the expanded reservoir to the SBA.

Preliminary analyses estimated that the mini dam raise under Initial Plan 1 could increase Los Vaqueros Reservoir storage capacity to about 126,000 acre-feet. However, this estimate was refined through subsequent studies and analyses, which indicated that the 15-foot dam raise could only provide about 115,000 acre-feet of total storage capacity. Based on the refined storage capacity estimate, it was determined that this plan was not cost effective compared with larger expansion scenarios. Additionally, a 15,000 acre-foot increase in storage capacity would not provide meaningful increases in Bay Area water supply reliability. Because of this, Initial Plan 1 was screened out and eliminated from further consideration.

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Table 3-5. Summary of Initial Plan Features

Initial Plans ¹	Focus		Retained Management Measures ¹						
	Bay Area Water Supply Reliability	Environmental Water Management	I. Enlarge Los Vaqueros Reservoir ²	II. Raise Los Vaqueros Dam in-place	XIV. Increase Delta diversion capacity to Bay Area water users facilities	XVIII. Construct an intertie from Los Vaqueros Project to the SBA upstream from Dyer Canal ³	XIX. Construct an intertie from Los Vaqueros Project to the SBA via Bethany Reservoir	XXI. Construct Desalination Plant	XXXII. Re-operate an enlarged Los Vaqueros Reservoir or other study area systems to improve water quality
Initial Plans in 2005 <i>Initial Alternatives Information Report</i>¹									
1. Raise Los Vaqueros Dam In-Place	✓			✓	✓	✓			
2. Enlarge Los Vaqueros Reservoir	✓		✓		✓	✓			
3. Desalination with Storage (Enlarge Los Vaqueros Reservoir)	✓		✓		✓	✓		✓	
4. Enlarge Los Vaqueros Reservoir with Dyer Canal Intertie		✓	✓		✓	✓			
5. Enlarge Los Vaqueros Reservoir with Bethany Reservoir Intertie		✓	✓		✓		✓		
6. Water Supply Reliability/Improved Environmental Water Management Combination with Dyer Canal Intertie	✓	✓	✓		✓	✓			
7. Water Supply Reliability/Improved Environmental Water Management Combination with Bethany Reservoir Intertie	✓	✓	✓		✓		✓		
8. Water Supply Reliability/Improved Environmental Water Management Combination with Water Quality Improvements	✓	✓	✓		✓	✓			✓
Additional Initial Plans in 2006 <i>Initial Economic Evaluation for Plan Formulation</i>									
Moderate In-Place Dam Raise Scenario		✓		✓	✓	✓			
Desalination Without New Storage	✓	✓					✓	✓	

Note:

¹ The management measures and 2005 initial plans are numbered to facilitate discussion, but neither the numbering nor the order in which the measures and plans appear are indicative of their performance or standing.

² Options for enlarging Los Vaqueros Reservoir up to 500 thousand acre-feet (TAF) were originally considered in the *Initial Alternatives Information Report* (Reclamation, 2005) and the *Initial Economic Evaluation for Plan Formulation Report* (Reclamation, 2006). However, subsequent operational analyses indicated that Bay Area water supply reliability demands and environmental water demands did not warrant the higher cost associated with demolishing the existing dam and building a new facility. As a result, options for expanding Los Vaqueros Reservoir greater than 275 TAF were eliminated from further consideration and the alternatives do not consider or include Los Vaqueros Reservoir expansions greater than 275 TAF.

³ Options for SBA connections based on the Dyer Canal intertie were considered in the *Initial Alternatives Information Report* (Reclamation, 2005) and the *Initial Economic Evaluation for Plan Formulation Report* (Reclamation, 2006). However, this option was subsequently screened out and a connection to Bethany Reservoir was included in all alternatives that include a connection to South Bay Aqueduct water agencies.

Key: Bay Area = San Francisco Bay Area

Reclamation = U.S. Department of the Interior, Bureau of Reclamation

SBA = South Bay Aqueduct

TAF = thousand acre-feet

Initial Plan 2 – Enlarge Los Vaqueros Reservoir Focused on Bay Area Water Supply Reliability This initial plan included enlarging Los Vaqueros Reservoir by up to 400,000 acre-feet (total storage capacity of 500,000 acre-feet), increasing Delta diversion and conveyance capacity and constructing conveyance facilities to the SBA to improve Bay Area water supply reliability during dry periods. Initial Plan 2 was carried forward for further consideration due to its potential to reduce shortages for Bay Area water users.

Initial Plan 3 – Desalination with Enlarged Los Vaqueros Reservoir Focused on Bay Area Water Supply Reliability This initial plan included constructing a new, brackish water desalination facility in the Bay Delta estuary, in combination with an expanded Los Vaqueros Reservoir and new delivery facilities to improve Bay Area water supply reliability. This plan assumed that when desalinated supplies exceeded demands, desalinated water would be temporarily stored and/or used conjunctively to decrease reliance on other local water sources (such as groundwater).

Initial Plan 3 was eliminated from further consideration due to higher construction and operations costs relative to the other plans. Additionally, desalinated water stored in the reservoir for later use would require a retreatment process before being delivered to Local Agency Partners, increasing operational costs and reducing efficiency. The potential environmental impacts of a desalination facility on biological resources were also somewhat prohibitive because of the large quantity of brine waste and increased water temperature, which would be introduced into the Delta environment.

Initial Plans Focused on Developing Environmental Water Supplies

Two initial plans were formulated to address the primary planning objective of developing environmental water supplies. Each plan included diverting surplus flows from the Delta to an expanded Los Vaqueros Reservoir, and constructing delivery facilities to CVP and SWP water users affected by pumping curtailments. Under these plans, deliveries would be made to SBA water users from the expanded reservoir; the resulting pumping reduction at Banks Pumping Plant then could be used either to deliver environmental water supplies south of the Delta or to directly accommodate fish actions (pumping curtailments) at the export facilities.

The two initial plans described below are similar; however, the first would deliver water from Los Vaqueros Reservoir to the SBA near the Dyer Canal Back Surge Pool, while the second would deliver water to Bethany Reservoir.

Initial Plan 4 – Enlarge Los Vaqueros Reservoir with Dyer Canal Intertie Focused on Environmental Water Supplies This initial plan included an expansion of Los Vaqueros Reservoir by up to 400,000 acre-feet (total storage capacity of 500,000 acre-feet), increasing Delta diversion capacity, and constructing delivery facilities from the reservoir to the SBA near the Dyer Canal Back Surge Pool for developing environmental water supplies. Under this plan, deliveries would be made to SBA water users from the expanded reservoir; the resulting pumping reduction at Banks Pumping Plant then could be used for environmental water management purposes, such as delivering SOD environmental water supplies.

Although this plan was initially carried forward, further evaluations indicated that a connection to the Dyer Canal would provide less operational flexibility for developing environmental water

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supplies than the Bethany Reservoir intertie (as included in Initial Plan 5 below). In addition, environmental impacts of the connection to Dyer Canal were greater than those for the connection to Bethany Reservoir. Therefore, this initial plan and the connection to Dyer Canal were eliminated from further consideration.

Initial Plan 5 – Enlarge Los Vaqueros Reservoir with Bethany Reservoir Intertie Focused on Environmental Water Supplies Initial Plan 5 was similar to Initial Plan 4 described above, except with water delivery to the SBA at Bethany Reservoir instead of at Dyer Canal. Similar to Initial Plan 4, deliveries would be made to SBA water users from the expanded reservoir; the resulting pumping reduction at Banks Pumping Plant then could be used for environmental water management purposes, such as delivering environmental water supplies south of the Delta. Existing SWP facilities would be used to deliver environmental water supplies from Bethany Reservoir to SBA users and additional environmental water supplies could be conveyed south through the California Aqueduct.

Initial Plan 5 was carried forward for further development due to evaluations indicating it would result in the largest increase in environmental water supply. Through further evaluation of project conveyance facilities, it was also determined that the South Bay connection at Bethany Reservoir was more cost-effective and provided greater operational flexibility and project benefits than the connection to Dyer Canal. With the connection to Bethany Reservoir, the demands of SBA users and associated capacity use would not restrict environmental water deliveries. In addition, the potential environmental impacts for the connection to Bethany Reservoir were less than those of the connection to Dyer Canal. Accordingly, a connection to Bethany Reservoir was included in all alternatives that include a connection to South Bay water agencies.

Initial Plans Focused on Combined Objectives

Three initial plans were formulated to represent a reasonable balance amongst the planning objectives of Bay Area water supply reliability, environmental water supply, and water quality. For comparison purposes, each combination plan was formulated with the following major components: enlarging Los Vaqueros Reservoir from 100,000 acre-feet to 500,000 acre-feet; increasing the diversion and conveyance capacity from the Delta to the enlarged Los Vaqueros Reservoir; and constructing new pumping and conveyance facilities from the central Delta diversion to Los Vaqueros Reservoir. The delivery intertie configuration for the plans differed, as described below.

Initial Plan 6 – Enlarge Los Vaqueros Reservoir with Dyer Canal Intertie with Combined Focus on Water Supply/Improved Environmental Water Management This initial plan consisted of enlarging Los Vaqueros Reservoir to replace environmental water purchases south of the Delta and improve Bay Area water supply reliability. It was similar to Initial Plan 4, except that a portion of the increased storage space in Los Vaqueros would be dedicated to water supply reliability. Deliveries would be made from the reservoir through a new intertie to the SBA near the Dyer Canal.

This plan was not carried forward as it presented one of the lowest total yields for environmental and Bay Area water supply reliability. Additionally, as described above, it was determined that an intertie to Bethany Reservoir, rather than directly to the SBA, would provide greater

efficiency and flexibility for meeting the combined environmental water supply and Bay Area water reliability planning objectives.

Initial Plan 7 – Enlarge Los Vaqueros Reservoir with Bethany Reservoir Intertie with Combined Focus on Water Supply/Improved Environmental Water Management This initial plan consisted of enlarging Los Vaqueros Reservoir to increase Bay Area water supply reliability and replace environmental water purchases south of the Delta. It was similar to Initial Plan 6 described above, but included a connection from Los Vaqueros Reservoir to Bethany Reservoir rather than a direct connection to the SBA at Dyer Canal. Existing SWP facilities would be used to deliver environmental water supplies from Bethany Reservoir to SBA users, and additional environmental water supplies could be conveyed south through the California Aqueduct. Unlike Initial Plan 6, with the connection to Bethany Reservoir under Initial Plan 7, the demands of SBA users and associated capacity use would not restrict environmental water deliveries.

Evaluations indicated that Initial Plan 7 would provide benefits for both Bay Area water supply reliability and environmental water management. Because this plan provided benefits for multiple objectives, incremental increases in environmental water supply were more cost effective than under other initial plans, which focused on environmental water management (e.g., Initial Plans 5 and 6). Accordingly, Initial Plan 7 was carried forward for further development due to evaluations that indicated it would result in the lowest cost for environmental water supply and highest potential for Federal interest.

Initial Plan 8 – Enlarge Los Vaqueros Reservoir with Combined Focus on Water Supply/Improved Environmental Water Management with Water Quality Improvements This initial plan consisted of enlarging Los Vaqueros Reservoir to increase Bay Area water supply reliability and replace SOD environmental water purchases. It was similar to Initial Plan 6 described above, but Initial Plan 8 was the only plan with specific operations to improve water quality. Although all initial plans would improve the quality of M&I and environmental water supplies on a long-term average basis, there were times when water quality would be slightly reduced. Under Initial Plan 8, operations were modified to achieve equivalent or improved water quality for deliveries to SBA water agencies and CCWD.

Initial Plan 8 was eliminated from further consideration due to improvements in water quality at the expense of water supply reliability and Bay Area water supply beneficiaries expressed limited interest in or need for water quality benefits from an expanded Los Vaqueros Reservoir. However, water quality benefits that could be accomplished without significant impacts on water supply yield were considered further.

Additional Initial Plans in the 2006 Initial Economic Evaluation for Plan Formulation

Through further development and refinement of the initial plans and management measures carried forward, two additional initial plans were identified, as described in the 2006 *Initial Economic Evaluation for Plan Formulation Report* (Reclamation) and summarized below.

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Moderate In-Place Dam Raise Scenario

This initial plan consisted of a moderate expansion of Los Vaqueros Reservoir to 275,000 acre-feet. Preliminary engineering studies indicated that the existing dam could not be raised more than 10 feet to 15 feet without fully dewatering the reservoir and reconstructing the dam and spillway facilities. However, additional engineering studies and analyses were conducted that determined it would be possible to raise the existing dam core and cross section in-place to achieve a moderate reservoir expansion of up to 275,000 acre-feet in total capacity. This initial plan also included increasing diversion and conveyance capacity from the Delta to the enlarged reservoir. Additionally, this initial plan included construction of conveyance facilities from the expanded reservoir to the SBA.

The moderate expansion to 275,000 acre-feet was carried forward for further development due to evaluations that indicated it had potential to provide cost savings compared to larger expansions. This was because, in a moderate expansion, portions of the existing dam structure, inlet/outlet, and associated facilities could be preserved, and a portion of the foundation of the existing dam left intact.

Desalination without New Storage

Although Initial Plan 3 was not retained for further development, it was considered that desalination might still be a viable alternative component. Consequently, an initial plan was identified that would involve constructing a new, brackish water desalination plant drawing water from Mallard Slough and located adjacent to the existing Randall-Bold WTP. To meet its water quality goals, CCWD would use high quality water from the desalination plant in place of receiving water supplies from Los Vaqueros Reservoir; desalinated supplies would be blended with other CCWD supplies similar to existing conditions. Storage space in Los Vaqueros Reservoir that would otherwise have been exercised to meet CCWD water quality goals could instead be used to contribute to the Bay Area water supply reliability and environmental water supply objectives. A new intertie would be constructed to deliver supplies from the reservoir to SBA beneficiaries.

The desalination without new storage initial plan was not carried forward due to evaluations that indicated it was not cost-effective relative to other initial plans considered. Through examination of existing infrastructure and an assessment of the portion of CCWD's service area that could be served by this initial plan, it was determined that only about 30 percent of CCWD's demand on Los Vaqueros Reservoir could be offset. After accounting for the emergency storage space that CCWD would reserve in the reservoir, the resulting capacity made available by the desalination facility would be up to 15,000 acre-feet per year. Because the volume of water made available for other purposes would be relatively small compared to the significant costs required for construction and operations of a desalination facility, this plan was not cost-effective compared to other initial plans. In addition, challenges were identified with the disposal of concentrated brine waste from the desalination facility. Consequently, this initial plan was not carried forward for further development in Investigation alternative plans. However, desalination without new storage is being evaluated as part of other Bay Area regional studies, including the BARR Drought Contingency Plan.

Key Findings from Initial Plan Evaluation

Following analysis of the initial plans described above, and documented in Reclamation's 2005 *Initial Alternatives Information Report* and 2006 *Initial Economic Evaluation for Plan Formulation Report*, plan formulation efforts and supporting technical studies continued to refine facility configurations, operations, and sizes. Evaluations indicated there were three primary cost breakpoints for enlarging Los Vaqueros Dam. As shown in Figure 3-3, identified cost breakpoints included the following enlargement scenarios:

- **Enlargement to 115,000 acre-feet** – Enlargements up to 115,000 acre-feet could be constructed in-place by adding fill to the top of the existing dam and would not require dewatering of the reservoir.
- **Enlargement to 160,000 acre-feet** – Enlargements from 115,000 to 160,000 acre-feet could be constructed in-place by adding fill to the top and front side of the existing dam and would not require dewatering of the reservoir.
- **Enlargement to 275,000 acre-feet** – Enlargements from 160,000 to 275,000 acre-feet could be constructed in-place by adding fill to the top, front, and back side of the existing dam, which would require dewatering of the reservoir. Enlargements to greater than 275,000 acre-feet require would demolition of the existing Los Vaqueros Dam and construction of a new dam upstream.

Intermediate dam raises between these cost breakpoint enlargements would require a majority of the costs associated with the next higher breakpoint enlargement, but would only provide a portion of the increased storage capacity. Because of this, intermediate expansions between the cost break-point enlargement scenarios were not considered for inclusion in Investigation alternatives.

Further studies also indicated that the 275,000 acre-foot moderate expansion would be more cost-effective than larger 500,000 acre-foot expansion in addressing the M&I and environmental water management objectives of the Investigation. The moderate expansion scenario would allow for portions of the existing dam structure, inlet/outlet, and associated facilities to be preserved, and a portion of the foundation of the existing dam to be left intact.

Although larger reservoir expansion options up to 500,000 acre-feet were also initially carried forward in the set of initial plans, subsequent operational analyses indicated that Bay Area water supply reliability demands and environmental water demands did not warrant the higher cost associated with demolishing the existing dam and building a new facility. As a result, options for expanding Los Vaqueros Reservoir storage to greater than 275,000 acre-feet were eliminated from further consideration. Accordingly, the Investigation alternatives described in the following section did not consider or include Los Vaqueros Reservoir expansions greater than 275,000 acre-feet.

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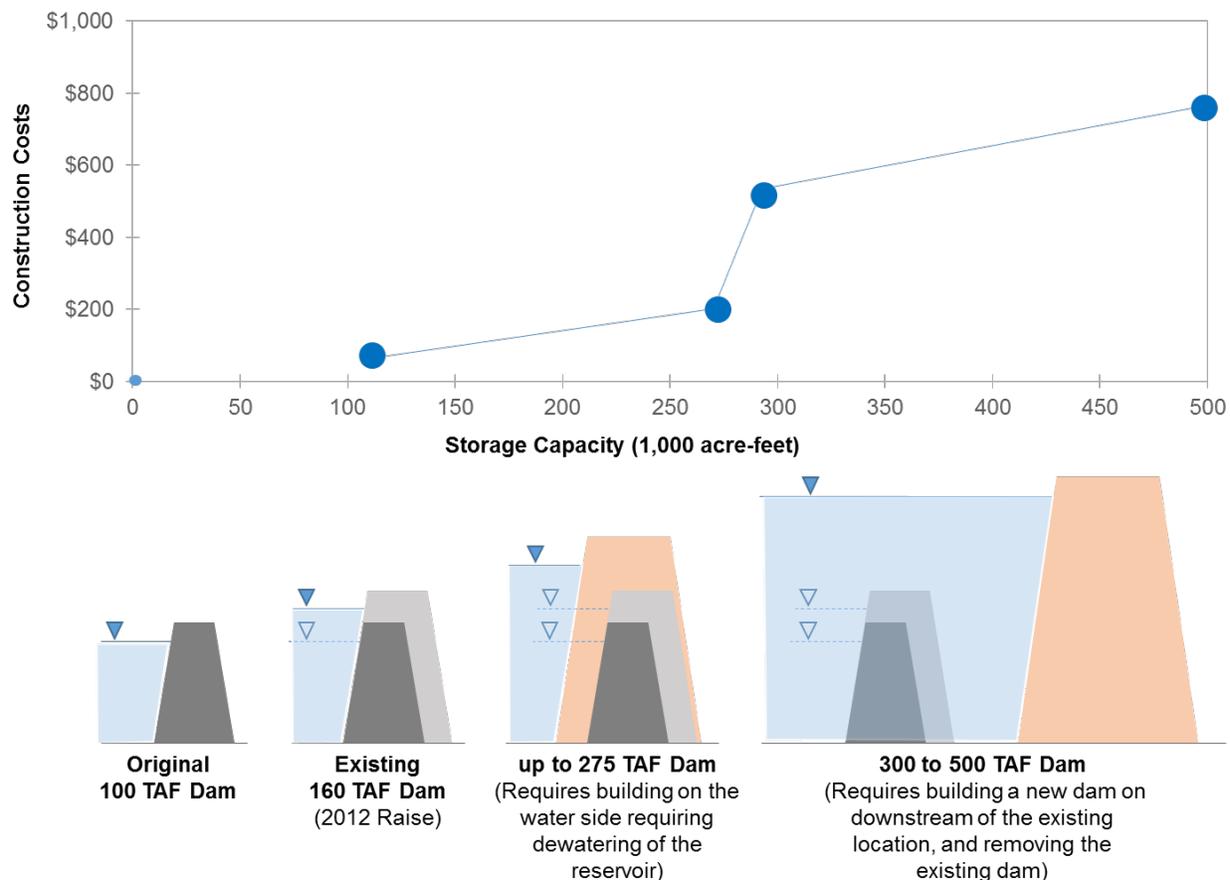


Figure 3-3. Estimated Los Vaqueros Dam Construction Costs (Dam Construction Costs Only, 2015 Dollars, \$ millions) and Construction Requirements Resulting in Cost Break-Points

Alternatives Evaluated in the 2010 Final EIS/EIR

Consistent with the P&G, an iterative plan formulation process was applied to assess and refine initial plans and management measures and formulate alternative plans. This section provides an overview of the formulation and refinement of the alternative plans evaluated in the 2010 Final EIS/EIR. As described above, all reservoir size options greater than expansion to 275 TAF were eliminated and all initial plans except Initial Plan 2, Initial Plan 5, and Initial Plan 7 were not carried forward. During the formulation of alternatives included in the 2010 Final EIS/EIR, additional alternatives were developed and evaluated. A smaller 160 TAF reservoir expansion alternative (60 TAF additional storage capacity) was included in the final alternatives evaluated in the 2010 Final EIS/EIR.

The 160 TAF reservoir expansion alternative (60 TAF additional storage) was developed to facilitate CCWD’s plans to secure water transfers for CCWD customers, provide supplemental dry-year water supply, and reduce the extent of supplemental drought supply acquisition. Under this alternative, CCWD would increase the size of Los Vaqueros Reservoir to 160 TAF. This alternative could be implemented solely by CCWD and specifically addressed water supply

reliability planning objectives without requiring new intake or conveyance facilities. This alternative was further refined as a smaller reservoir alternative that could serve CCWD customers and other Bay Area water agencies through existing interties.

Several plan types were identified for further development into alternative plans, incorporating various combinations of (1) increased storage capacity in Los Vaqueros Reservoir (275 TAF or 160 TAF total capacity); (2) modified and/or expanded Delta intake and conveyance facilities; and (3) an optional pipeline to Bethany Reservoir. Different operational emphases were also explored to achieve the two planning objectives to differing degrees. Based on further development of these plan types, incorporation of facilities siting studies, input from public scoping, and coordination with resource agencies and other interested parties, the following alternative plans were developed and evaluated:

- **2010 Final EIS/EIR Alternative 1** – 275 TAF Expansion (175 TAF additional storage capacity) of Los Vaqueros Reservoir, South Bay Connection to Bethany Reservoir, Environmental Water Management, and Water Supply Reliability Dual Emphasis
- **2010 Final EIS/EIR Alternative 2** – 275 TAF Expansion (175 TAF additional storage capacity) of Los Vaqueros Reservoir, South Bay Connection to Bethany Reservoir, and Environmental Water Management Emphasis
- **2010 Final EIS/EIR Alternative 3** – 275 TAF Expansion (175 TAF additional storage capacity) of Los Vaqueros Reservoir, No South Bay Connection to Bethany Reservoir, and Environmental Water Management Emphasis
- **2010 Final EIS/EIR Alternative 4** – 160 TAF Expansion (60 TAF additional storage capacity) of Los Vaqueros Reservoir, No South Bay Connection to Bethany Reservoir, and Water Supply Reliability Emphasis

Table 3-6 summarizes the alternatives evaluated in the 2010 Final EIS/EIR.

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Table 3-6. Summary of Physical Features and Key Operations for Alternatives Evaluated in the 2010 Final EIS/EIR

Component	Description	2010 Final EIS/EIR Alternatives			
		1	2	3	4 (No Action)
Primary Physical Features	Los Vaqueros Reservoir Storage Capacity	275 TAF	275 TAF	275 TAF	160 TAF
	Pipeline to Bethany Reservoir	470 cfs	470 cfs	-	-
	New (Alternatives 1 and 2) or Expanded (Alternative 3) Old River Intake Facilities	Up to 170 cfs ¹	Up to 170 cfs ¹	70 cfs expansion	-
	New Delta-Transfer Pipeline	350 cfs	350 cfs	250 cfs	-
	New Transfer-Los Vaqueros Pipeline (fill capacity/release capacity)	670 cfs/ 470 cfs	670 cfs/ 470 cfs	570 cfs (fill only)	-
Operational Emphasis	Environmental Water Management and/or Water Supply Reliability	EWM & WSR	EWM	EWM	WSR
Key Environmental Water Management Operations	Improved Fish Screening	✓	✓		
	Dedicated Storage for Environmental Water Purposes (wildlife refuges, delta fishery protection, instream flows, etc.)		✓	✓	
	In-lieu Environmental Water Deliveries – CCWD foregoes CVP Diversions, which are then Delivered for Environmental Purposes			✓	
	No Diversion Period for CCWD during Environmentally-sensitive Periods	✓	✓	✓	✓
	No-Diversion Period for SBA during Environmentally-sensitive Periods – Water Supply Provided Instead from Storage in Los Vaqueros Reservoir	✓	✓		
Key Water Supply Reliability Operations	Delta Supply Restoration – Delivery of M&I Reliability Supplies to SBA	✓			
	Increased CCWD Dry Year Supply Reliability	✓	✓	✓	✓
	Increased Bay Area Emergency Water Storage	✓	✓	✓	✓

Note:

¹ In the 2010 Final EIS/EIR, Alternatives 1 and 2 included a new Delta pump station with a capacity up to 170 cfs. However, this new pump station was eliminated subsequent to the release of the 2010 Final EIS/EIR (see Appendix A – Plan Formulation, Chapter 5) and is not evaluated in the Feasibility Report.

Key:

Bay Area = San Francisco Bay Area
 CCWD = Contra Costa Water District
 cfs = cubic feet per second
 CVP = Central Valley Project
 EIS/EIR = Environmental Impact Statement/Environmental Impact Report
 EWM = environmental water management
 M&I = municipal and industrial
 SBA = South Bay Aqueduct
 WSR = water supply reliability

2010 Final EIS/EIR Alternative 1

2010 Final EIS/EIR Alternative 1 consisted of enlarging Los Vaqueros Reservoir from 100 TAF (reservoir storage capacity at the time) to 275 TAF total capacity, expanding CCWD Delta intakes, and constructing various conveyance and delivery components to allow for water deliveries from the Los Vaqueros Project to Bethany Reservoir, as shown in Table 3-6. The primary focuses of this alternative included: (1) increasing Bay Area water supply reliability, and

(2) improving environmental water management. This alternative also contributed to the secondary planning objective of water quality improvement.

Primary Facilities

The primary facilities associated with 2010 Final EIS/EIR Alternative 1 are illustrated in Figure 3-4 and include the following:

- Expanding Los Vaqueros Reservoir from 100 TAF (reservoir storage capacity at the time) to 275 TAF total capacity.
- Increasing conveyance capacity from the Old River Pump Station to the existing Transfer Facility by constructing a new 350 cfs Delta-Transfer Pipeline parallel to the existing 320 cfs Old River Pipeline. Total conveyance capacity for the two pipelines would be 670 cfs. Construction of the new Delta-Transfer Pipeline would allow for full utilization of the existing diversion capacity at the Old and Middle River pump stations, effectively increasing Delta diversion capacity to 500 cfs.
- Increasing conveyance capacity from the Transfer Facility into Los Vaqueros Reservoir by constructing a new pump station at Transfer Facility and a 670 cfs Transfer-Los Vaqueros Pipeline parallel to the existing 400 cfs Transfer Pipeline. The existing 400 cfs pipeline would only be used for gravity flow releases, whereas the new Transfer-Los Vaqueros Pipeline would be used for filling and release operations to Bethany Reservoir.
- Constructing a new 470 cfs Transfer-Bethany Pipeline to deliver water supplies to Bethany Reservoir. This pipeline would connect with the Delta-Transfer Pipeline, allowing direct delivery of diversions from the Delta intakes, and the Transfer Pipeline, allowing delivery of releases from Los Vaqueros Reservoir. Two prospective alignments are being considered that include tunnel segments and would terminate with a tie-in to Bethany Reservoir.
- Expanding the Transfer Facility to a total pumping capacity of 670 cfs and a storage capacity of 12 million gallons to accommodate movement of higher flow volumes and higher water surface elevations (resulting in higher hydraulic head) in Los Vaqueros Reservoir.
- Relocating and/or replacing existing recreational facilities in the Los Vaqueros watershed disturbed or displaced by the reservoir expansion, and constructing additional recreational facilities to enhance recreational opportunities (additional fishing access areas and trails, and an expanded marina complex).

2010 Final EIS/EIR Alternative 1 also included expanding CCWD's existing Delta diversion capacity to 670 cfs by adding a new 170 cfs Delta intake and pump station along Old River. This new intake would be operated in conjunction with the existing 250 cfs Old River Pump Station and 250 cfs Middle River Pump Station. However, as described in Appendix A – Plan Formulation, Chapter 5, subsequent studies found this new intake was not needed. Consequently, it is not included in the final alternatives evaluated in this Feasibility Report.

Key Operations and Accomplishments

2010 Final EIS/EIR Alternative 1 was formulated with a dual emphasis on primary planning objectives, using an expanded Los Vaqueros Reservoir to improve environmental water management and increase Bay Area water supply reliability. Operations were formulated to meet the project objectives while minimizing impacts and avoiding harm to other water users. This alternative would also contribute to the secondary planning objective of water quality improvement.

A key component of this alternative was the Transfer-Bethany Pipeline and appurtenant facilities to connect CCWD's Transfer Facility and Bethany Reservoir. With the Transfer-Bethany Pipeline, water could be conveyed to Bethany Reservoir and near the existing SWP South Bay Pumping Plant. From the point of delivery, the water could either be pumped into the SBA for use by SBA water agencies or moved to San Luis Reservoir for use by SCVWD as CVP water supply. Operations would be coordinated with SWP and CVP operations and water for SBA water agencies would be diverted under existing CVP and SWP water right permits and modified as needed.

CCWD has both a long-term contract with Reclamation for CVP water and separate water rights for storage of Delta surplus water in Los Vaqueros Reservoir. CCWD's separate Los Vaqueros water rights are subject to permit terms and conditions to ensure that exercising those water rights does not adversely affect the CVP and SWP operations under the water rights permits held by Reclamation and DWR, respectively. All 2010 Final EIS/EIR alternatives were formulated to adhere to these requirements.

Operations to improve environmental water management included improved fish screening, a no-diversion period, and multiple Delta intake locations. With improved fish screening, a portion of the contracted SWP and CVP water delivered to the Local Agency Partners would be provided through the expanded Los Vaqueros Reservoir system, using state-of-the-art, positive-barrier fish screens to protect fish more effectively than the existing CVP and SWP Delta export pumping systems. With the no-diversion period, a portion of the additional storage capacity in an expanded Los Vaqueros Reservoir would be used to replace Delta pumping Local Agency Partners for 30 days during the most critical fish period in the spring. This also included adaptive management of the timing of the no-diversion period to optimize fisheries benefits. Additionally, availability of multiple Delta intakes under this alternative, including the construction of a new Delta intake and pump station, would provide opportunities for additional fish protection.

Operations to improve water supply reliability under 2010 Final EIS/EIR Alternative 1 included Delta supply restoration, dry year storage, and emergency storage. Delta supply restoration would increase water deliveries to Local Agency Partners through direct diversions or delivery of stored water to partially restore delivery reductions due to regulatory restrictions of CVP and SWP operations (e.g., 2008 USFWS BO and 2009 NMFS BO). Operations for dry year storage consisted of increasing the amount of water available in dry years to Local Agency Partners, reducing the need to purchase supplemental dry year supplies, activate dry-year exchange programs, or institute drought management measures. Emergency storage of water for the Bay Area region would be available during shortages caused by natural disasters or other emergencies. Emergency water supplies would be delivered through either the South Bay connection or existing interties between water agencies. Other operational benefits provided

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under this alternative would include emergency water supply and potential water quality benefits for SBA water users. The increased storage capacity of Los Vaqueros Reservoir would provide increased emergency water supplies for Local Agency Partners through existing interties with the CCWD system.

This alternative would result in some improvements in the quality of water delivered to Local Agency Partners by providing higher quality water from Los Vaqueros Reservoir (instead of the Delta) during dry periods and reducing deliveries of water through Clifton Court Forebay. In Clifton Court Forebay, warm, shallow, slow-moving water can result in algae growth, an increase in organic carbon content, and taste and odor issues. Additional storage under this alternative would also provide water quality improvements for CCWD in dry years by increasing the amount of water available for blending. Estimated accomplishments for environmental water management, water supply reliability, and water quality under 2010 Final EIS/EIR Alternative 1 are summarized in Table 3-7.

2010 Final EIS/EIR Alternative 2

Alternative 2 consisted of enlarging Los Vaqueros Reservoir, expanding CCWD Delta intakes, and constructing various conveyance and delivery components to allow for water deliveries from the Los Vaqueros Project to Bethany Reservoir, as shown in Table 3-6. Facilities for Alternative 2 were the same as those included in Alternative 1 (see Figure 3-4). 2010 Final EIS/EIR Alternative 2 was distinct from Alternative 1 in that water system operations were focused on environmental water management. This alternative would also contribute to the secondary planning objective of water quality improvement.

Primary Facilities

Facilities associated with 2010 Final EIS/EIR Alternative 2 are illustrated in Figure 3-4. New and expanded facilities under this alternative for increased storage, pumping, conveyance, and power, as well as for recreation facilities, were the same as described for 2010 Final EIS/EIR Alternative 1.

Table 3-7. Summary of Estimated Accomplishments for 2010 Final EIS/EIR Alternatives

Benefits	Alternative 1		Alternative 2		Alternative 3 ³		Alternative 4 (No Action)	
	Long-Term Average ¹	6-Year Drought Average ²	Long-Term Average ¹	6-Year Drought Average ²	Long-Term Average ¹	6-Year Drought Average ²	Long-Term Average ¹	6-Year Drought Average ²
Environmental Water Management								
Wheeling for Improved Fish Screening (TAF/year)	141	55	135	54	-	-	-	-
Environmental Water Supplies from Dedicated Storage (TAF/year)	-	-	11	-	20	65	-	3
Additional Real-time Operating Benefits	Multiple intake locations to further avoid fish impacts; timing of pumping reductions at SWP/CVP Delta export facilities to further benefit fish.						-	
Water Supply Reliability								
SBA Increased Water Supply Reliability (TAF/year)	6	10	-	-	-	-	-	-
CCWD Increased Water Supply Reliability (TAF/year) ⁴	-	3	-	3	3	20	10	60
Emergency Water Storage (TAF/year) ⁵	107	67	101	58	235	130	116	69
Water Quality								
SBA Water Quality	Incidental improvement in taste, odor, salinity				-		-	
CCWD Water Quality	Incidental improvement in CCWD's ability to meet delivered water quality goals							

Notes:

¹ Long-term average values estimated using CalSim-II based on 82-year period of simulation.

² 6-year drought average is based on the hydrology of 1987-1992 drought.

³ Estimated benefits from Alternative 3 are from the 2009 Draft EIS/EIR. Due to identification of significant and unavoidable impacts under Alternative 3, benefits and impacts analyses were not included in the 2010 Final EIS/EIR for this alternative.

⁴ 2010 Final EIS/EIR Alternatives 1, 2, and 3 assume 20 TAF of the increased storage capacity would be for CCWD. Alternative 4 assumes 60 TAF additional storage for Local Agency Partners.

⁵ Average amount of water available in Los Vaqueros Reservoir for a single-year emergency. Emergency supplies under Alternatives 3 and 4 would be delivered to Local Agency Partners through existing interties.

Key:

Bay Area = San Francisco Bay Area

CCWD = Contra Costa Water District

CVP = Central Valley Project

SBA = South Bay Aqueduct

SWP = State Water Project

TAF = thousand acre-feet

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Key Operations and Accomplishments

2010 Final EIS/EIR Alternative 2 was distinct from Alternative 1 in that water system operations are focused on environmental water management. Although this alternative had the potential to provide some increases in Bay Area water supply reliability, these increases would be to a lesser extent than 2010 Final EIS/EIR Alternative 1. Operations were formulated to meet the project objectives while minimizing impacts and avoiding harm to other water users. This alternative would also contribute to the secondary planning objective of water quality improvement.

Similar to 2010 Final EIS/EIR Alternative 1, a key component of this alternative was the Transfer-Bethany Pipeline and appurtenant facilities. From the point of delivery in Bethany Reservoir, the water could either be pumped into the SBA for use by the Local Agency Partners or released into the California Aqueduct, where it could then be delivered to the Delta Mendota Canal. From the California Aqueduct/Delta Mendota Canal, the water could then be delivered directly through subsequent conveyance facilities or stored in the San Luis Reservoir for later use to meet environmental water needs (e.g., Refuge water supply needs). It was assumed that operations would be coordinated with SWP and CVP operations and that water for Local Agency Partners and dedicated storage for environmental water would be diverted under existing CVP and SWP water right permits, which would be modified as needed.

CCWD has both a long-term contract with Reclamation for CVP water and separate water rights for storage of Delta surplus water in Los Vaqueros Reservoir. CCWD's separate Los Vaqueros water rights are subject to permit terms and conditions to ensure that exercising those water rights does not adversely affect the CVP and SWP operations under the water rights permits held by Reclamation and DWR, respectively. All 2010 Final EIS/EIR alternatives were formulated to adhere to these requirements.

Operations to improve environmental water management under 2010 Final EIS/EIR Alternative 1 included improved fish screening, a no-diversion period, multiple Delta intake locations, and dedicated storage for environmental water. Operations for improved fish screening, the no-diversion period, and multiple Delta intake locations were the same as under 2010 Final EIS/EIR Alternative 1. Operations for dedicated storage for environmental water included the use of capacity in the new and enlarged storage and conveyance facilities to provide water supplies for environmental purposes, such as the Refuges, Delta fishery protection, instream flows, or other environmental purposes. For example, water from the expanded Los Vaqueros Reservoir system could be delivered to Central Valley Refuges through the Transfer-Bethany Pipeline. This water could be delivered through the California Aqueduct/Delta Mendota Canal or be transferred to the San Luis Reservoir where it would be available for later delivery to the Refuges, increasing the quantity of water available to these habitat areas. Dedicated storage for environmental water would also increase flexibility for Reclamation and DWR to manage cold water storage in upstream reservoirs and Delta diversions to benefit fisheries. Under these operations, CCWD and South Bay water supplies would be provided from storage in Los Vaqueros Reservoir during certain periods, allowing reduced reliance on upstream storage and Delta diversions during sensitive periods for fish.

Operations to improve water supply reliability under 2010 Final EIS/EIR Alternative 2 included dry year storage and emergency storage, as described for 2010 Final EIS/EIR Alternative 1, but do not include Delta supply restoration for Local Agency Partners.

Similar to 2010 Final EIS/EIR Alternative 1, this alternative would result in some improvements in the quality of water delivered to Local Agency Partners by providing higher quality water from the reservoir instead of the Delta during dry periods and reducing deliveries of water through Clifton Court Forebay. Additional storage under this alternative would also have the potential to provide water quality improvements for CCWD in dry years by increasing the amount of water available for blending.

Estimated accomplishments for environmental water management, water supply reliability, and water quality under 2010 Final EIS/EIR Alternative 2 are summarized in Table 3-7.

2010 Final EIS/EIR Alternative 3

2010 Final EIS/EIR Alternative 3 consisted of enlarging Los Vaqueros Reservoir, expanding CCWD Delta intakes, and constructing various conveyance components to support an expanded Los Vaqueros Reservoir. This alternative did not include a delivery pipeline from the Los Vaqueros Project to Bethany Reservoir, representing a reduced facility scenario compared to 2010 Final EIS/EIR Alternative 1 and Alternative 2. The focus of this alternative was improving environmental water management; however, 2010 Final EIS/EIR Alternative 3 was eliminated from further consideration in the 2010 Final EIS/EIR.

Primary Facilities

Facilities associated with 2010 Final EIS/EIR Alternative 3 are illustrated in Figure 3-5. Similar to 2010 Final EIS/EIR Alternative 1 and Alternative 2, a major component of this alternative was expanding Los Vaqueros Reservoir from 100 TAF (reservoir storage capacity at the time) to 275 TAF total capacity. Because delivery to Bethany Reservoir was not included, this alternative included fewer and smaller pumping, intake, and conveyance components. These included the following:

- Expanding CCWD's Old River intake and pump station from 250 cfs to 320 cfs by replacing existing pumps with higher capacity pumps and installing additional fish screens in existing vacant bays. The expanded capacity at the Old River Pump Station would provide a total Delta diversion capacity of 570 cfs when combined with the 250 cfs Middle River Pump Station.
- Increasing conveyance capacity from the Old River Pump Station to the existing Transfer Facility by constructing a new 250 cfs Delta-Transfer Pipeline parallel to the existing 320 cfs Old River Pipeline. Total conveyance capacity for the two pipelines would be 570 cfs.
- Increasing conveyance capacity from the Transfer Facility into Los Vaqueros Reservoir by constructing a new pump station at Transfer Facility and a 570 cfs Transfer-LV Pipeline parallel to the existing 400 cfs Transfer Pipeline. The existing 400 cfs pipeline would only be used for gravity flow releases, whereas the new Transfer-LV pipeline would be used to fill the expanded reservoir.
- Expanding the Transfer Facility to a total pumping capacity of 570 cfs and a storage capacity of 12 million gallons to accommodate movement of higher flow volumes and higher water surface elevations (resulting in higher hydraulic head) in Los Vaqueros Reservoir.

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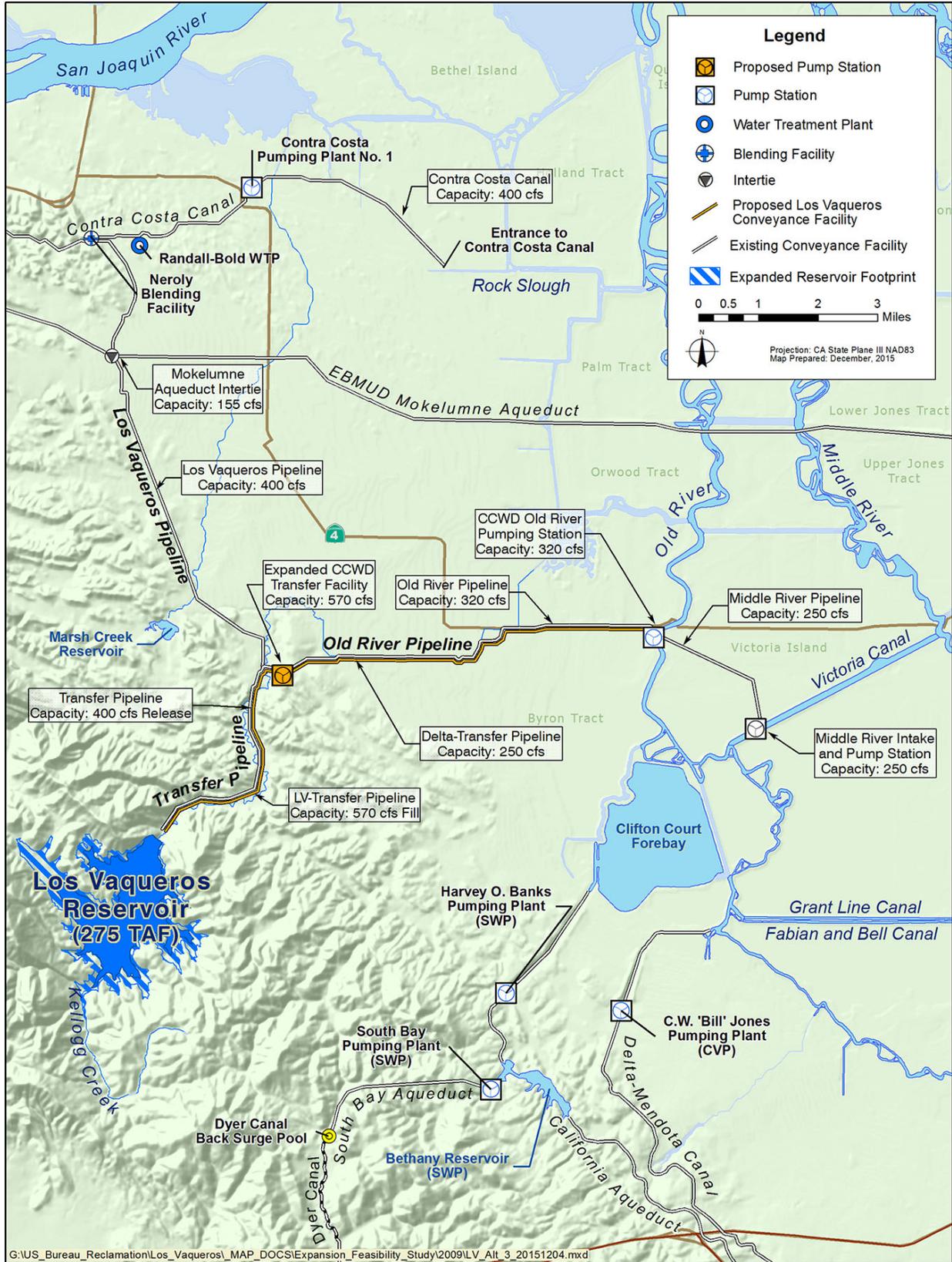


Figure 3-5. Project Facilities Associated with 2010 Final EIS/EIR Alternative 3

- Relocating and/or replacing existing recreational facilities in the Los Vaqueros watershed disturbed or displaced by the reservoir expansion, and constructing additional recreational facilities to enhance recreational opportunities (additional fishing access areas, trails, and an expanded marina complex).

Key Operations and Accomplishments

The water system operations for this alternative were formulated to evaluate whether it would be possible to achieve the project objectives without constructing the Transfer-Bethany Pipeline or the new Delta intake and pump station. Because this alternatives did not include the connection to Bethany Reservoir, CVP and SWP supplies would not be delivered to the Local Agency Partners through the expanded Los Vaqueros Reservoir system, and the fisheries and reliability benefits associated with improved fish screening would not be achieved. This alternative also would not provide increased water supply reliability for these agencies. It was assumed that operations would be coordinated with SWP and CVP operations and that water for Local Agency Partners would be diverted under existing CVP and SWP water right permits, modified as needed. Operations were formulated to meet the planning objectives while minimizing impacts and avoiding harm to other water users.

CCWD has both a long-term contract with Reclamation for CVP water and separate water rights for storage of Delta surplus water in Los Vaqueros Reservoir. CCWD's separate Los Vaqueros water rights are subject to permit terms and conditions to ensure that exercising those water rights does not adversely affect the CVP and SWP operations under the water rights permits held by Reclamation and DWR, respectively. All Los Vaqueros Reservoir Expansion Investigation (Investigation) 2010 Final EIS/EIR alternatives were formulated to adhere to these requirements.

Operations to improve environmental water management under 2010 Final EIS/EIR Alternative 3 included the no-diversion period, multiple Delta intake locations, and dedicated storage for environmental water. With the no-diversion period, CCWD would cease pumping from the Delta during critical fish periods in the spring and instead rely on releases from the expanded Los Vaqueros Reservoir. Multiple Delta intake locations (Old River and Middle River intake and pump stations) could be adaptively managed to reduce impacts on fish. With dedicated storage for environmental water, additional water stored in the expanded reservoir would be reserved for environmental purposes. Under operations for dedicated storage for environmental water, CCWD would draw from stored Los Vaqueros Reservoir supplies to serve its customers and refrain from pumping from the Delta during periods that would allow Reclamation to retain water storage in upstream reservoirs. The retained storage in upstream reservoirs that had been reserved for delivery to CCWD would be reallocated for environmental purposes both north and south of the Delta, including Refuge water supply deliveries, cold water releases to support salmon spawning, or other environmental purposes. Therefore, under Alternative 3, there would be no direct delivery of environmental water supplies from the expanded reservoir, as would occur under Alternative 1 and Alternative 2.

Operations to improve water supply reliability under 2010 Final EIS/EIR Alternative 3 included dry year storage and emergency storage, as described for 2010 Final EIS/EIR Alternative 1 and Alternative 2, but did not include Delta supply restoration. Operations for dry year storage would consist of increasing the amount of water available in dry years to CCWD, thereby reducing the need to purchase supplemental dry year supplies, activate dry-year exchange programs, or

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institute drought management measures. This alternative would also provide emergency storage of water for the Bay Area region that would be available during shortages caused by natural disasters or other emergencies. It was assumed that emergency water supplies for Alternative 3 would be delivered through, and limited by the capacity of, existing interties between water agencies.

Additional storage under this alternative would have the potential to provide water quality improvements for CCWD in dry years by increasing the amount of water available in Los Vaqueros Reservoir for blending. Estimated accomplishments for environmental water management, water supply reliability, and water quality under 2010 Final EIS/EIR Alternative 3 are summarized in Table 3-7.

2010 Final EIS/EIR Alternative 4

2010 Final EIS/EIR Alternative 4 was implemented by CCWD with construction completed in 2012. This alternative consisted of enlarging Los Vaqueros Reservoir, but to a lesser extent than 2010 Final EIS/EIR Alternatives 1, 2, and 3. This alternative did not include any increase or expansion of Delta diversions, conveyance capacity, delivery, or power facilities. The focus of this alternative was improving water supply reliability. 2010 Final EIS/EIR Alternative 4 represented a “reduced project” alternative. It was included to evaluate the extent to which the project objectives could be achieved if a smaller reservoir were constructed to provide water supply reliability improvements and water quality benefits for CCWD and its customers. It was also constructed for other Local Agency Partners that have existing interties or connections with CCWD’s water supply system and that choose to participate in the project. As described in subsequent sections, this alternative was ultimately approved for implementation by CCWD and construction to enlarge the reservoir to 160 TAF was completed in 2012. The facilities and operations described below are existing conditions and, therefore, Alternative 4 is used to represent the No Action Alternative for this Feasibility Report.

Primary Facilities

Facilities associated with 2010 Final EIS/EIR Alternative 4 are illustrated in Figure 3-6.

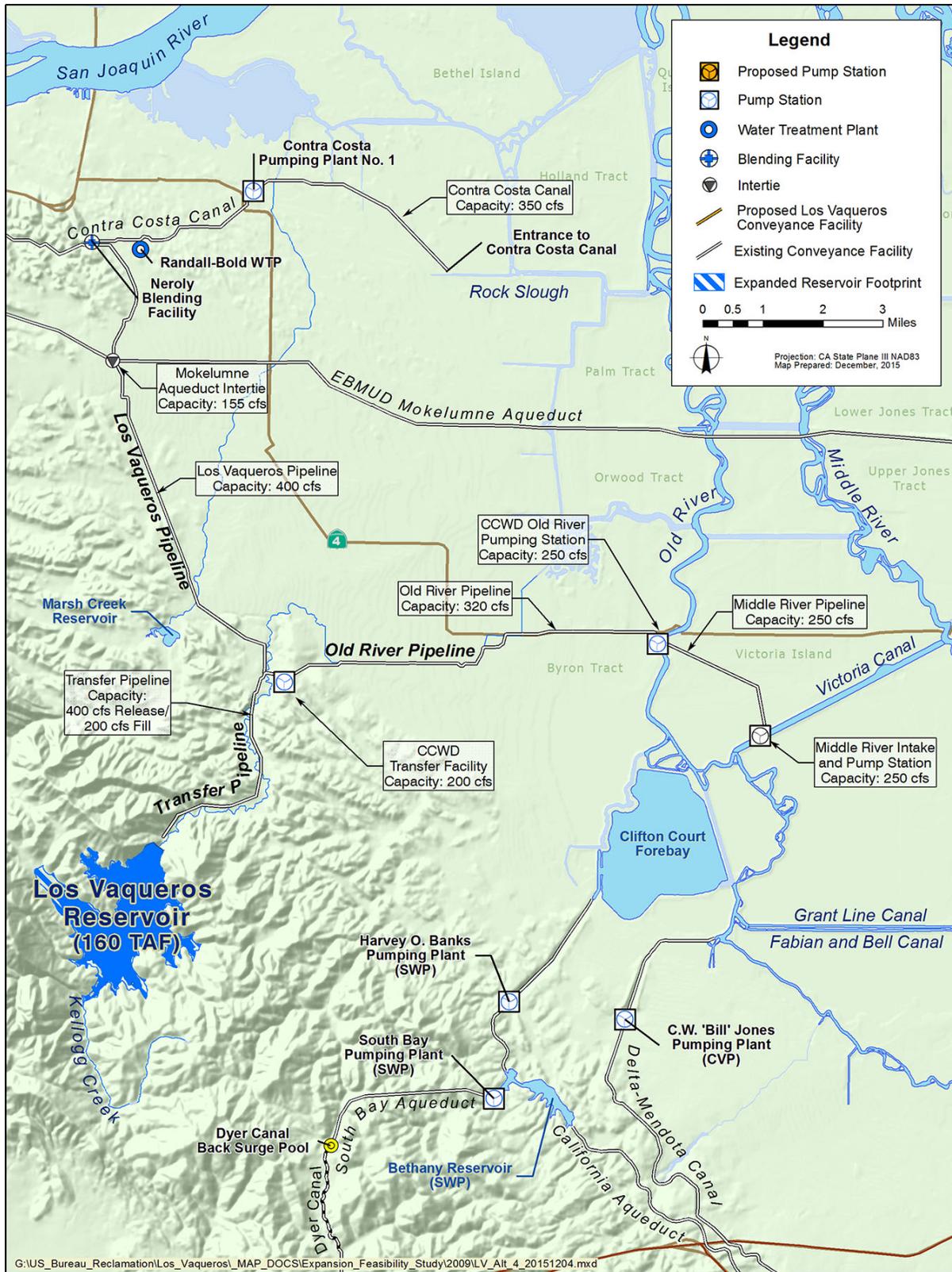


Figure 3-6. Project Facilities Associated with 2010 Final EIS/EIR Alternative 4 (Implemented)

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The primary component of this alternative was expanding Los Vaqueros Reservoir from 100 TAF (reservoir storage capacity at the time) to 160 TAF total capacity (current reservoir storage capacity). This involved raising the existing dam through building on the top and downstream shell, and construction/modification of appurtenant facilities such as the spillway, outlet facilities, and reservoir oxygenation system. Construction under this alternative did not require dewatering of the reservoir. This alternative also included minor upgrades to the Transfer Facility, which were accomplished in the existing facility site. As with all the comprehensive alternative plans, existing recreational facilities in the Los Vaqueros watershed disturbed or displaced by the reservoir expansion have been relocated or replaced. This alternative did not include construction of additional recreational facilities to enhance recreational opportunities.

Key Operations and Accomplishments

The water system operations for the smaller reservoir expansion constructed under 2010 Final EIS/EIR Alternative 4 were formulated to increase water supply reliability for CCWD customers and other Bay Area water agency participants that CCWD could deliver water directly through interties or indirectly through exchange in times of shortage. Operations were formulated to meet the project objectives while minimizing impacts and avoiding harm to other water users. It was assumed that operations would be coordinated with SWP and CVP operations.

CCWD has both a long-term contract with Reclamation for CVP water and separate water rights for storage of Delta surplus water in Los Vaqueros Reservoir. CCWD's separate Los Vaqueros water rights are subject to permit terms and conditions to ensure that exercising those water rights does not adversely affect the CVP and SWP operations under the water rights permits held by Reclamation and DWR, respectively. All Investigation 2010 Final EIS/EIR alternatives were formulated to adhere to these requirements.

Operations to improve environmental water management under 2010 Final EIS/EIR Alternative 4 included the no-diversion period and multiple Delta intake locations. With the no-diversion period, CCWD would continue operations to cease pumping from the Delta during critical fish periods in the spring and instead rely on releases from the expanded Los Vaqueros Reservoir. Under this alternative, multiple Delta intake locations (Old River and Middle River intake and pump stations) would continue to be adaptively managed to reduce impacts on fish.

Operations to improve water supply reliability under 2010 Final EIS/EIR Alternative 4 included dry year storage and emergency storage. Operations for dry year storage consisted of increasing the amount of water available in dry years from Los Vaqueros Reservoir to CCWD. Dry year storage operations also included benefits for other Bay Area water agency participants that CCWD could deliver water directly through existing interties or indirectly through exchanges. This alternative also provided emergency storage water for the Bay Area region that would be available during shortages caused by natural disasters or other emergencies. It was assumed that emergency water supplies would be delivered through existing interties between water agencies.

2010 Final EIS/EIR Alternative 4 would provide greater water quality improvements for CCWD in dry years than 2010 Final EIS/EIR Alternatives 1, 2, and 3; additional storage under this alternative would increase the amount of water available to CCWD for blending. Estimated accomplishments for environmental water management, water supply reliability, and water quality under 2010 Final EIS/EIR Alternative 4 are summarized in Table 3-7.

Two-Step Approach for Implementation of Investigation

After the Draft EIS/EIR was released in 2009, a two-step approach was identified for expanding Los Vaqueros Reservoir, with an initial expansion to be completed by CCWD. CCWD had immediate and urgent needs to take action to protect its water supply quality and reliability, while Reclamation and other potential partners in a 275-TAF reservoir expansion needed to complete studies on broader Delta water system actions. Because of this, the 2010 Final EIS/EIR included evaluation of effects for a timing variant (i.e., two-step approach) on the 275 TAF expansion alternatives, where the reservoir could first be expanded to 160 TAF to meet CCWD's immediate needs (Phase 1), then lead agencies could consider further expansion of the reservoir to 275 TAF at a later time (Phase 2).

Evaluations in the 2010 Final EIS/EIR indicated that the two-step approach would result in the same types of impacts as the 275 TAF alternative plans, but might be greater in magnitude for (1) areas at the dam site and marina facilities where ground disturbance would occur twice, (2) effects associated with two rounds of construction activities (e.g., construction traffic during two periods), and (3) additive footprint impacts associated with the need to use borrow area sites associated with both the 160 TAF and 275 TAF expansions. The effects of a two-step approach for the 275 TAF alternative plans, with an interim expansion to 160 TAF, were evaluated and disclosed in the 2010 Final EIS/EIR.

The 2010 Final EIS/EIR included evaluations for water operations, incorporating regulatory constraints from the 2008 Coordinated Long Term Operations of the CVP and SWP BO, 2008 USFWS BO, and 2009 NMFS BO (released in June 2009). Additionally, all of the 2010 Final EIS/EIR alternative plans included integration of certain features of CCWD's existing operations into the Los Vaqueros Reservoir Expansion Project.

While the 2010 Final EIS/EIR included analysis of a two-step approach for expansion of Los Vaqueros Reservoir in two phases (initial expansion to 160 TAF, followed by a later expansion to 275 TAF), an update to the EIS/EIR would be required prior to moving forward with a second phase of reservoir expansion.

Selection of 2010 Final EIS/EIR Alternative 4 – 160 TAF Enlargement for Phase 1

2010 Final EIS/EIR Alternative 4 was selected as the environmentally superior alternative under CEQA, the preferred alternative under NEPA, and was identified as the environmentally preferable alternative in the ROD. This alternative was selected as a local action to meet CCWD's immediate and urgent water supply reliability and water quality needs. The 2010 Final EIS/EIR concluded that implementation of the 160 TAF expansion by CCWD would not preclude further expansion of the reservoir to 275 TAF at a later time and stated that Reclamation would continue to study the larger expansion alternatives in the context of other ongoing Delta initiatives and programs. CCWD completed construction in 2012.

Refinement of Alternatives in the 2010 Final EIS/EIR

Following completion of the initial reservoir expansion to 160 TAF by CCWD in 2012, Reclamation, CCWD, and DWR continued to investigate further expanding the Los Vaqueros Project to provide additional regional water supply reliability and statewide environmental benefits. Refinements to the alternative plans were conducted to account for changes that have occurred since the 2010 Final EIS/EIR was released or are anticipated to occur in the coming years, including the Value Planning Study, elimination of the new Delta pump station, and others, as summarized below and described in more detail in Appendix A – Plan Formulation.

Additionally, key changes to the regulatory and environmental conditions that are considered for the refinements of the alternative plans, as well as other environmental documents/findings by participating agencies that affect current and future water allocation conditions, are described in Chapter 1 of this Feasibility Report in the “Related Studies, Projects, and Programs” section. These include activities of Federal agencies, activities of California agencies, joint activities of Federal and California agencies, and activities of regional and local entities/agencies.

Value Planning Study for Los Vaqueros Expansion Investigation, Phase 2

In July 2016, Reclamation completed a *Final Value Planning Report* (Reclamation 2016) for the Phase 2 Expansion project, pursuant to Reclamation policy. The value planning effort convened a group of subject matter experts, known as the Value Study Team, for a one-week intensive work session with the goal of developing ideas to achieve the most appropriate and highest value solutions for the Phase 2 expansion project. The report includes a summary of recommendations developed by the Value Study Team to provide improvements to the overall project. Several of the recommendations included in the report have been incorporated into the Investigation and draft Supplement. The most significant recommendation included in the report was to modify the Eastside Option for the Transfer-Bethany Pipeline to shorten the length of the pipeline and eliminate the tunnel section. An additional recommendation described phasing construction activities to complete the Transfer-Bethany Pipeline before the dam enlargement in order to provide benefits to potential project partners as early as possible. The report also summarizes the advantages of operating the Phase 2 expansion to increase water supply to the Refuges.

New Delta Pump Station Eliminated

Technical evaluations since the release of the 2010 Final EIS/EIR, in consideration of key changes to the planning baseline, indicated that there was limited functionality for including the new 170 cfs Old River Intake and Pump Station under Investigation alternatives. The current Delta diversion capacity is limited to 320 cfs due to the capacity of the Old River Pipeline. Under 2010 Final EIS/EIR Alternatives 1 and 2, the addition of the new Delta-Transfer Pipeline would effectively increase Delta diversion capacity by 180 cfs through allowing full utilization of the existing 500 cfs combined diversion capacity of the Old and Middle River Pump Stations. Based on recent technical studies, it was determined that additional increases in Delta diversion capacity beyond the 180 cfs increase provided by the new Delta-Transfer Pipeline were limited and not cost-effective. Eliminating the new Delta Pump Station would also reduce potential environmental effects from construction and operation of these facilities.

Further, the existing 250 cfs Old River Pump Station was designed for an eventual expansion of up to 320 cfs (as included under 2010 Final EIS/EIR Alternative 3). Engineering studies since

the release of the 2010 Final EIS/EIR determined that it would be possible to expand the Old River Pump Station in place to a capacity of up to 420 cfs, effectively adding an additional 170 cfs of pumping capacity without constructing a new intake facility. Accordingly, if additional intake and pumping capacity is needed in the future, this could be achieved through expansion of the existing Old River Pump Station.

Drivers for Refinements to the 2010 Alternative Plans

These changes to conditions that have occurred or are anticipated to occur since the 2010 Final EIS/EIR was released have driven further refinements to the 2010 Alternative Plants:

- Implementation of the 160 TAF enlargement
- Changes in other local infrastructure
 - Middle River Intake Project (completed in 2010)
 - Contra Costa Canal Replacement Project (under construction)
 - Rock Slough Fish Screen Project (completed in 2011)
 - Freeport Regional Water Project (completed in 2011)
 - SBA Improvements and Enlargement Project (completed in 2012)
- Full implementation of Reasonable and Prudent Alternative Actions in the 2008 USFWS BO and the 2009 NMFS BO
- Recent extended drought in California

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