Chapter 3

Affected Environment/Environmental Consequences

This chapter describes, for each resource area, the affected environment/environmental setting for the project area potentially affected by the action alternatives. This chapter also presents the analyses of the impacts that would result from the No Action /No Project Alternative or implementation of the action alternatives described in Chapter 2, and considers how the environmental commitments could reduce or eliminate these impacts. The sections of this chapter, by resource area, are as follows

3.1 Water Supply
3.2 Water Quality
3.3 Groundwater Resources
3.4 Geology and Soils
3.5 Air Quality
3.6 Climate Change
3.7 Fisheries
3.8 Vegetation and Wildlife
3.9 Agricultural Land Use
3.10 Regional Economics
3.11 Environmental Justice
3.12 Indian Trust Assets
3.13 Cultural Resources
3.14 Visual Resources
3.15 Socioeconomics
3.16 Power
3.17 Flood Control

Resource areas that are not analyzed in this document include:

- Hazards & Hazardous Materials
- Mineral Resources
- Noise
- Public Services and Utilities
- Transportation/Traffic

The action alternatives would not require any construction activities; therefore, short- and long-term impacts to transportation/traffic, noise, and public services and utilities would not occur. Because water transfers would not result in the disturbance of land, there would be no impacts to hazardous materials and mineral resources.

Because this document addresses both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), the terms used in this document reflect both NEPA and CEQA. Table 3-1 presents a list of

NEPA terms that are synonymous with CEQA terms and are used throughout this document.

Table 3-1. NEPA and CEQA Terms

NEPA	CEQA
Proposed Action	Proposed Project
No Action Alternative	No Project Alternative
Environmentally Preferred Alternative	Environmentally Superior Alternative
Purpose and Need	Project Objectives
Affected Environment	Environmental Setting
Environmental Consequences	Environmental Impacts
Environmental Commitments	Mitigation Measures
Environmental Impact Statement (EIS)	Environmental Impact Report (EIR)

The impacts of each alternative are discussed by resource area and alternative. Each resource area section is structured so that an *italicized* impact statement introduces potential changes that could occur from implementation of each alternative. A discussion of how the resource area would be affected by the impact then follows this initial statement. The impact discussion is concluded with a determination that indicates if there is no impact to a resource area or if the impact to a resource area is beneficial, less than significant, or significant. Pursuant to NEPA, significance is used to determine whether an EIS or some other level of documentation is required, and once the decision to prepare an EIS is made, the magnitude of the impact is evaluated and no further judgment of significance is required. Therefore, any determinations of significance are for CEQA purposes only.

Section 3.1
Water Supply

This section discusses how and when surface water supplies are delivered to water users, the management of surface water, and how long-term water transfers could benefit or adversely affect water supplies.

3.1.1 Affected Environment/Environmental Setting

This section describes existing water supplies, including source and management, for agencies that could take part in the transfers.

3.1.1.1 Area of Analysis

The evaluation of potential effects on surface water supply and management from the implementation of long-term transfers includes the waterways that provide water to the buyers or sellers. Sellers include water rights holders on the Sacramento and San Joaquin rivers or their tributaries, including the Feather, Yuba, American, and Merced rivers. Some sellers are also within the Delta, and most transfers would need to move through the Delta to be delivered to buyers.

Potential buyers are located south and west of the Delta, and include the Contra Costa Water District (WD), the East Bay Municipal Utility District (MUD), and ten member agencies of the San Luis & Delta-Mendota Water Authority (SLDMWA). Not all potential buyers will purchase water from transfers. For some potential buyers, the ability to purchase water would depend on whether purchased water could be moved to the buyer’s service area. Contra Costa WD would divert water from one of its diversion facilities in the Delta, East Bay MUD would divert water at the Freeport facility on the Sacramento River, and SLDMWA would receive water from Jones or Banks Pumping Plants in the Delta. SLDMWA could also receive water from Merced Irrigation District (ID) through San Joaquin River diversion facilities belonging to Banta Carbona ID, West Stanislaus ID, and Patterson ID.

Figure 3.1-1 shows the various potential sellers and buyers and key waterways in the area of analysis.

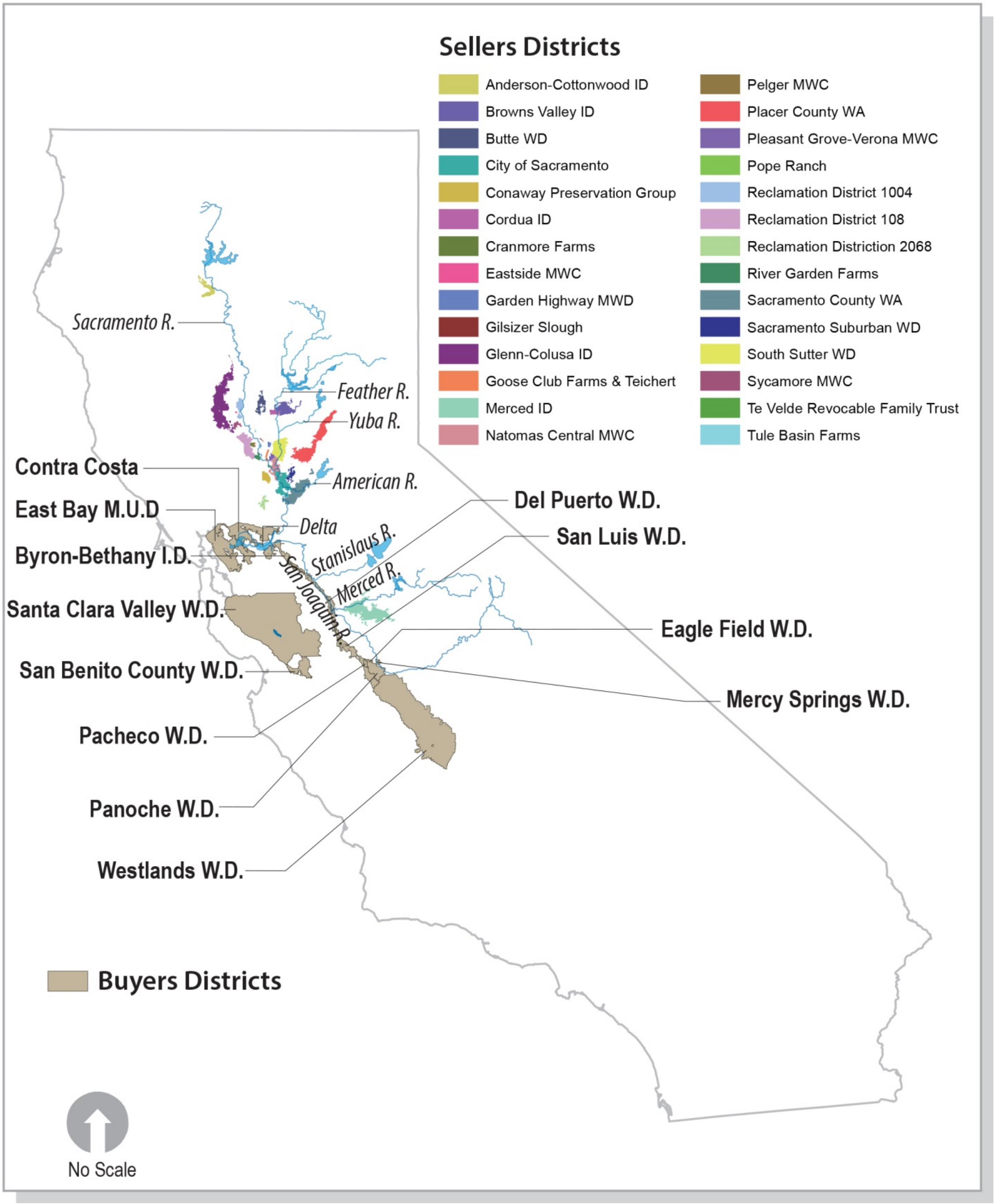

Figure 3.1-1. Location of Potential Buyer and Sellers

3.1.1.2 Regulatory Setting

The following section describes the applicable laws, rules, regulations and policies governing the transfer of surface and groundwater water in the area of analysis.

3.1.1.2.1 Federal

Reclamation approves water transfers consistent with provisions of the Central Valley Project Improvement Act (CVPIA) and State law that protect against injury to other legal users of water. According to the CVPIA Section 3405(a), the following principles must be satisfied for any transfer:

- Transfer may not violate the provisions of Federal or state law;
- Transfer may not cause significant adverse effects on Reclamation's ability to deliver Central Valley Project (CVP) water to its contractors or other legal user;
- Transfer will be limited to water that would be consumptively used or irretrievably lost to beneficial use;
- Transfer will not have significant long-term adverse impact on groundwater conditions; and
- Transfer will not adversely affect water supplies for fish and wildlife purposes.

Reclamation will not approve a water transfer if these basic principles are not satisfied and will issue its decision regarding potential CVP transfers in coordination with the U.S. Fish and Wildlife Service (USFWS), contingent upon the evaluation of impacts on fish and wildlife.

In addition, the biological opinions[1] on the Coordinated Operations of the CVP and State Water Project (SWP) (USFWS 2008; National Oceanic Atmospheric Administration Fisheries Service [NOAA Fisheries] 2009) analyze transfers through the SWP Banks and CVP Jones Pumping Plants from July to September that are up to 600,000 acre-feet (AF) in critical and dry years. For all other year types, the maximum transfer amount is up to 360,000 AF. For this Environmental Impact Statement/Environmental Impact Report (EIS/EIR), annual transfers would not exceed the above capacities and would be pumped through Banks or Jones Pumping Plants between July and September unless it shifts based on consultation with USFWS and NOAA Fisheries.

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[1] A written statement setting forth the opinion of the USFWS or the NOAA Fisheries as to whether a federal action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of a critical habitat. See 16 USCA 1536(b).

3.1.1.2.2 State

The State Water Resources Control Board (SWRCB) is responsible for reviewing transfer proposals and issuing petitions for temporary and long-term transfers related to post-1914 water rights. Transfers of CVP water outside of the CVP service area require SWRCB review and approval. Several sections of the California Water Code (WC) provide authority to the SWRCB to carry out transfers as presented below.

- <u>Short-Term Transfers</u>: Section 1725 allows a water rights permittee or licensee to temporarily change a point of diversion, place, or purpose of use for short-term water transfers (limited to one year). Short-term transfers under Section 1725 are limited to water that would have been consumptively used or stored absent the water transfer. Petitioners for transfers must provide the SWRCB notification in writing of the proposed change, providing information outlining the buyer's consumptive use and documentation that no injury to other legal users and no unreasonable effects to fish, wildlife, or other instream beneficial uses would occur. The petition is publicly noticed, and parties can file objections to the transfer. The SWRCB must evaluate and respond to the notification within 55 days if objections are filed.

- <u>Long-Term Transfers</u>: Section 1735 addresses long-term transfers that take place over a period of more than one year. Long-term transfers of water under post-1914 water rights must not cause substantial injury to any legal user of water and must not unreasonably affect fish, wildlife, or other instream beneficial uses. Long-term transfers are subject to the requirements of California Environmental Quality Act (CEQA) and must also comply with the SWRCB public noticing and protest process.

- <u>No Injury Rule</u>: Numerous sections of the WC (including Sections 1702, 1706, 1725, 1735 and 1810, among others) protect legal users of water from impacts that might result due to transfers, referred to as the "no injury rule." The no injury rule applies to both Pre-1914 water rights (WC Section 1706) and post-1914 water rights. The SWRCB has jurisdiction over changes to post-1914 water rights, and the courts typically have jurisdiction over changes in pre-1914 water rights.

- <u>Effects on Fish and Wildlife</u>: Sections 1725 and 1736 require that the SWRCB make a finding that post-1914 water rights water transfers will not result in unreasonable effects on fish and wildlife or other instream beneficial uses.

- <u>Third-Party Impacts</u>: Sections 386 and 1810 require the proposed transfer not result in unreasonable effects to the overall economy of the area from which the water is being transferred where the use of a state, regional or local public agency's conveyance capacity is required.

3.1.1.2.3 Regional/Local

County governments also have requirements related to transferring water outside of the county, primarily related to groundwater extraction. Reclamation requires transfer participants to comply with local requirements (including ordinances relating to well drilling, well spacing, and groundwater extraction) and local groundwater management plans, as well as compliance with adjudications and with the overdraft protections in WC Section 1745 et seq.

Many of the counties in the Seller Service Area have ordinances addressing groundwater transfers to users outside of the particular county. Chapter 3.3, Groundwater Resources, has more information on these county ordinances.

3.1.1.3 Existing Conditions

Water supplies available for transfer come from either groundwater or surface water. This section will focus on the availability of surface water supplies to their users as a result of the alternatives. This section does not address potential groundwater impacts (see Section 3.3) or flood risk (see Section 3.17).

The following sections describe the existing water supply conditions within the area of analysis.

3.1.1.3.1 Sellers Service Area

Sellers making water available for transfer are generally north of the Delta, but also include Merced ID (Figure 3.1-1).

Sacramento River Area

The Sacramento River flows south for 447 miles through the northern Central Valley of California, between the Pacific Coast Range and the Sierra Nevada, and enters the Delta from the north. The major tributaries to the Sacramento River are the Feather and the American rivers.

Some of the potential sellers on the Sacramento River receive CVP water that is stored upstream from their service areas in Shasta Reservoir on the Sacramento River. Shasta Reservoir is managed for flood control, water supply, recreation, fish and wildlife enhancement, power, and salinity control in the lower Sacramento River and the Delta.

Several CVP sellers hold Sacramento River Settlement Contracts[2] (Settlement Contracts). Reclamation entered into settlement negotiations with water users on the Sacramento River beginning in 1944, and most contracts were completed by 1964. The negotiations focused on the natural flow of the Sacramento River, stored CVP water, diversions, and pre-CVP water rights held by the Sacramento River Settlement Contractors. The term of the Settlement Contracts for municipal and industrial (M&I) water is 40 years, and for irrigation water it is

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[2] The Settlement Contracts are currently the subject of litigation. The court of appeals en banc panel remanded the matter to district court. The Sacramento River Settlement Contractors have petitioned the supreme court and that petition is pending.

40 years with an option to extend the contract for another 40 years (Reclamation 2004b).

As part of the original contract negotiations, a quantitative study of pre-CVP water use by the Sacramento River Settlement Contractors was conducted. This resulted in a determination of Base Supply and Project Water volumes. Base Supply is water that the Sacramento River Settlement Contractors divert, without payment, from April through October, based on their water rights. Project Water is water that the Sacramento River Settlement Contractors purchase from Reclamation, primarily in the months of July, August, and September. Project Water is subject to all federal regulations.

The Sacramento River Settlement Contractors can divert up to 1.8 million AF of Base Supply from the Sacramento River, and can purchase up to 380,000 AF of Project Water each year (Reclamation 2004a).

Anderson-Cottonwood ID

The Anderson-Cottonwood ID is located near Redding, California (Figure 3.1-1). Anderson-Cottonwood ID has a Sacramento River Settlement Contract for 121,000 AF of Base Supply and 4,000 AF of Project Water per year.

Anderson-Cottonwood ID, through either multiple year or single year agreements, could transfer a maximum of 5,225 AF of water annually through groundwater substitution.

Conaway Preservation Group, LLC

The Conaway Preservation Group, LLC operates the 16,088 acre Conaway Ranch located east of the cities of Davis and Woodland in Yolo County (Figure 3.1-1). The Conaway Ranch is managed for agriculture, wildlife habitat, and flood control in the Yolo Bypass. Conaway Preservation Group has a Sacramento River Settlement Contract with Reclamation for up to 50,190 AF[3] of Base Supply and 672 AF of Project Water from the Sacramento River. Conaway Ranch uses groundwater resources to supplement surface water supplies.

Conaway Preservation Group, LLC, through either multiple year or single year agreements, could transfer a maximum of 35,000 AF annually through groundwater substitution, and/or 9,239 AF per year by cropland idling or crop shifting.

Cranmore Farms, LLC

Cranmore Farms, LLC (Pinnacle Land Ventures, LLC or Broomieside Farms) is on the east side of the Sacramento River. It diverts water for agricultural and habitat use from the Sacramento River through a Sacramento River Settlement

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[3] After January, 2016, the contract amount will decrease to 40,290 AF. Conaway Preservation Group's water right was split, selling 10,000 AF to the Woodland-Davis Clean Water Agency.

Contract with Reclamation for 8,070 AF of Base Supply and 2,000 AF of Project Water annually.

Cranmore Farms, LLC, through either multiple year or single year agreements, could transfer a maximum of 8,000 AF annually through groundwater substitution, and/or 2,500 AF per year by crop idling or crop shifting.

Eastside Mutual Water Company (MWC)

The Eastside MWC is in the northern part of the Sacramento Basin on the Sacramento River (Figure 3.1-1). The Eastside MWC has a Sacramento River Settlement Contract with Reclamation for 2,170 AF of Base Supply and 634 AF of Project Water.

Eastside MWC, through either single or multi-year agreements, could transfer up to 2,230 AF per year through groundwater substitution.

Glenn-Colusa ID

Glenn-Colusa ID holds pre- and post-1914 appropriative water rights to divert water from the Sacramento River, Stony Creek, and their tributaries which is used to irrigate 141,000 acres. Glenn-Colusa ID also conveys water to 20,000 acres of wildlife habitat comprising the Sacramento, Delevan, and Colusa National Wildlife refuges. Glenn-Colusa ID has a Sacramento River Settlement Contract for 720,000 AF of Base Supply and 105,000 AF of Project Water. In addition to surface water, Glenn-Colusa ID relies on groundwater for a portion of its supply.

Glenn-Colusa ID, through either single or multi-year transfers, agreements, could transfer up to 66,000 AF per year through crop idling and shifting and/or 25,000 AF per year through groundwater substitution.

Natomas Central MWC

The Natomas Central MWC is along the Sacramento River on the border of northern Sacramento County and southern Sutter County. The Natomas Central MWC has a Sacramento River Settlement Contract with Reclamation for 98,200 AF of Base Supply and 22,000 AF of Project Water.

Natomas Central MWC, through either multiple year or single year agreements, could transfer a maximum of 30,000 AF annually thorough groundwater substitution.

Pelger MWC

The Pelger MWC is located on the east side of the Sacramento River near Robbins (Figure 3.1-1). The Pelger MWC has a Sacramento River Settlement Contract with Reclamation for 7,110 AF of Base Supply and 1,750 AF of Project Water.

The Pelger MWC, through either multiple year or single year agreements, could transfer a maximum of 3,750 AF annually through groundwater substitution, and/or 2,538 AF per year by crop idling or crop shifting.

Pleasant Grove-Verona MWC

The Pleasant Grove-Verona MWC is just northeast of the confluence with the Sacramento and Feather rivers (Figure 3.1-1). The Pleasant Grove-Verona MWC provides irrigation water to 6,857 acres of farmland through a Sacramento River Settlement Contract with Reclamation for 23,790 AF of Base Supply and 2,500 AF of Project Water.

Pleasant Grove-Verona MWC, through either multiple year or single year agreements, could transfer a maximum of 10,000 AF annually through groundwater substitution, and/or 10,000 AF per year by crop idling or crop shifting.

Reclamation District (RD) 108

RD 108 is on the west side of the Sacramento River, just north of the confluence with the Feather River. RD 108 has a Sacramento River Settlement Contract for 199,000 AF of Base Supply and 33,000 AF of Project Water.

RD 108, through either multiple year or single year agreements, could transfer a maximum of 15,000 AF annually through groundwater substitution, and/or up to 20,000 AF per year by crop idling or crop shifting.

RD 1004

RD 1004 is in the northern portion of the Sacramento Valley, and has a Sacramento River Settlement Contract for 56,400 AF of Base Supply and 15,000 AF of Project Water.

RD 1004, through either single year or multiyear agreements, could transfer a maximum of 10,000 AF through crop idling and/or crop shifting, or up to 7,175 AF through groundwater substitution.

River Garden Farms

River Garden Farms is on the west side of the Sacramento River. River Garden Farms has a Sacramento River Settlement Contract with Reclamation for 29,300 AF of Base Supply and 500 AF of Project Water. River Garden Farms supplements its surface water supply with three groundwater wells.

River Garden Farms, through either multiple year or single year agreements, could transfer a maximum of 9,000 AF annually through groundwater substitution.

Sycamore MWC

The Sycamore MWC farm is in the northern Sacramento Valley (Figure 3.1-1). Most of the farm is located in Sutter County, with a small northern portion in

Colusa County. The Glenn-Colusa Canal and the Colusa Trough run through the parcel on the south and east side, respectively. Sycamore MWC has a Sacramento River Settlement Contract for 22,000 AF of Base Supply and 9,800 AF of Project Water.

Sycamore MWC, through either multiple year or single year agreements, could transfer up to 15,000 AF through crop idling or crop shifting, and/or up to 10,000 AF through groundwater substitution.

Te Velde Revocable Family Trust

The Te Velde Revocable Family Trust is on the west side of the Sacramento River in unincorporated Yolo County, just downstream of the confluence of the Feather and Sacramento rivers. Te Velde has a Sacramento River Settlement Contract of a Base Supply of 4,000 AF and its own water right of 7,094 AF diverting water out of the Sacramento River.

Te Velde, through multiple year agreements, could transfer a maximum of 7,094 AF annually through groundwater substitution, and/or 7,094 AF per year by crop idling or crop shifting.

Feather River Area

Lake Oroville is on the Feather River. Operated by the California Department of Water Resources (DWR), it is the largest reservoir in the SWP and provides water to downstream contractors. Water from Lake Oroville is released to meet export demands, generate power at the Hyatt Powerplant beneath Oroville Dam and at the Thermalito Powerplant and to support downstream fisheries and water quality objectives.

Butte WD

Butte WD is in southern Butte County and northern Sutter County (Figure 3.1-1). The Butte WD receives water from the Thermalito Afterbay through a Feather River Settlement Contract between the Joint Water District Board (Joint Board), of which Butte WD is a member and DWR. Butte WD’s share of the Feather River Settlement supply is for 133,200 AF per year under an agreement allocating the Settlement supply among all the member units of the Joint Board.

The Butte WD, through either single or multiple year agreements, could transfer a maximum of 11,500 AF per year by crop idling or crop shifting, and/or 5,500 AF per year from groundwater substitution. An agreement with DWR would be required for Butte WD to implement a transfer.

Garden Highway MWC

The Garden Highway MWC is on the west side of the Feather River approximately midway between its confluence with the Yuba River and the confluence with the Sacramento River (Figure 3.1-1). The Garden Highway MWC may divert up to 18,000 AF per year from the Feather River for agriculture under its water rights permit and Feather River Settlement Agreement with DWR.

Garden Highway MWC, through either multiple year or single year agreements, could transfer a maximum of 12,287 AF annually through groundwater substitution. An agreement with DWR would be required for Garden Highway to implement a transfer.

Gilsizer Slough Ranch
The Gilsizer Slough Ranch is between the Feather and Sacramento rivers. Gilsizer Slough Ranch has a water right to the Feather River for 5,386 AF per year from the Sacramento River.

Gilsizer Slough Ranch, through either multiple year or single year agreements, could transfer a maximum amount of 3,900 AF through groundwater substitution.

Goose Club Farms and Teichert Aggregates
Goose Club Farms and Teichert Aggregates are on the west bank of the Feather River, just north of the confluence with the Sacramento River (Figure 3.1-1). Goose Club Farms and Teichert Aggregates have a water right on the Feather River for 15,000 AF per year.

Goose Club Farms and Teichert Aggregates, through either multiple year or single year agreements, could transfer a maximum of 10,000 AF annually through groundwater substitution, or 10,000 AF per year by crop idling or crop shifting.

South Sutter WD
South Sutter WD is just northeast of the confluence of the Feather and Sacramento rivers (Figure 3.1-1). South Sutter WD owns and operates Camp Far West Reservoir on the Bear River approximately 6.5 miles northeast of Wheatland. South Sutter WD holds water right Licenses 11118 and 11120 (Applications 14804 and 10221, respectively) for diversions from the Bear River. The maximum combined direct diversion plus collection to storage under these licenses is 180,550 AF per year; and the maximum combined direct diversion plus withdrawal from storage under these licenses is 138,300 AF per year.

South Sutter WD, through either multiple year or single year agreements, could transfer a maximum of 15,000 AF annually through stored reservoir release from Camp Far West Reservoir.

Tule Basin Farms
Tule Basin Farms is on the east side of the Sacramento River in the center of the Sacramento Valley (Figure 3.1-1). The Farm has a water right to 8,980 AF per year for agriculture and habitat needs out of the Feather River.

Tule Basin Farms, through either multiple year or single year agreements, could transfer up to 7,320 AF per year through groundwater substitution.

Yuba River Area

Browns Valley ID
The Browns Valley ID is on the Yuba River, just upstream of the confluence with the Feather River. Browns Valley ID has pre-1914 water rights for 34,171 AF per year on the Yuba River. Browns Valley ID completed an EIR for water transfers to willing buyers in 2009 based on water conservation measures that reduced consumptive use in the conveyance system.

Browns Valley ID, through either multiple year or single year agreements, could transfer a maximum amount of 3,100 AF through conservation measures, and/or 5,000 AF per year by stored reservoir release from Merle Collins Reservoir.

Cordua ID
Cordua ID is in Yuba County, near the confluence of the Yuba and Feather rivers. Cordua ID may divert up to 60,000 AF per year from the Yuba River under its water rights and an agreement with the Yuba County Water Agency.

Cordua ID, through either multiple year or single year agreements, could transfer a maximum amount of 12,000 AF per year through groundwater substitution.

American River

On the American River, Reclamation's Folsom Reservoir captures and holds up to 1,010,000 AF of CVP water. The reservoir provides flood control for downstream areas, water supply, hydropower, flows for American River fisheries and helps to meet water quality needs in the Delta.

City of Sacramento
The City of Sacramento is on both sides of the American River at its confluence with the Sacramento River (Figure 3.1-1), and has water rights to the American River for 245,000 AF per year and to the Sacramento River for 81,000 AF per year[4]. The City also has a network of groundwater supply wells in its service area. The City provides water for M&I purposes.

City of Sacramento, through either multiple year or single year agreements, could transfer a maximum of 5,000 AF annually through groundwater substitution.

Placer County Water Agency
The Placer County Water Agency is in the upper reaches of the American River, upstream of the Folsom Reservoir. Placer County Water Agency operates the

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[4] The full amount of this contract will not be made available until 2030.

Middle Fork Project reservoir on the American River, diverting up to 120,000 AF of water under its own water rights.

Placer County Water Agency could make up to 47,000 AF of water available each year for transfer through reoperation of the Middle Fork Project Reservoir, from Hell Hole and French Meadows reservoirs. Placer County Water Agency would prefer to use long term agreements to transfer water rather than individual single year contracts.

Sacramento County Water Agency

The Sacramento County Water Agency, located south of the City of Sacramento service area, provides M&I water to residents outside of the City of Sacramento boundaries (Figure 3.1-1). The Sacramento County Water Agency has a water right to 71,000 AF per year of surface water from the Sacramento River and 52,000 AF per year through two contracts with Reclamation. They also obtain up to 8,900 AF per year from groundwater.

The Sacramento County Water Agency, through either multiple year or single year agreements, could transfer a maximum of 15,000 AF annually through groundwater substitution.

Sacramento Suburban WD

Sacramento Suburban WD is downstream of the Folsom Reservoir on the American River (Figure 3.1-1). Through water rights and agreements with the Placer County Water Agency, Sacramento Suburban WD provides water to approximately 172,000 people in the greater Sacramento region. Sacramento Suburban WD also has a network of groundwater supply wells in its service area.

The Sacramento Suburban WD, through either multiple year or single year agreements, could transfer a maximum of 30,000 AF annually through groundwater substitution.

Delta Region

Pope Ranch

Pope Ranch is just east of RD 2068, in the southern Sacramento Valley on the north side of the Delta (Figure 3.1-1). Pope Ranch can divert a total of 2,800 AF.

Pope Ranch, through either multiple year or single year agreements, could transfer a maximum amount of 2,800 AF through groundwater substitution.

RD 2068

RD 2068 is in the southern Sacramento River Valley on the north side of the Delta (Figure 3.1-1). RD 2068 has a water right for a total of 80,000 AF.

RD 2068, through either multiple year or single year agreements, could transfer a maximum amount of 4,500 AF through groundwater substitution or 7,500 AF through crop-idling and/or crop shifting.

Merced River

Merced ID
Merced ID is on the Merced River upstream of the confluence with the San Joaquin River. Merced ID has water rights on the Merced River and stores water in McClure and McSwain lakes. Merced ID supplies water for agriculture, and M&I purposes.

Merced ID, through either multiple year or single year agreements, could transfer a maximum of 30,000 AF annually through stored reservoir releases.

3.1.1.3.2 Buyers Service Area

Transfer buyers are in the Central Valley or the San Francisco Bay Area. These buyers include the participating members of the SLDMWA (Figure 3.1-1), the Contra Costa WD, and the East Bay MUD. These areas receive water from multiple sources, including the SWP, the CVP, local surface water sources, and groundwater. With the exception of East Bay MUD, these potential buyers would require any transferred water to be moved through the Delta.

SLDMWA
The SLDMWA is made up of 29 federal and exchange water service contractors that manage approximately 2,100,000 acres in western San Joaquin Valley, and San Benito and Santa Clara counties. The SLDMWA was established in 1992 and entered into a cooperative agreement and subsequently in 1998 entered into a transfer agreement with Reclamation to operate and maintain CVP facilities in the San Joaquin Valley, including the Delta-Mendota Canal.

Of the 29 members of the SLDMWA, there are ten that would receive water transfers through the program (see Table 2-6). Deliveries to these districts would be diverted through the Delta through the CVP’s Jones Pumping Plant or the SWP’s Banks Pumping Plant. After diversion, the transfers would be delivered via the Delta-Mendota Canal, California Aqueduct and San Luis Canal. Deliveries of transfers from Merced ID could also be routed from the San Joaquin River through Banta Carbona ID, West Stanislaus ID, or Patterson ID.

Contra Costa WD
The Contra Costa WD is in Contra Costa County and principally relies on four Delta intakes for its water supplies. Contra Costa WD is a potential buyer of water. Contra Costa WD receives CVP water and has its own water rights to Delta water supplies.

East Bay MUD

East Bay MUD provides M&I water supplies to portions of Alameda and Contra Costa counties in the east San Francisco Bay area. East Bay MUD would receive transfer water through the Freeport Regional Water Authority's intake on the Sacramento River near Freeport. Due to the intake's northern location, the transfers would not be subject to the constraints on Delta pumping. East Bay MUD receives water from a variety of sources, including the Mokelumne River, a CVP contract with Reclamation for dry year supplies from the American River, and local supplies.

3.1.2 Environmental Consequences/Environmental Impacts

These sections describe the environmental consequences/environmental impacts associated with each alternative.

3.1.2.1 Assessment Methods

Impacts to surface water supplies are analyzed by comparing the conditions in water bodies and surface supplies without implementing transfers to the expected conditions of supplies with implementation. The No Action/No Project Alternative operations were simulated in CalSim, while water transfers and exports from the Delta were simulated using a post-processing tool (as described in Appendix B, Water Operations Assessment).

The post-processing tool also includes changes in flows in waterways caused by streamflow depletion from groundwater substitution. Data for the post-processing tool was provided by the SACFEM 2013 model, which includes highly variable hydrology (from very wet periods to very dry periods) was used as a basis for simulating groundwater substitution pumping. The model simulated the potential to export groundwater substitution pumping transfers through the Delta during 12 of the 33 years from water year (WY) 1970 through WY 2003 (the SACFEM 2013 model simulation period). Each of the 12 annual transfer volumes was included in a single model simulation. Including each of the 12 years of transfer pumping in one simulation rather than 12 individual simulations allows for the potential cumulative effects from pumping from prior years. For example, transfer pumping in 1976 simulated pumping in a critical year followed by a critical year, while transfer pumping in 1987 simulated substitution pumping in a dry year followed by a critical year and a long term drought. Appendix D, Groundwater Model Documentation, includes more information about the use of SACFEM 2013 in this analysis.

3.1.2.2 Significance Criteria

Impacts on surface water supplies would be considered potentially significant if the long-term water transfers would:

- Result in substantial long-term adverse effects to water supply for beneficial uses.

The significance criteria described above apply to all surface water bodies that could be affected by transfers. Changes in surface water supplies are determined relative to existing conditions (for CEQA) and the No Action/No Project Alternative (for the National Environmental Policy Act [NEPA]).

3.1.2.3 Alternative 1: No Action/No Project

Surface water supplies would not change relative to existing conditions. Water users would continue to experience shortages under certain hydrologic conditions, requiring them to use supplemental water supplies. Under the No Action/No Project Alternative, some agricultural and urban water users may face potential shortages under dry and critical hydrologic conditions. These users may take alternative water supply actions in response to potential shortages, including increased groundwater pumping, cropland idling, reduction of landscape irrigation, water rationing, or pursuing supplemental water supplies. Impacts to surface water supplies would be the same as the existing conditions.

3.1.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.1.2.4.1 Seller Service Area

Groundwater substitution transfers could decrease flows in neighboring surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP reservoirs. Groundwater substitution transfers make surface water available for transfer by reducing surface water diversions and replacing that water with groundwater pumping. The resulting increase in surface water supplies can then be transferred downstream to other users that do not have access to groundwater.

However, groundwater basins are naturally recharged after drawdown by both rainfall and through surface water and groundwater interactions. Streams that overlie an aquifer can lose water through the streambed to the aquifer (a “losing” stream), decreasing the amount of water available in the stream for other beneficial uses (Figure 3.1-2). Additional recharge to the groundwater basin can also intercept groundwater flow that would have entered a stream.

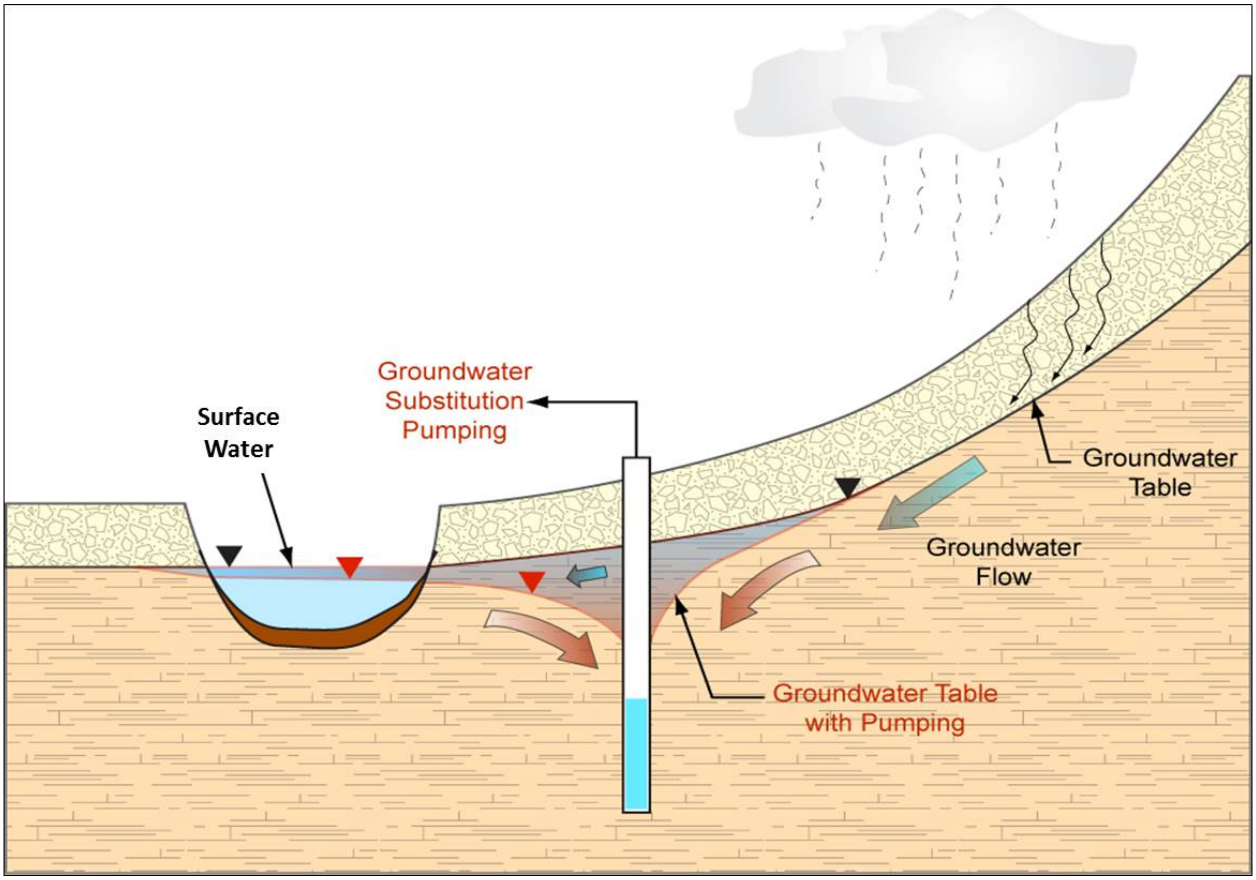

Figure 3.1-2. Groundwater and Surface Water Interactions Related to Groundwater Substitution Pumping

A portion of the groundwater recharge would occur during periods when there is higher flow in waterways. During these times, although the recharge would decrease flows in the waterways, the decreased flows would not affect water supplies or the ability to meet flow or quality standards. However, if the recharge occurs during dry periods, then the recharge would decrease river flows at times when it would affect Reclamation and DWR. Reclamation and DWR are responsible for meeting river flow and water quality standards on the Sacramento River, its tributaries, and within the Delta. If decreased river flows affect the ability to meet these standards, Reclamation and DWR would need to either decrease Delta exports or release additional flow from upstream reservoirs to meet flow or water quality standards. Transfers would not affect whether the water flow and quality standards are met, however, the actions taken by Reclamation and DWR to meet these standards because of instream flow reductions due to the groundwater recharge could affect CVP and SWP water supplies.

Decreased streamflows during dry periods could affect CVP and SWP supplies in the near term or longer term. When faced with decreased streamflows, the

CVP and SWP could choose to decrease Delta exports (affecting supplies to users south of the Delta) or increase releases from storage. Increased releases from storage would vacate storage that could be filled during wet periods, but would affect water supplies in subsequent years if the storage is not refilled.

Figure 3.1-3 shows the modeled potential changes (both in total volume and percent reductions) in total exports at both Jones and Banks pumping plants as a result of surface water and groundwater interactions over the modeled period of record. This figure only shows reductions to exports associated with streamflow depletion, and does not include increases in exports to convey water transfers to the buyers. The reductions in CVP and SWP supplies are not complete within one year, but can extend over multiple years as the groundwater aquifer refills. During periods where transfers occur in back-to-back years (such as 1987-1992), the water supply effects increase because effects compound over time.

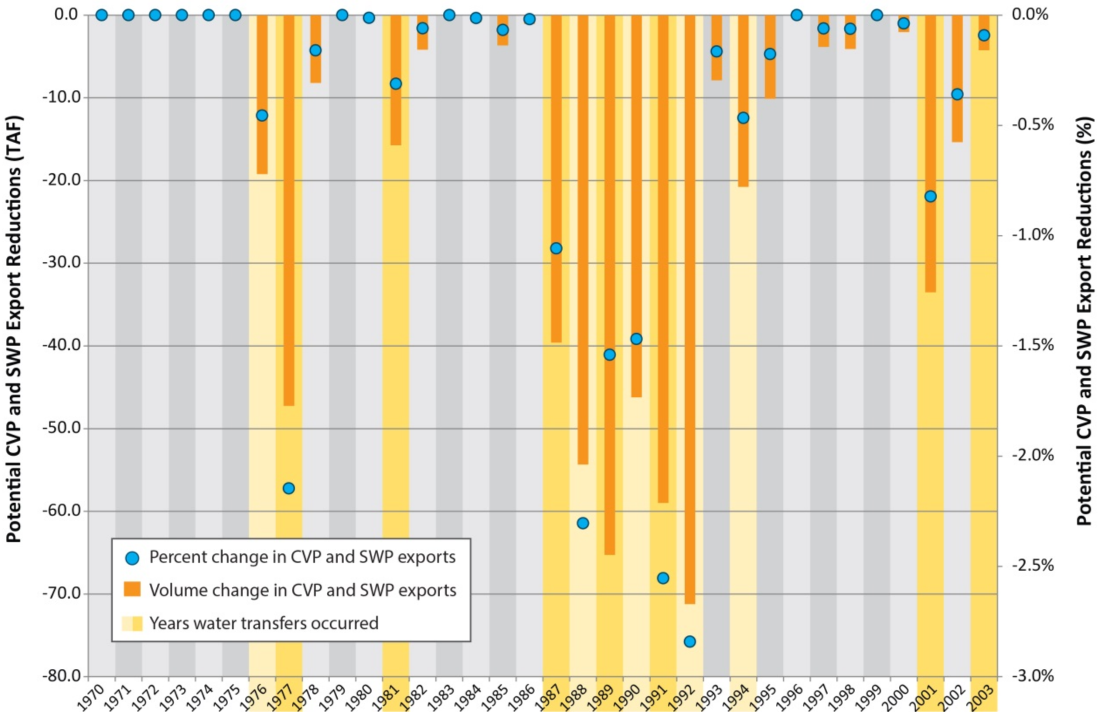

Figure 3.1-3. Potential Changes in Total Exports at the Delta Pumping Station as a Result of Surface Water and Groundwater Interaction

As a result of the groundwater and surface water interaction, the losses to surface flow from groundwater basin recharge shown in Figure 3.1-3, above, would reduce the water available to the CVP and SWP. Overall, the increased supplies delivered from water transfers would be greater than the decrease in supply because of streamflow depletion; however, the impacts from streamflow depletion may affect water users that are not parties to water transfers. On average[5], the losses due to groundwater and surface water interaction would result in approximately 15,800 AF of water annually compared to the No Action/No Project Alternative, or approximately a loss of 0.3 percent of the supply. This change in water supply is small, but the impacts in a single year could be greater. In a period of multiple dry years (such as 1987-1992), the streamflow depletion causes a 2.8 percent reduction in CVP and SWP supplies, or 71,200 AF. While the impacts to water supplies in the Buyer Service Area as a result of streamflow depletion would be small on average, the greater depletion in some years could have a potentially significant effect on water supply. To reduce these effects, Mitigation Measure WS-1 includes a streamflow depletion factor to be incorporated into transfers to account for the potential water supply impacts to the CVP and SWP. Mitigation Measure WS-1 would reduce the impacts to less than significant.

Water supplies available to users on the rivers downstream of reservoirs could decrease following stored reservoir release transfers. Stored reservoir release transfers would allow buyers to acquire transfer water from reservoirs owned by non-Project entities, such as Hell Hole and French Meadows reservoirs. Sellers would release water from these reservoirs, resulting in lower reservoir storage levels following the transfer. A reduction in downstream water supplies could occur when the reservoirs began to refill. In order to refill the reservoir storage vacated for the transfer, water would have to be held in the reservoirs that would otherwise have flowed downstream. To avoid impacting downstream users, the refill can only occur when all water needs downstream have been met and excess water remains in the system, referred to as Delta excess conditions. Additionally, this refill can only occur when downstream reservoirs cannot capture the water due to flood storage requirements. As demonstrated in Figure 3.1-4, reservoir levels are lower with the transfers than without until refilling to normal levels.

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[5] The model used in the analysis assumes the maximum quantity of groundwater substitutions. In general, this maximum amount of water transferred is not likely in any given year, and therefore the impacts described here are the worst-case scenario. In practice, it is likely that the impacts will be less than what is modeled.

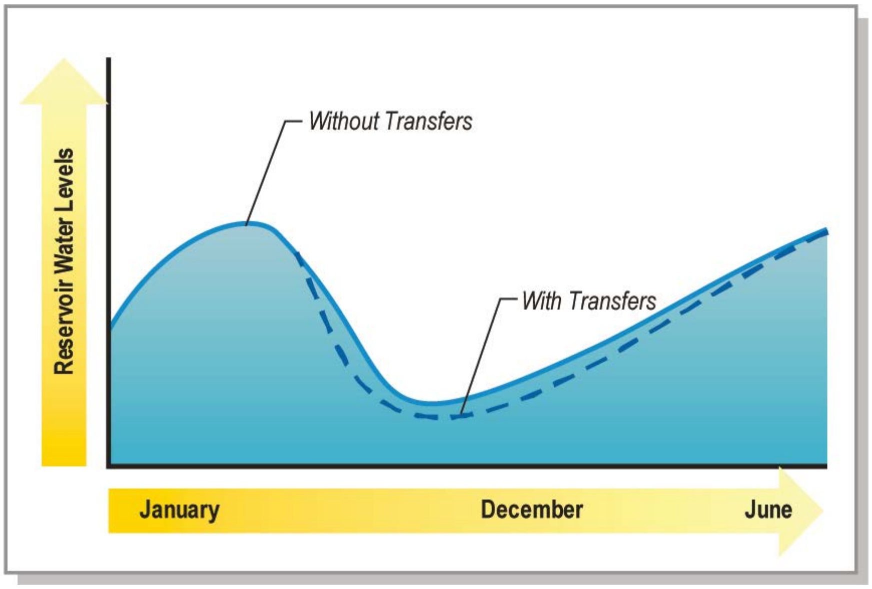

Figure 3.1-4. Reservoir Level Changes Under Stored Reservoir Release Transfers

Supplies in the seller's reservoirs would be decreased due to the transfer until the vacated storage was refilled during high flow periods. Figure 3.1-4 shows the refill occurring within one year, however, if one or more dry years follow the transfer year, or if a downstream reservoir does not enter flood control conditions for multiple years, the refill may not be able to occur for multiple years. As described in Chapter 2, each stored reservoir release transfer would include a refill agreement which specifies that the reservoir could only be refilled when it would not adversely affect downstream water users. Therefore, the impact of reservoir release transfers on downstream water users would be less than significant.

3.1.2.4.2 Buyers Service Area

Transfers would increase water supplies in the Buyer Service Area. Under the No Action Alternative, water users would be subject to reductions in their water supply due to dry hydrologic conditions. Under the Proposed Action, additional water supply would benefit water users who receive the transferred water. The transfer water would help provide supplemental water to lands that are experiencing substantial shortages. For transfers to agricultural users, water would only be delivered to lands that were previously irrigated. Water transfers to M&I users would also help relieve shortages. Any water transferred to buyers would need to be used for beneficial uses. The increased water supply to buyers would be a beneficial effect.

3.1.2.5 Alternative 3: No Cropland Modifications

The No Cropland Modification Alternative does not include cropland idling. Potential water supply effects of the Proposed Action are caused by groundwater substitution and stored reservoir release transfers, which are the same in Proposed Action and Alternative 3. The effects in the Seller and Buyer Service Areas would be the same as the Proposed Action.

3.1.2.6 Alternative 4: No Groundwater Substitutions

With the No Groundwater Substitution Alternative there would not be any groundwater substitution pumping. The potential water supply impacts associated with streamflow depletion would not occur. However, the potential impacts associated with stored reservoir release transfers would be the same as the Proposed Action. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.1.3 Comparative Analysis of Alternatives

Table 3.1-1 lists the effects of each of the action alternatives and compares them to the existing conditions and No Action/No Project Alternative.

Table 3.1-1. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
Surface water supplies would not change relative to existing conditions	1	NCFEC	None	NCFEC
Groundwater substitution transfers could decrease flows in surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP/SWP reservoirs.	2, 3	S	WS-1: Streamflow Depletion Factor	LTS
Water supplies on the rivers downstream of reservoirs could decrease following reservoir release water transfers	2, 3, 4	LTS	None	LTS
Transfers would increase water supplies in the Buyers Service Area	2, 3, 4	B	None	B

Notes:
B = Beneficial
LTS = Less than significant
NCFEC = No change from existing conditions
S = Significant

3.1.3.1 Alternative 1: No Action/No Project Alternative

There would be no impacts on water supplies.

3.1.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Streamflow depletion from groundwater substitution transfers could result in small decreases in water supplies to CVP and SWP users. Stored reservoir release transfers could decrease carryover storage in participating reservoirs, but refill criteria would prevent water supply impacts to downstream users from refilling that storage. The effects on water supply would be less than significant.

3.1.3.3 Alternative 3: No Cropland Modifications

This alternative would have similar effects on water supply as the Proposed Action. The effects to water supply would be less than significant.

3.1.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would not include groundwater substitution transfers, so the streamflow depletion effects on CVP and SWP supplies in the other two action alternatives would not occur. Effects from refilling surface water storage from stored reservoir release transfers could still occur, but they would be avoided with the inclusion of the refill criteria. The effects on water supply would be less than significant.

3.1.4 Environmental Commitments/Mitigation Measures

3.1.4.1 Mitigation Measure WS-1: Streamflow Depletion Factor

The purpose of Mitigation Measure WS-1 is to address potential streamflow depletion effects to CVP and SWP water supply. Reclamation will apply a streamflow depletion factor to mitigate potential water supply impacts from the additional groundwater pumping due to groundwater substitution transfers. The streamflow depletion factor equates to a percentage of the total groundwater substitution transfer that will not be credited to the transferor and is intended to offset the streamflow effects of the added groundwater pumping due to transfer.

As described in the impact analysis, the magnitude of the potential water supply impact depends on hydrologic conditions surrounding the transfer period (both before and after). The exact percentage of the streamflow depletion factor will be assessed and determined on a regular basis by Reclamation and DWR, in consultation with buyers and sellers, based on the best technical information available at that time. The percentage will be determined based on hydrologic conditions, groundwater and surface water modeling, monitoring information, and past transfer data. Application of the streamflow depletion factor will offset potential water supply effects and reduce them to a less than significant level. The streamflow depletion factor may not change every year, but will be refined as new information becomes available and may become more site specific as better data and groundwater modeling becomes available.

Reclamation and DWR require the imposition of a streamflow depletion factor because they will not move transfer water if doing so will violate the no injury rule. This process to evaluate and determine the streamflow depletion factor will help verify that the factor reduces potential impacts to avoid legal injury to CVP or SWP water supplies and a substantial impact or injury.

3.1.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on water supply.

3.1.6 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten year period. The cumulative effects analysis for water supply considers SWP water transfers, CVP M&I Water Shortage Policy (WSP), and the San Joaquin River Restoration Program (SJRRP). Chapter 4 further describes these projects and policies.

3.1.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.1.6.1.1 Seller Service Area

Groundwater substitution transfers in combination with other cumulative projects could decrease flows in surface water channels following a transfer while groundwater basins recharge, and could decrease pumping at the Jones and Banks Pumping Plants or require additional releases from upstream Project storage. The SWP transfers include groundwater substitution up to a maximum of 6,800 AF. As described in Section 3.1.2.4.1, increased groundwater pumping could result in decreased surface water supplies as a result of surface water and groundwater interactions, resulting in decreased water available for exports at the Delta pumping plants or the need to release additional water from upstream Project reservoirs. Mitigation Measure WS-1 would reduce the impacts of the Proposed Action to less-than-significant levels.

Mitigation Measure WS-1 includes a streamflow depletion factor determined and applied by Reclamation and DWR; both CVP and SWP transfers would be held to this standard to avoid any significant incremental effects. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to changes in surface water flows.

3.1.6.1.2 Buyer Service Area

The Proposed Action in combination with other cumulative past, present, and future projects could affect water supply in the Buyer Service Area. As described in Table 1-1 in Section 1.2.1, existing CVP water supply allocations for water users south of the Delta are frequently not fully met. In any given WY, the volume of water delivered is dependent on forecasted reservoir inflows and Central Valley hydrologic conditions, amounts of storage in CVP reservoirs, regulatory requirements, and management of Section 3406(b)(2) water resources and Sections 3406 (b)(3) and (d) concerning refuge water supplies in accordance with implementation of the CVPIA. These conditions have had a significant cumulative impact on water supplies in the region.

Other cumulative projects could also affect water supplies. The M&I WSP could change water supplies to CVP users. The SJRRP could affect supplies within the Buyer Service Area as a result of reduced flood flows from the San Joaquin River that could supplement water supply to buyers in wet years. SWP transfers and the Lower Yuba River Accord could also increase supplies to the Buyer Service Area.

Cumulatively, past, present, and future physical and regulatory limitations have reduced water supplies to the Buyer Service Area, which would be a significant cumulative effect on water supply. The Proposed Action would increase water supplies to buyers who may be affected by reduced allocations, which would help offset adverse impacts. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative water supply impacts would not be cumulatively considerable.

3.1.6.2 Alternative 3: No Cropland Modification

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

3.1.6.3 Alternative 4: No Groundwater Substitution

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

3.1.7 References

Bureau of Reclamation. 2004a. *Federal Register December 16, 2004 Volume 69 Number 241, Sacramento River Settlement Contractors. Page 75341-75342.* Accessed on: September 02, 2014. Available at: http://www.gpo.gov/fdsys/pkg/FR-2004-12-16/pdf/04-27479.pdf

___________. 2004b. *Sacramento River Settlement Contractors Environmental Impact Statement. Final Report*. Pp 2-2 to 2-3. Accessed on: January 21, 2014. Available at: http://www.usbr.gov/mp/mp150/envdocs/Final_EIS.pdf

National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries). 2009. Biological Opinion on the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan. National Marine Fisheries Service, Southwest Region, Long Beach, CA. June 4, 2009. 844 pp.

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Section 3.2
Water Quality

Maintaining surface water quality in California's water bodies is important to ensure safe drinking water and to maintain environmental, recreational, industrial, and agricultural beneficial uses. This section describes the existing water quality of the water bodies within the area of analysis, and discusses potential effects on surface water quality from implementation of the proposed alternatives. Section 3.3 addresses potential water quality effects to groundwater.

Surface water quality effects could occur from all types of transfer methods including cropland idling, crop shifting, groundwater substitution, stored reservoir water, and conservation.

3.2.1 Affected Environment/Environmental Setting

This section identifies the area of analysis, describes applicable laws and policies relevant to water quality, and provides a description of existing water quality for each of the water bodies with the potential to be affected by long-term water transfers.

3.2.1.1 Area of Analysis

The area of analysis for water quality is divided into two regions: the Seller Service Area and the Buyer Service Area. Figure 3.2-1 shows the area of analysis for water quality.

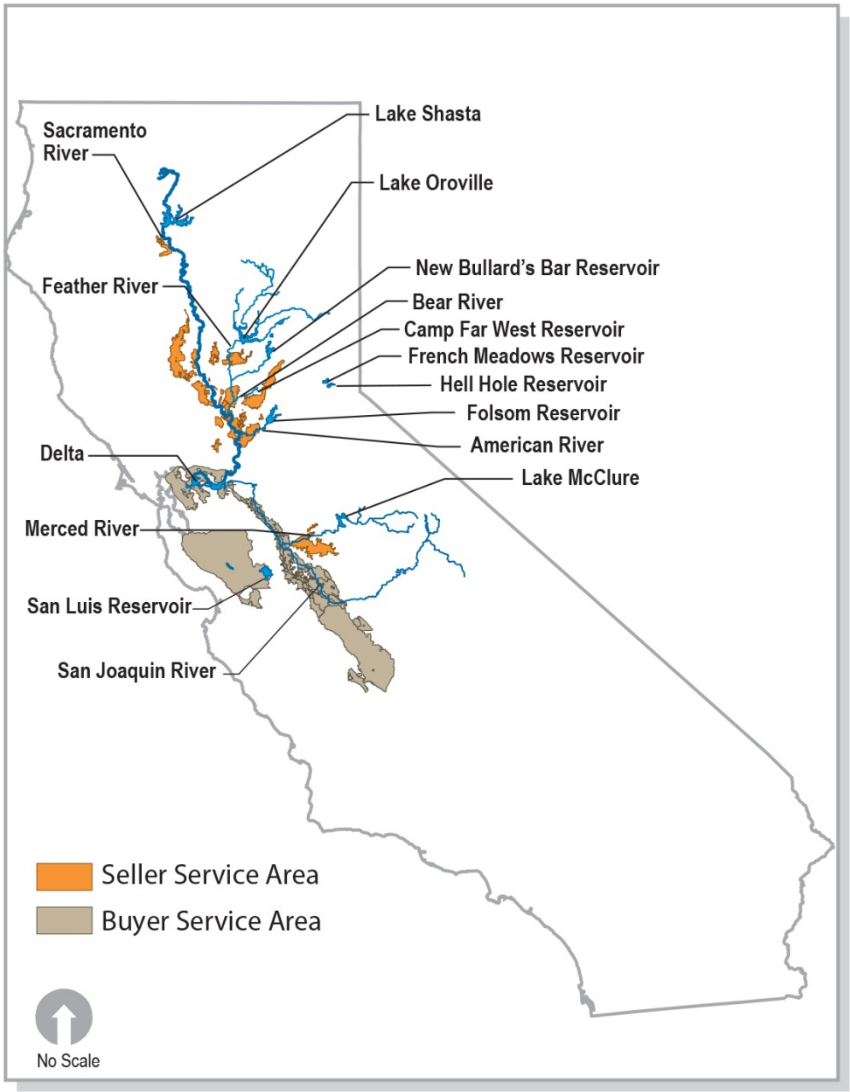


Figure 3.2-1. Water Quality Area of Analysis

3.2.1.1.1 Seller Service Area

The alternatives have the potential to affect water bodies within the Sacramento River Basin, including:

- Shasta Reservoir and the Sacramento River downstream of Shasta Reservoir to the Sacramento-San Joaquin Delta (Delta);
- Lake Oroville and the Feather River downstream of Lake Oroville; Camp Far West Reservoir, the Bear River downstream of Camp Far West Reservoir, and the Yuba River downstream of the confluence with the Bear River; and Collins Lake and Dry Creek downstream of Collins Lake;

- Folsom Reservoir and the American River downstream of Folsom Reservoir to its confluence with the Sacramento River, and Hell Hole and French Meadows reservoirs and the Middle Fork American River downstream of Hell Hole and French Meadows reservoirs; and
- Delta Region, including the river channels and sloughs at the confluence of the Sacramento and San Joaquin rivers.

Within the San Joaquin River Basin, potentially affected water bodies in the Seller Service Area include:

- Lake McClure and the Merced River downstream of Lake McClure; and
- San Joaquin River from the Merced River to the Delta.

3.2.1.1.2 Buyer Service Area

Potentially affected water bodies in the Buyer Service Area include:

- San Luis Reservoir in Merced County.

3.2.1.2 Regulatory Setting

There are numerous Federal and State laws and policies that protect water quality.

3.2.1.2.1 Federal

Safe Drinking Water Act (SDWA)

The Federal SDWA was enacted in 1974 and authorized the U.S. Environmental Protection Agency (USEPA) to establish safe standards of purity for naturally-occurring and man-made contaminants. It requires all owners or operators of public water systems to comply with primary (health-related) standards and encourages attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the USEPA through primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the USEPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants. In California, the USEPA has delegated SDWA powers to the state government.

Clean Water Act (CWA)

The Federal Water Pollution Control Act of 1948 was the first major law addressing water pollution in the United States. When it was amended in 1972, this law became commonly known as the CWA. The CWA established the basic structure for regulating discharges of pollutants into the waters of the U.S. It gave the USEPA the authority to implement pollution control programs and to set water quality standards for known contaminants in surface waters. The CWA also made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions (USEPA 2002). In California, the USEPA has delegated authority to the state government.

Section 303(d) of the CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The 303(d) list includes water bodies that do not meet water quality standards for their beneficial uses. The CWA requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality (USEPA 2012a). A TMDL is the sum of the allowable loads within an individual waterbody of a single pollutant from all contributing point and nonpoint sources (USEPA 2012a). TMDLs are tools for implementing water quality standards and establish the allowable daily pollutant loadings or other quantifiable parameters (e.g., pH or temperature) for a waterbody.

Several water bodies within the area of analysis have been identified as impaired by certain constituents of concern and appear on the most recent 303(d) list. Table 3.2-1 presents the 2010 303(d) listed water bodies within the area of analysis.

Table 3.2-1. 303(d) Listed Water Bodies Within the Area of Analysis and Associated Constituents of Concern

Water Body Name	Constituent	Estimated Area Affected [2]	Proposed TMDL Completion Year
Shasta Reservoir	Cadmium	20 acres	2020
	Copper	20 acres	2020
	Zinc	20 acres	2020
	Mercury	27,335 acres	2021
Sacramento River (Keswick Dam to Delta)	Chlordane	16 miles	2021
	DDT	98 miles	2021
	Dieldrin	98 miles	2021
	Mercury	16 miles	2021
	PCBs	98 miles	2021
	Unknown toxicity	129 miles	2019
Lake Oroville	Mercury	15,400 acres	2021
	PCBs	15,400 acres	2021

Water Body Name	Constituent	Estimated Area Affected [2]	Proposed TMDL Completion Year
Lower Feather River	Chlorpyrifos	42 miles	2019
	Group A Pesticides [1]	42 miles	2011
	Mercury	42 miles	2012
	PCBs	42 miles	2021
	Unknown Toxicity	42 miles	2019
Camp Far West Reservoir	Chlorpyrifos	21 miles	2021
	Copper	21 miles	2021
	Diazinon	21 miles	2010
	Mercury	21 miles	2015
Lower Bear River (Below Camp Far West Reservoir)	Mercury	1,945 acres	2015
Dry Creek	Chlorpyrifos Diazinon E.Coli Unknown Toxicity	34 Miles	2021
Hell Hole Reservoir	Mercury	1,370 acres	2021
Folsom Reservoir	Mercury	11,064 acres	2019
Lower American River	Mercury	27 miles	2010
	Unknown Toxicity	27 miles	2021
	PCBs	27 miles	2021
Lake McClure	Mercury	5,605 acres	2021
Merced River	Chlorpyrifos	50 miles	2008
	Diazinon	50 miles	2008
	Group A Pesticides [1]	50 miles	2011
	Mercury	50 miles	2019
	Unknown Toxicity	50 miles	2021
	Water Temperature	50 miles	2021
	E.Coli	50 miles	2021
San Joaquin River (Merced River to Delta)	Alpha-BHC	29 miles	2022
	Boron	29 miles	2007
	Chlorpyrifos	40 miles	2007
	DDE	32 miles	2011
	DDT	40 miles	2011
	Diazinon	8.4 miles	2007
	Group A Pesticides [1]	40 miles	2011
	Electrical Conductivity	40 miles	2021
	Mercury	40 miles	2012
	Water Temperature	40 miles	2021
	Toxaphene	3 miles	2019
	Diuron	3 miles	2021
	Unknown Toxicity	40 miles	2019

Water Body Name	Constituent	Estimated Area Affected [2]	Proposed TMDL Completion Year
Sacramento-San Joaquin Delta	Chlordane	6,795 acres	2007
	Chlorpyrifos	43,614 acres	2011
	DDT	43,614 acres	2011
	Diazinon	43,614 acres	2007
	Dieldrin	6,795 acres	2011
	Dioxin	1,603 acres	2019
	Electrical Conductivity	20,819 acres	2019
	Furan Compounds	1,603 acres	2019
	Group A Pesticides	43,614 acres	2011
	Invasive Species	43,614 acres	2019
	Mercury	43,614 acres	2009
	Organic Enrichment/ Low Dissolved Oxygen	1,603 acres	2007
	Pathogens	1,603 acres	2008
	PCBs	8,398 acres	2019
	Unknown Toxicity	43,614 acres	2019

Source: SWRCB 2011.

Key:

alpha-BHC = Benzenehexachloride or alpha-HCH

DDE = Dichlorodiphenyldichloroethylene

DDT =Dichlorodiphenyltrichloroethane

PCBs = Polychlorinated biphenyls

Notes:

[1] Group A Pesticides: aldrin, dieldrin, endrin, chlordane, heptachlor, heptachlor expoxid, hexachlorocyclohexane, endosulfan, and toxaphehe

[2] Estimated area affected is given as the surface area (acres) of lakes or estuaries or length (river miles) for river systems.

The National Pollutant Discharge Elimination System is a permit program authorized by the CWA that controls water pollution by regulating point source discharges into waters of the United States. In California, the USEPA has delegated authority of this program to the State Water Resources Control Board (SWRCB). The SWRCB ensures that all point source discharges to surface waters will not conflict with existing water quality laws and the water quality standards established for that specific water body.

3.2.1.2.2 State

Porter-Cologne Water Quality Control Act

The California Porter-Cologne Water Quality Act (Porter-Cologne Act) was enacted in 1969 and established the SWRCB and nine Regional Water Quality Control Boards (RWQCBs). These boards are the primary agencies responsible for protecting California water quality to meet present and future beneficial uses. They are also responsible for regulating appropriative surface rights allocations.

According to the Porter-Cologne Act, the RWQCBs must establish water quality objectives for water bodies within their regions. The Porter-Cologne Act defines water quality objectives as "… the limits or levels of water quality constituents or characteristics which are established for the reasonable protections of the beneficial uses of water or the preventions of nuisance within a specified area” [Water Code 13050(H)]. The RWQCBs do this through the adoption of water quality control plans, or Basin Plans.

Regional Water Quality Control Plans

California Water Code (Section 13240) requires the preparation and adoption of water quality control plans (Basin Plans), and the Federal CWA (Section 303) supports this requirement. According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment of beneficial uses to be protected, water quality objectives to protect those uses, and an implementation program for achieving the objectives. Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the State and Federal requirements for water quality control (40 Code of Federal Regulations 131.20).

Basin Plans present water quality objectives in numerical or narrative format for specified water bodies or for protection of specified beneficial uses throughout a specific basin or region. State law defines beneficial uses to include (but not be limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). The beneficial uses designated for water bodies within the area of analysis are presented in Table 3.2-2 (Seller Service Area), and Table 3.2-3 (Buyer Service Area).

Table 3.2-2. Beneficial Uses of Water Bodies in the Seller Service Area

Beneficial Use Designation	Shasta Reservoir	Sacramento River	Lake Oroville	Lower Feather River	Bear River	Camp Far West Reservoir	Lower Yuba River	Hell Hole and French Meadows Reservoirs	Middle Fork American River	Folsom Reservoir	Lower American River	Lake McClure	Merced River	San Joaquin River	Sacramento-San Joaquin Delta
Municipal and Domestic Supply	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Agricultural Irrigation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stock Watering		✓			✓	✓	✓	✓	✓				✓	✓	✓
Industrial Process Supply													✓	✓	✓
Industrial Service Supply		✓									✓		✓		✓
Power Generation	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	
Water Contact Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canoeing and Rafting[1]		✓		✓	✓		✓		✓		✓		✓	✓	
Non-contact Water Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Warm Freshwater Habitat[2]	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Cold Freshwater Habitat[2]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Beneficial Use Designation	**Shasta Reservoir**	**Sacramento River**	**Lake Oroville**	**Lower Feather River**	**Bear River**	**Camp Far West Reservoir**	**Lower Yuba River**	**Hell Hole and French Meadows Reservoirs**	**Middle Fork American River**	**Folsom Reservoir**	**Lower American River**	**Lake McClure**	**Merced River**	**San Joaquin River**	**Sacramento-San Joaquin Delta**
Warm[3] and Cold[4] Water Migration Areas		✓		✓			✓						✓	✓	✓
Warm Water Spawning Habitat[3]	✓	✓	✓	✓			✓			✓			✓	✓	✓
Cold Water Spawning Habitat[4]	✓	✓	✓	✓			✓	✓	✓		✓		✓		
Navigation		✓													✓
Wildlife Habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 3.2-3. Beneficial Uses of Water Bodies in the Buyer Service Area

Beneficial Use Designation	California Aqueduct	Delta-Mendota Canal	San Luis Reservoir
Municipal and Domestic Supply	✓	✓	✓
Agricultural Irrigation	✓	✓	✓
Stock Watering	✓	✓	✓
Industrial Process	✓	✓	
Service Supply	✓		✓
Power Generation	✓		✓
Water Contact Recreation	✓	✓	✓
Non-contact Water Recreation	✓	✓	✓
Warm Freshwater Habitat		✓	✓
Wildlife Habitat	✓	✓	✓

Source: RWQCBCV 2011

The current Basin Plan that covers the water bodies in the Seller Service Area and Buyer Service Area (with the exception of the Delta) is the *Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins* (RWQCB, Central Valley [RWQCBCV] 2011). The current plan that covers the Delta is the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (SWRCB 2006), which was originally adopted in 1996 and revised in 2006. This plan is referred to as the Bay-Delta Plan.

SWRCB Decision 1641

SWRCB Decision-1641 and Water Right Order 2001-05 describe the current water right requirements to implement the flow-dependent objectives outlined in the Bay-Delta Plan. In SWRCB Decision-1641, the SWRCB assigned responsibilities to Reclamation and Department of Water Resources (DWR) for meeting these requirements. These responsibilities require that the Central Valley Project (CVP) and State Water Project (SWP) be operated to protect water quality, and that DWR and/or Reclamation ensure that the flow dependent water quality objectives are met in the Delta (SWRCB 2000).

DWR Non-Project Water Acceptance Criteria

DWR has developed acceptance criteria to govern the water quality of non-Project water that may be conveyed through the California Aqueduct. These criteria dictate that a pump-in entity of any non-project water program must demonstrate that the water is of consistent, predictable, and acceptable quality prior to pumping the local groundwater into the SWP. Since there cannot be any adverse impacts to SWP water deliveries, operations or facilities, the water quality criteria cannot constrain DWR's ability to operate the SWP for its intended purposes or to protect its integrity during emergencies (DWR 2014).

3.2.1.3 Existing Conditions

The following sections describe the general water quality for each of the water bodies in the area of analysis. The water quality information varies by geographic area due to availability of water quality data and the specific water quality concerns for each water body.

3.2.1.3.1 Seller Service Area

Sacramento River Area of Analysis

Shasta Reservoir

Shasta Reservoir receives water from the Sacramento River, McCloud River, and Pit River drainages and generally has good water quality. Shasta Reservoir is listed on the 2010 303(d) list as impaired due to heavy metal accumulations (mercury, cadmium, copper and zinc) from natural resource extraction. Streams that drain into Shasta Reservoir come in contact with areas disturbed by mining and become acidic and can contain concentrations of dissolved metals that violate existing water quality standards. The sources of the include West Squaw Creek below Balakala Mine, lower Little Backbone Creek, lower Horse Creek, and Town Creek, which are listed as impaired on the 2010 303(d) list (Reclamation 2013a).

Turbidity in Shasta Reservoir occurs from sediment discharge from tributaries, as well as wave erosion and shoreline erosion from changing surface water levels. Turbidity can decrease the clarity of the lake along the shoreline and can affect water-based recreation (Reclamation 2013a).

Table 3.2-4 summarizes general water quality in Shasta Reservoir.

Table 3.2-4. Water Quality in Shasta Reservoir

Water Quality Parameter	Minimum	Maximum	Average
pH^1 (standard units)	7.2	8.1	7.5
Turbidity^2 (NTU)	0.1	6553	27.5
Dissolved Oxygen^2 (mg/L)	0.1	24.2	10.7
Total Nitrogen^1(mg/L)	0.01	0.54	0.09
Total Phosphorus^1(mg/L)	0.0	0.13	0.03
Electrical Conductivity^1 (μS/cm)	105	131	117

Sources: $^{1-}$USGS 1980; $^{2-}$California DWR 2013. Water quality data from the California Data Exchange Center is from continuously hourly data from 2006 through 2011.

Key: NTU = Nephelometric Turbidity Units , mg/L = milligrams per liter; μS/cm = micro siemens per centimeter

Sacramento River

The 303(d) list indicates that certain segments of the Sacramento River contain several constituents of concern, including Chlordane, dichlorodiphenyltrichloroethane, Dieldrin, mercury, polychlorinated biphenyls (PCBs), and unknown toxicity (see Table 3.2-1); however, the water quality in the Sacramento River is generally of high quality and concentrations of undesirable constituents are generally low. The following sections report general water quality data for two locations along the Sacramento River.

Sacramento River at Balls Ferry

The Sacramento River sampling site at Balls Ferry is downstream of Shasta Dam approximately 21 miles south of Redding. Stream flow at this site is greatly influenced by managed releases from Shasta Reservoir and, during the rainy season, by storm water runoff. Water quality in this region is also influenced by human activities along the Sacramento River including agricultural, historical mining, and municipal and industrial (M&I) inputs (Reclamation 2013a). Land cover in the area is mainly forestland; cropland, pasture, and rangeland cover most of the remaining land area (U.S. Geological Survey [USGS] 2002).

Water quality within this portion of the Sacramento River is generally good. Water quality issues include the presence of mercury, pesticides, and trace metals.

Table 3.2-5 presents data for the general water quality parameters.

Table 3.2-5. Water Quality Parameters Sampled[1]on the Sacramento River at Balls Ferry

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.69	8.32	7.5
Turbidity (NTU)	0.54	64.3	7.5
Dissolved Oxygen (mg/L)	8.1	14	10.9
Total Organic Carbon (mg/L)	0.5	3.5	1.65
Total Nitrogen (mg/L)	0	1.3	0.14
Total Phosphorus (mg/L)	0.01	0.16	0.03
Electrical Conductivity (µS/cm)	79	136	113

Sources: DWR 2013

[1] *Samples Collected 12/2000 – 08/2010*

Sacramento River at Hood

The Sacramento River sampling site at Hood is located on the Lower Sacramento River south of Sacramento. Therefore, water quality samples at this site reflect the impacts of land use upstream. Impacts to water quality in this region include agricultural runoff, acid mine drainage, stormwater runoff, water releases from dams, diversions, and urban runoff (Reclamation 2013a). Table 3.2-6 presents the general water quality data for samples collected at Hood.

Table 3.2-6. Water Quality Parameters Sampled[1] at Sacramento River at Hood

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.4	8.4	7.5
Turbidity (NTU)	1.2	240	18.7
Dissolved Oxygen (mg/L)	5.2	12.4	8.8
Total Organic Carbon (mg/L)	0.6	11	2.4
Total Nitrogen (mg/L)	0.01	0.4	0.1
Total Phosphorus (mg/L)	0.02	1.0	0.09
Electrical Conductivity (µS/cm)	73	234	154

Sources: DWR 2013

[1] *Samples Collected 01/2006 - 01/2013.*

Feather River Area of Analysis

Lake Oroville

Lake Oroville generally has good water quality. The following water quality information was obtained from the 2007 Draft Environmental Impact Report (EIR) Oroville Facilities Relicensing (DWR 2007), which described water quality monitoring results for 2002 through 2004. Water temperatures from Lake Oroville releases generally met the Feather River temperature requirements established for the downstream hatchery. When temperature exceedances did occur, they were usually minor. In Lake Oroville, dissolved oxygen and pH levels at the monitoring stations generally met the objectives in the Basin Plan for the Sacramento River and San Joaquin River Basins. Occasionally, when Lake Oroville is thermally stratified during the summer, dissolved oxygen measured near the surface and bottom of the reservoir did not meet the Basin Plan objective. Mineral and electrical conductivity (EC) met all Basin Plan objectives (DWR 2007).

Lake Oroville retains most sediment that flows into the reservoir from the upper watershed, and only suspended material is released into the lower Feather River. Wave and wind action at the reservoir can result in some shoreline erosion (DWR 2007). Recreation activities can introduced contaminants into Lake Oroville, including sediment, petroleum hydrocarbons, bacteria/organic sewage, metals, pesticides, and garbage (California Department of Parks and Recreation [CDPR] 2004). Lake Oroville is not a significant source of metals but does trap sediments from upstream historic mining. Lake Oroville is listed as impaired on the 2010 303(d) list for mercury and PCBs. The source of the mercury is listed as resource extraction and likely attributed to upstream historic mining activities; the source of the PCBs is unknown.

Lower Feather River

The Lower Feather River extends from Lake Oroville down to its confluence with the Sacramento River. Water quality in the lower Feather River is substantially affected by agriculture and urbanization (Sacramento River Watershed Program 2010). The lower Feather River appears on the 2010 303(d) list of impaired water bodies for chlorpyrifos, Group A pesticides, mercury, PCBs and unknown toxicity. The source of the chlorpyrifos and Group A pesticides is listed as agriculture while the source of the mercury is listed as abandoned mines. The source of the PCBs and unknown toxicity remains unknown.

A major constituent of concern on the lower Feather River is diazinon, a pesticide applied to orchards growing plums, peaches and almonds. In 2002, the lower Feather River was listed on the 303(d) list of impaired water bodies for diazinon. In 2003, the RWQCBCV implemented TMDLs for this pesticide and worked with stakeholders to implement methods to reduce diazinon loading. As a result, 79 miles of river, including the lower Feather River, were removed from the 303(d) list in 2010 (USEPA 2012b) for impairment by diazinon.

Table 3.2-7. Water Quality Parameters Sampled[1] at the Feather River near Verona

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.8	8.5	7.6
Turbidity (NTU)	2.77	46.8	13.3
Dissolved Oxygen (mg/L)	7.5	10.7	9.1
Total Organic Carbon (mg/L)	0.8	4.6	1.8
Total Nitrogen (mg/L)	0.02	0.16	0.06
Total Phosphorus (mg/L)	0.01	0.08	0.03
Electrical Conductivity (µS/cm)	65	131	97

Sources: DWR 2013

[1] *Samples Collected 01/2006 - 01/2013.*

Yuba River Area of Analysis

Collins Lake

Collins Lake is a reservoir created to provide additional irrigation water for Browns Valley Irrigation District (ID). The reservoir has a total storage capacity of 49,500 acre-feet (AF) (Browns Valley ID 2014). Dry Creek is located downstream of the lake, which eventually joins the Yuba River. Collins Lake is not currently listed for any 303(d) water quality impairments.

Dry Creek

Dry Creek is currently listed as impaired by chlorpyrifos, diazinon, E.Coli, and unknown toxicity. Chlorpyrifos and diazinon are pesticides with agriculture listed as potential sources. Potential sources of E.Coli and unknown toxicity are listed as unknown.

Lower Yuba River

The water quality of the lower Yuba River is generally good and has improved in recent decades due to controls on hydraulic and other destructive mining techniques, changes in pesticide regulations, and the establishment of minimum instream flows (HDR and SWRI 2007). Dissolved oxygen concentrations, total dissolved solids (TDS), pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota. The surface water monitoring performed by the Sacramento River Watershed Program over the past decade generally indicates that water quality supports the beneficial uses (e.g., irrigation, fisheries habitat) designated for the water bodies in the Yuba River Basin (Sacramento River Watershed Program 2010). To date, no TMDLs have been established for the Yuba River.

Table 3.2-8 presents general water quality data for the lower Yuba River near the Feather River confluence.

Table 3.2-8. Water Quality Parameters Sampled[1] on the Yuba River Upstream of Feather River Confluence (Yuba R A MO)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.9	8.3	7.5
Turbidity (NTU)	1.17	46.8	9.18
Dissolved Oxygen (mg/L)	7.72	12.2	10.3
Total Organic Carbon (mg/L)	0.9	2.3	1.6
Total Nitrogen (mg/L)	0.01	0.07	0.04
Total Phosphorus (mg/L)	0.01	0.03	0.01
Electrical Conductivity (μS/cm)	66	100	85.7

Sources: DWR 2013
[1] Samples collected 11/2008 – 2/2011

Bear River Area of Analysis

Camp Far West Reservoir

Camp Far West Reservoir is listed as impaired by mercury on the 2010 303(d) list. Historic gold mining has led to elevated mercury concentrations in fish, especially spotted bass. The California Office of Environmental Health Hazard Assessment (OEHHA) has issued a public advisory recommending no consumption of largemouth, smallmouth, or spotted bass from Camp Far West Reservoir by women of childbearing age and children (California OEHHA 2009).

Bear River

Flows within the Bear River are continuous and dependent on releases from Camp Far West Reservoir. The lower Bear River is listed as impaired by chlorpyrifos, copper, diazinon, and mercury. The source of the chlorpyrifos and diazinon is agriculture. The source of the copper is unknown. The mercury is from historic mining, as noted above for Camp Far West Reservoir (SWRCB 2011).

Table 3.2-9 presents general water quality data for the lower Bear River.

Table 3.2-9. Water Quality Parameters Sampled[1] on the Lower Bear River (Bear R NR MO)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.8	7.9	7.4
Turbidity (NTU)	0.8	101	23.3
Dissolved Oxygen (mg/L)	5.5	12.1	8.7
Total Organic Carbon (mg/L)	1.1	10.5	4.3
Total Nitrogen (mg/L)	0.02	0.26	0.97
Total Phosphorus (mg/L)	0.02	0.19	0.07
Electrical Conductivity (µS/cm)	85	208	140

Sources: DWR 2013

[1] *Samples collected 11/2008 – 8/2012*

American River Area of Analysis

French Meadows Reservoir

Water in French Meadows Reservoir is generally considered to be of good quality with a strong trout population. There are currently no TMDLs developed for French Meadows Reservoir. Limited water quality data is available for French Meadows Reservoir, as shown in Table 3.2-10.

Table 3.2-10. Water Quality Parameters Sampled[1] at French Meadows Reservoir

Water Quality Parameter	Value
pH (standard units)	7.3
Turbidity (NTU)	0.4
Dissolved Oxygen (mg/L)[1]	9.6
Total Organic Carbon (mg/L)	1.2
Total Nitrogen (mg/L) [1]	0.012
Total Phosphorus (mg/L)	1.1
Electrical Conductivity (µS/cm)	26

Sources: Storet 1985; [1] Storet 1981

[1] *Two samples, collected in 1981 and 1985.*

Hell Hole Reservoir

Water in Hell Hole Reservoir is generally considered to be of good quality. In 2010 the Commercial and Sport Fishing designated use was listed as impaired due to mercury impairment. A TMDL has not yet been developed for this impairment. The source of the mercury exceedance is listed as unknown (USEPA 2013). Limited water quality data is available for Hell Hole Reservoir, as shown in Table 3.2-11.

Table 3.2-11. Water Quality Parameters Sampled[1] at Hell Hole Reservoir

Water Quality Parameter	Value
pH (standard units) [1]	7.1
Dissolved Oxygen (mg/L)	9.6
Total Nitrogen (mg/L)	0.11
Total Phosphorus (mg/L)	0.01
Electrical Conductivity (μS/cm) a	26

Sources: Storet 1985; [1]Storet 1969

[1] *Two samples, collected in 1969 and 1985.*

Middle Fork American River

Water in the Middle Fork American River is generally considered to be of good quality. Table 3.2-12 presents the results of a region-wide RWQCBCV Recreation Beneficial Use Study in 2008 for the Middle Fork American River.

Table 3.2-12. Water Quality Parameters Sampled on the Middle Fork American River at Mammoth Bar

Water Quality Parameter	08/27/2008	08/31/2008	09/03/2008
pH (standard units)	9.08	7.11	5.41
Temperature (º C)	20.8	18.8	18.4
Specific Conductivity (umhos/cm)	40	40	37
E Coli (MPN/100mL)	2	2	1

Sources: SWRCB 2008

Folsom Reservoir

Snowmelt and precipitation from the upper American River Watershed discharges water into Folsom Reservoir and Lake Natoma. In general, runoff from the relatively undeveloped watershed is of very high quality, rarely exceeding California’s water quality objectives (Wallace, Roberts, & Todd et al. 2003). Due to changes in the operation of Shasta Dam, releases from Folsom Reservoir are used to fulfill water delivery obligations and downstream water quality standards that would normally be met by releases from Shasta (Reclamation 2013b). The reservoir is listed on the 2010 303(d) list as impaired by mercury. The source of the mercury is historic mining. Table 3.3-13 presents general water quality data for Folsom Reservoir.

Table 3.3-13. Water Quality Parameters Sampled at Folsom Reservoir

Water Quality Parameter	Minimum	Maximum	Average
PH (standard units)	5.8	8.5	7.1
Turbidity (NTU)	1	68	1.2
Dissolved Oxygen (mg/L)	7.0	14	10.3
Total Organic Carbon (mg/L)	2	3.5	N/A
Total Nitrogen (mg/L)	N/A	N/A	N/A
Total Phosphorus (mg/L)	N/A	N/A	N/A
Electric Conductivity (μS/cm)	19	123	52

Source: Larry Walker Associates 1999

Lower American River

Gold mining has occurred within the American River basin since the Gold Rush in 1848. The lower American River is listed as an impaired water body because of mercury lost during gold recovery. The urbanized portions of the lower American River are also listed for unknown toxicity. This is believed to be a result of use of herbicides and pesticides on landscaped residential and commercial areas.

Table 3.2-14. Water Quality Parameters Sampled[1] on the Lower Fork American River (American River at Water Treatment Plant)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	5.9	9.3	7.4
Turbidity (NTU)	0.7	146	4.5
Dissolved Oxygen (mg/L)	5.2	12.95	9.5
Total Organic Carbon (mg/L)	0.7	3.0	1.7
Total Nitrogen (mg/L)	0.01	0.19	0.05
Total Phosphorus (mg/L)	0.01	0.1	0.02
Electrical Conductivity (μS/cm)	40	95	60

Sources: DWR 2013
[1] Samples collected 01/2006 – 12/2012

Table 3.2-15 summarizes water quality data measured downstream of Folsom Dam in Lake Natoma at Negro Bar from April to September 2008. In general, water quality in Lake Natoma meets standards in the Basin Plan for the Sacramento River and San Joaquin River Basins.

Table 3.2-15. Water Quality at Lake Natoma (at Negro Bar) - April to September 2008

Water Quality Parameter	Units	Minimum	Maximum	Average	RL
Arsenic (Dissolved)	µg/l	<0.5	<0.5	0.5	0.5
Barium (Dissolved)	µg/l	11	17	13.5	0.5
Calcium (Dissolved)	mg/l	5	9	7	1
Chromium (Dissolved)	µg/l	<0.5	1	0.74	0.5
Copper (Dissolved)	µg/l	0.5	0.8	0.6	0.5
Cyanide	µg/l	<2.0	<2.0	<2.0	2.0
Iron (Dissolved)	µg/l	<100	<100	<100	100
Magnesium (Dissolved)	mg/l	1	3	2	1
Manganese (Dissolved)	µg/l	5	28	15.5	0.6
Mercury	ng/l	<2.0	<2.0	<2.0	2.0
Nickel (Dissolved)	µg/l	<1.0	<1.2	<1.2	1.2
Silver (Dissolved)	µg/l	<0.5	<0.6	<0.6	0.5
TDS	mg/l	40	72	52	10
TSS	mg/l	<1.0	3.4	2.4	1.0
Zinc (Dissolved)	µg/l	<2.0	<2.5	<2.5	2.5

Source: Reclamation 2009
Key:
RL = reporting limit

Merced River Area of Analysis

Lake McClure

Very little water quality data was available for Lake McClure. The lake is listed as impaired for mercury due to resource extraction. Table 3.2-16 presents general water quality data collected on the Merced River, just upstream from Lake McClure.

Table 3.2-16. Water Quality Parameters Sampled[1] on the Merced River Near Briceburg

Water Quality Parameter	Average
pH (standard units)	7.2
Turbidity (NTU)	2
Dissolved Oxygen (mg/L)	10
Total Organic Carbon (mg/L)	1.6
Total Nitrogen (mg/L)	0.16
Total Phosphorus (mg/L)	0.02
Electrical Conductivity (µS/cm)	43

Source: Kratzer and Shelton 1998
[1] *Samples were collected during the period from 1972 through 1990.*

The results from three additional sampling events in March and April 2003 on the Merced River at Briceberg are presented in Table 3.2-17.

Table 3.2-17. Water Quality Parameters Sampled on the Merced River At Briceburg

Water Quality Parameter	Average[1]
pH (standard units)	7.8
Turbidity (NTU)	1.7
Dissolved Oxygen (mg/L)	12
Total Organic Carbon (mg/L)	1.5
Electrical Conductivity (µS/cm)	61

Source: DWR 2013

[1] *Samples were collected from March-April 2003*

Merced River

Table 3.2-18 presents general water quality data for the Merced River near Stevinson (near the mouth of the Merced River). The Merced River is listed as impaired by mercury due to resource extraction.

Table 3.2-18. Water Quality Parameters Sampled[1] on the Merced River Near Stevinson

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.29	7.5	6.9
Turbidity (NTU)	2.13	22.8	7.3
Dissolved Oxygen (mg/L)	7.88	12.1	9.7
Electrical Conductivity (µS/cm)	58	156	105

Source: DWR 2013

[1] *Samples were collected during the period from 09/1998 – 05/1999.*

San Joaquin River Area of Analysis

Agricultural drainage, along with wastewater treatment plant discharges, runoff from dairies, and other sources, contribute to suspended sediment and other constituents of concern in the river. San Joaquin River water quality standards include salinity standards at Vernalis, which is just downstream of the confluence with the Stanislaus River. The salinity standard (measured as EC) is 700 µS/cm from April 1 to August 31, and 1000 µS/cm for the remainder of the year. Water quality in the San Joaquin River at Maze River (just upstream of the water quality compliance point at Vernalis) is shown in Table 3.2-19. Water quality at Vernalis is presented in Table 3.2-20. The Stanislaus River enters the San Joaquin River between these two points, and at some times, can be used to improve water quality to meet standards at Vernalis.

Table 3.2-19. Water Quality Parameters Sampled[1] on the San Joaquin River At Maze Bridge

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7.2	8.5	7.8
Turbidity (NTU) [2]	5	160	32.1
Total Organic Carbon (mg/L)	3.6	7.7	4.9
Total Nitrogen (mg/L)	1.6	3.3	2.4
Total Phosphorus (mg/L)	0.19	0.57	0.42
Electrical conductivity (µS/cm)	213	1700	1140

Source: DWR 2013
[1] Samples taken from 1984 through 1994.

Table 3.2-20. Water Quality Parameters Sampled[1] on the San Joaquin River At Vernalis

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.9	9.07	7.7
Turbidity (NTU) [2]	1.9	157	18.5
Total Organic Carbon (mg/L)	1.4	10.4	3.8
Total Nitrogen (mg/L)	0.08	3.2	1.3
Total Phosphorus (mg/L)	0.05	0.37	0.15
Electrical conductivity (µS/cm)	99	1077	531

Source: DWR 2013
[1] Samples taken from 2006 through 2013.

Delta Region

Delta Water Quality Concerns

The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. Salinity is a water quality constituent that is of specific concern and is described below. Table 3.2-21 presents water quality data for salinity at selected stations within the Delta.

Table 3.2-21. Water Quality Data for Selected Stations within the Delta

Location	Mean TDS (mg/L)	Mean Electrical Conductivity (µS/cm)	Mean Chloride, Dissolved (mg/L)
Sacramento River at Hood	92.4	155	6.1
North Bay Aqueduct at Barker Slough	188	323	24
SWP Clifton Court Intake	235	401	62
CVP Banks Pumping Plant	225	392	59
Contra Costa Intake at Rock Slough	255	553	77
San Joaquin River at Vernalis	324	531	68

Source: DWR 2013
mg/L = milligram per liter.
µS/cm = microsiemen per centimeter
Sampling period varies, depending on location and constituent, but generally is between 2006-2012

Salinity

Salinity is a measure of the mass fraction of dissolved salts (including chloride and bromide) in water, typically measured in parts per thousand (ppt). Salinity may also be measured using other methods. TDS is a measure of the concentration of salt, as measured in milligrams per liter (mg/L) (DWR 2001). TDS is defined as those solids remaining after drying a sample to a constant weight at 180 degrees Celsius. EC is a measure of the ability of a solution to carry a current and depends on the total concentration of ionized substances dissolved in the water. Because changes in EC of water are generally directly proportional to changes in dissolved salt concentrations, EC is a convenient surrogate measure for TDS.

Salinity is a concern in the Delta because it can adversely affect municipal, industrial, agricultural, and recreational uses. Table 3.2-22 illustrates that within the Delta, mean TDS concentrations are highest in the west Delta and the south Delta channels that are affected by the San Joaquin River (CALFED 2000). Salinity issues in the Sacramento and San Joaquin rivers result from natural sources, urban discharges, and agricultural discharges. As the water from the rivers flows through the Delta, salinity intrusion from the Pacific Ocean contributes to these issues (DWR 2012). The extent of seawater intrusion into the Delta is a function of daily tidal fluctuations, the freshwater inflow to the Delta from the Sacramento and San Joaquin rivers, the rate of export at the SWP and CVP intake pumps, and the operation of various control structures, such as the Delta Cross-Channel Gates and Suisun Marsh Salinity Control System (DWR 2001). In the southern Delta, salinity is largely associated with the high concentrations of salts carried by the San Joaquin River into the Delta (SWRCB 1997). The high mean concentration of TDS in the San Joaquin River at Vernalis reflects the accumulation of salts in agricultural soils and the effects of recirculation of salts via the Delta Mendota Canal (CALFED 2000). Locations in the north portion of the Delta at Barker Slough and in the Sacramento River at Greene’s Landing, which are not substantially affected by seawater intrusion, have lower mean concentrations of TDS than other locations in the Delta. A similar pattern is seen using mean EC levels as a surrogate for TDS.

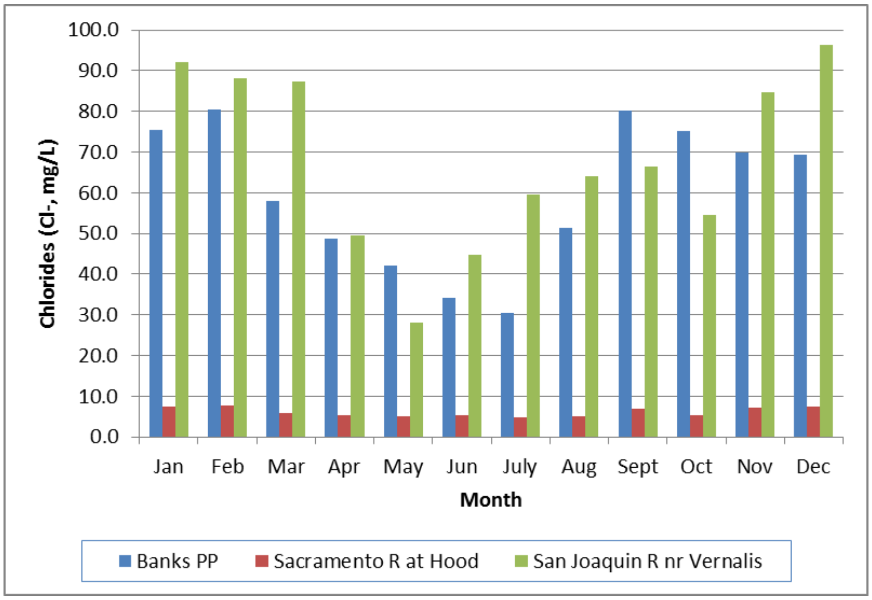
Table 3.2-22. Comparison of TDS Concentrations at Selected Stations Within the Delta

TDS (mg/L)	Sacramento River at Greenes/Hood	Old River at Station 9	Banks Pumping Plant	San Joaquin River Near Vernalis/Mossdale
Mean	95	200	195	273
Median	92	173	182	261
Low	50	107	116	83
High	404	450	388	578

Source: DWR 2001
TDS detection limit = 1.0 mg/L
Samples collected between 1996 and 1999

Water quality data collected between 1996 and 1999 show that TDS levels at Banks Pumping Plant, in the Sacramento River at Hood, and in the western Delta at Old River at Station 9 never exceeded the secondary MCL for drinking water of 500 mg/L (Table 3.2-22) (DWR 2001). In the San Joaquin River near Vernalis, only six out of the 143 samples exceeded the secondary MCL for TDS. The secondary MCL for chloride is 250 mg/L, and the secondary MCL for EC is 900 microsiemen per centimeter (µS/cm). Because TDS is a measure of the TDS and does not measure the relative contribution of individual constituents such as chloride and bromide, it is possible to meet the secondary TDS MCL for TDS (500 mg/L) but still exceed a standard for an individual salt constituent such as chloride (250 mg/L) (DWR 2001). For this reason, and because of their importance in formation of disinfection by-products, chloride is addressed in detail in the following sections.

Figure 3.2-2 presents monthly median chloride concentrations at Banks Pumping Plant, Sacramento River at Hood, and the San Joaquin River near Vernalis. As Figure 3.3-2 shows, the lowest median concentrations of chloride typically occur in spring and early summer (April through July). The monthly median concentrations of chloride for the period of record (January 2006-December 2012) do not exceed the secondary MCL for chloride of 250 mg/L.

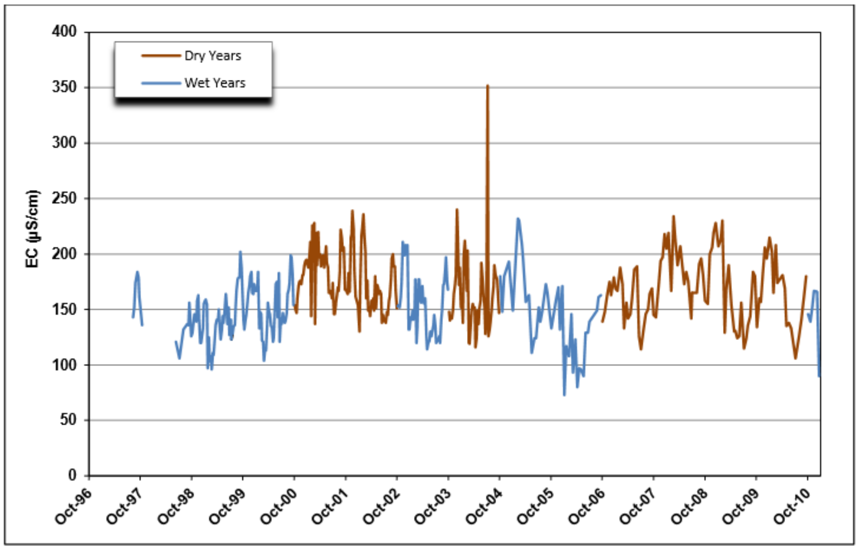


Source: DWR 2013.

Note: Bars represent the average monthly value.

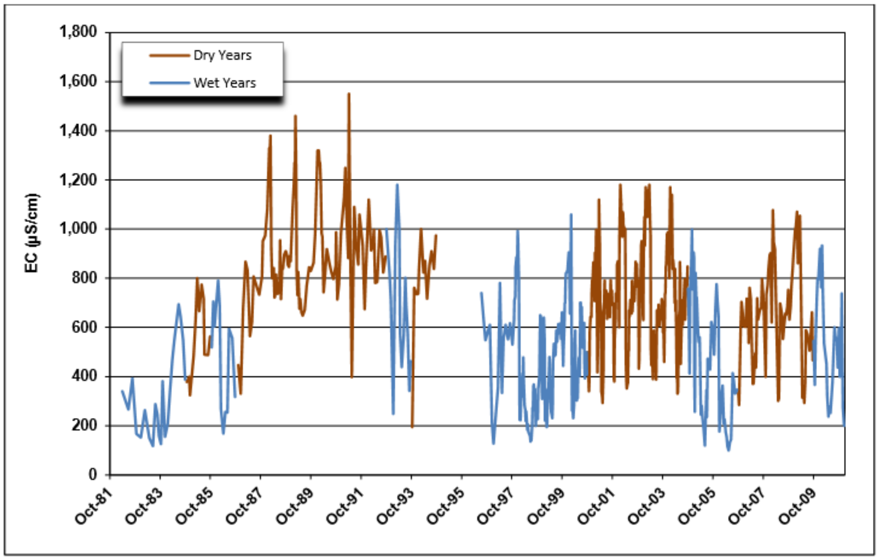
Figure 3.2-2. Monthly Average Chloride Concentrations at Banks Pumping Plant, Sacramento River at Hood, and San Joaquin River near Vernalis

Salinity patterns in the Delta also vary with water year type. As shown in Figure 3.2-3 through 3.2-5, salinity, as measured by EC, is higher in dry years than in wet years (DWR 2013). In addition, a DWR project report (DWR 2013) found that EC levels generally rise during the late summer and fall months when river flows are low.



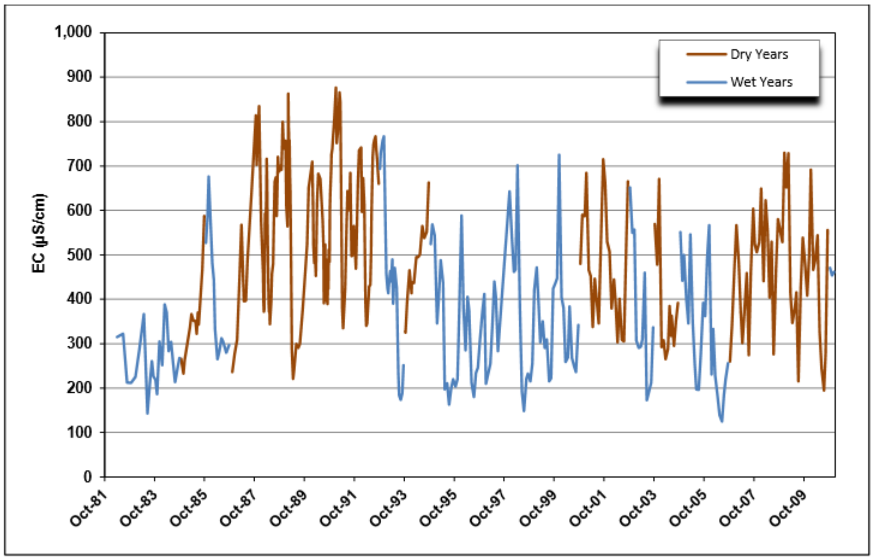
Source: DWR 2012.

Figure 3.2-3. Average EC (µS/cm) by Year Type at the Sacramento River at Hood in the Sacramento-San Joaquin Delta



Source: DWR 2012. Blank periods indicate no data available.

Figure 3.2-4. Average EC (µS/cm) by Year Type at the San Joaquin River at Vernalis in the Sacramento-San Joaquin Delta



Source: DWR 2012.

Figure 3.2-5. Average EC (µS/cm) by Year Type at Banks Pumping Plant in the Sacramento-San Joaquin Delta

Buyer Service Area

San Luis Reservoir

San Luis Reservoir is an off-stream reservoir that stores excess winter and spring water from Delta. Water is delivered to the reservoir through the California Aqueduct and Delta-Mendota Canal. In the summer months, the reservoir provides a water supply for over 20 million residents and more than half a million acres of irrigated agriculture. Water levels in San Luis Reservoir vary each season because of the amount and timing of water delivered from the California Aqueduct and Delta-Mendota Canal.

The 2013 *San Luis Reservoir State Recreation Area Final Resource Management Plan/General Plan and Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR)* states that water quality in the reservoir generally meets drinking water standards, but the reservoir has several water quality concerns:

- High turbidity and TDS levels in the reservoir;
- Algal blooms and taste and odor problems (during a drought year);
- High total organic carbon and bromide concentration from the source water; and
- Pathogen contamination through grazing trespass and recreation (Reclamation and CDPR 2013).

During the summer months, when water levels are lowest, water quality in San Luis Reservoir can decline due to a combination of warmer temperatures, wind-induced nutrient mixing, and algal blooms near the reservoir surface. When San Luis Reservoir approaches its late summer/early fall low point, algae concentrations in water drawn into the reservoir's pumping plants may be high enough that the water becomes difficult to treat.

San Luis Reservoir was designated as mercury impaired on the 2010 California 303(d) List. The potential source of the mercury was listed as unknown (SWRCB 2011).

3.2.2 Environmental Consequences/Environmental Impacts

This section describes the methodology applied for the water quality analysis and presents the environmental impacts/environmental consequences associated with each alternative.

3.2.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential water quality effects of the alternatives.

3.2.2.1.1 Reservoirs and Waterways within the Seller and Buyer Service Areas

The analysis for reservoirs and waterways uses both quantitative and qualitative methods to assess changes in water quality. The quantitative analysis relies on hydrologic modeling results that estimate changes in river flow rates and reservoir storage for the CVP and SWP reservoirs and the rivers that they influence. If the change in storage is equal to or less than 1,000 AF, or if the change in flow is less than ten cubic feet per second (cfs), it is assumed that there would be no water quality impacts as this is within the error margins of the model. If the changes are small and within the normal range of fluctuations (similar to the No Action/No Project Alternative) for that time period, it is generally assumed that any water quality impacts would be less than significant. Appendix B describes the modeling efforts to quantify changes in reservoir surface water storage and river flow rates.

Reservoir storage data is not available for all reservoirs included in the area of analysis. Where this data is not available, effects are evaluated based on transfer quantities, anticipated changes in water storage (increases or decreases), and the timing of the changes.

3.2.2.1.2 Sacramento-San Joaquin Delta

The analysis for the Delta uses both quantitative and qualitative methods to assess changes in water quality. The quantitative analysis relies on water quality modeling results that predict changes in various water quality parameters under each of the action alternatives. Appendix C describes the modeling analysis undertaken to quantify changes in water quality in the Delta. Where modeling is not available, effects are evaluated based on transfer quantities, anticipated changes in flow through the Delta (increases or decreases), and the timing of the changes.

3.2.2.1.3 Other Water Quality Impacts

All other water quality effects are analyzed at a qualitative level using the best available information and taking into consideration the magnitude and timing of the change, as well as any location specific water quality issues.

3.2.2.2 Significance Criteria

For the purposes of this EIS/EIR, impacts to water quality would be considered significant if implementation of any of the alternatives would:

- Violate existing water quality objectives or standards;
- Result in long-term adverse effects on beneficial uses; or
- Substantially degrade existing water quality.

3.2.2.3 Alternative 1: No Action/No Project Alternative

3.2.2.3.1 Seller Service Area

Under the No Action/No Project Alternative, changes in reservoir storage and river flows would not affect water quality in reservoirs within the Seller Service Area. Reservoir storage and river flows would continue to fluctuate seasonally and annually based on hydrologic conditions. Therefore, there would be no changes in water quality associated with the No Action/No Project Alternative.

3.2.2.3.2 Buyer Service Area

San Luis Reservoir

Under the No Action/No Project Alternative, changes in reservoir storage would not affect water quality in San Luis Reservoir. Similar to the Seller Service Area, the water operations in the Buyer Service Area in the No Action/No Project Alternative would not change from existing conditions. Water quality and water temperatures in the San Luis Reservoir would exhibit the same range of constituent levels and be subject to the same environmental influences and variations that are already present. Therefore, there would be no water quality effects and no changes from existing conditions associated with the No Action/No Project Alternative in San Luis Reservoir.

3.2.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.2.2.4.1 Seller Service Area

Cropland idling transfers could result in increased deposition of sediment on water bodies. Crop management practices and soil textures are key factors to determine erosion potential. The Proposed Action could result in farmers in Butte, Colusa, Glenn, Solano, Sutter, and Yolo counties leaving up to 59,973 acres of fields idle. Since these fields would be dry and have less vegetative cover, they may be more susceptible to erosion from strong winds and runoff. Increased sediment transport via wind erosion could result in increased deposition of transported sediment onto surface water bodies which could increase turbidity and affect water quality.

As described in Section 3.4, the rice crop cycle and the prevalent soil textures in Butte, Colusa, Glenn, Sutter, and Yolo Counties would reduce potential impacts from wind erosion in this region. Rice cultivation typically includes discing the field after harvest to incorporate the leftover rice straw into the soils. After harvest and discing in late September and October, rice fields are flooded to aid in decomposition of the straw. Once dried, the combination of decomposed straw and clay texture soils typically produces a hard, crust-like surface. If left undisturbed, this surface crust would remain intact throughout the summer, when wind erosion would be expected to occur, until winter rains begin. This surface crust would not be conducive to soil loss from wind erosion. During the winter rains, the hard, crust-like surface typically remains intact and the amount of sediment transported through winter runoff would not be expected to increase. Therefore, there would be little-to-no increase in sediment transport resulting from wind erosion or winter runoff from idled rice fields under the Proposed Action.

In Butte, Colusa, Glenn, Solano, Sutter, and Yolo counties, there could be a combined maximum of 8,500 acres of alfalfa, corn, or tomato cropland idled. The sellers who expressed interest in participating in cropland idling transfers in these counties are located mainly on clay and clay loam soils that have low erodibility (as described in greater detail in Section 3.4). Due to the primary clay soil textures in counties in the Seller Service Area as well as relatively small acreages of non-rice crops proposed for idling, substantial soil erosion as a result of idling non-rice crops is not expected.

Under normal farming practices, farmers typically leave fields fallow during some cropping cycles in order to make improvements such as land leveling and weed abatement or to reduce pest problems and improve soils. As discussed in Section 3.4, Geology and Soils, farmers employ management practices to reduce potential soil erosion impacts, to avoid substantial loss of soils and to protect soil quality (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2009). While farmers would not be able to engage in management practices that require consumptive use of water on an idled field, they could continue to employ erosion control techniques such as surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch covers (USDA NRCS 2009). Therefore, cropland idling under the Proposed Action would not result in substantial soil erosion or sediment deposition into waterways. Impacts to water quality would be less than significant.

Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff. Under the Proposed Action, cropland idling/shifting would occur, and regionally, changes in irrigation practices and pesticide application could occur compared to the No Action/No Project Alternative. The changes in the quantity of irrigation water applied to the land could alter the concentration of pollutants associated with leaching and runoff. Because farmers would apply less water to fields under the Proposed Action, there would be less potential for leaching of salts and other pollutants. In addition, the reduction in application of fertilizers and pesticides under the Proposed Action compared to the No Action/No Project Alternative would result in decreased concentrations of nitrogen and phosphorus in surface water runoff. In cases of crop shifting, farmers may alter the application of pesticides and other chemicals which negatively affect water quality if allowed to enter area waterways. Since crop shifting would only affect currently utilized farmland, a significant increase in agricultural constituents of concern is not expected.

Because there would be less total leaching potential and runoff under the Proposed Action than there would be under the No Action/No Project Alternative, water quality would not decrease as a result of a reduction in applied water. There could be an improvement in the quality of surface water runoff returning to nearby water bodies. Overall, the effect on water quality with respect to leaching and surface water runoff would be less than significant.

Cropland idling/shifting transfers could change the quantity of organic carbon in waterways. Both cropland idling and crop shifting would lead to reductions in irrigation which would decrease the amount of agricultural runoff entering waterways. Agricultural runoff often contains nutrients such as nitrogen and phosphorous that promote excessive algae growth and increase organic carbon in waterways. A reduction in agricultural runoff could reduce the amount of nutrients that would enter waterways and could reduce one source of organic carbon. The reduction in agricultural runoff may not actually cause a quantifiable decrease in organic carbon because there are other sources and a variety of factors that contribute to organic carbon levels in waterways. However, cropland idling/crop shifting under the Proposed Action would not be expected to increase organic carbon in waterways, and therefore this impact would be less than significant.

Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows. Groundwater substitution transfers would use groundwater for irrigation instead of surface water. The amount of groundwater substituted for surface water under the Proposed Action would be relatively small compared to the amount of surface water used to irrigate agricultural fields in the Seller Service Area. Groundwater would mix with surface water in agricultural drainages prior to irrigation return flow reaching the rivers. Constituents of concern that may be present in the groundwater could enter the surface water as a result of mixing with irrigation return flows. Any constituents of concern, however, would be greatly diluted when mixed with the existing surface waters applied because a much higher volume of surface water is used for irrigation purposes in the Seller Service Area. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. Section 3.3 provides additional discussion of groundwater quality. Groundwater substitution transfers would result in a less-than-significant impact on water quality.

Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts. Based on modeling efforts, changes in CVP and SWP reservoir storage between the Proposed Action and the No Action/No Project Alternative are shown in Table 3.2-23. Changes in reservoir storage are primarily influenced by storing transfer water in April, May, and June of dry and critical years (until the Delta pumps can convey the water to the buyers) and streamflow depletion from groundwater substitution transfers.

Table 3.2-23. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	-0.6	-0.6	-0.4	-0.1	0.0	0.0	0.0	-0.2	-0.3	-0.4	-0.5	-0.6
AN	-4.1	-4.1	-3.0	-2.4	-2.0	-2.0	-2.0	-0.1	-0.3	-0.5	-0.6	-0.8
BN	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.2	-1.4	-1.4	-1.6	-1.6
D	-1.9	-1.7	-1.7	-1.6	-1.6	-1.6	4.9	14.1	37.3	23.2	-2.9	-3.1
C	-4.1	-4.3	-4.3	-4.3	-4.6	-4.6	-2.0	21.2	58.2	6.5	-6.2	-6.2
Lake Oroville												
W	-3.1	-3.0	-2.2	-1.8	0.0	0.0	0.0	0.0	-0.2	-0.4	-1.0	-1.5
AN	-10.9	-10.9	-11.0	-11.0	-9.2	-0.7	-0.7	-0.7	-0.2	-5.9	-3.8	-2.3
BN	-2.5	-3.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.2	-4.5	-5.1	-5.5
D	-3.8	-3.8	-4.0	-4.0	-4.0	-4.0	-3.7	3.3	4.8	1.0	-8.2	-4.0
C	-10.0	-10.6	-11.6	-11.6	-11.8	-12.0	-12.1	-10.8	-7.0	-4.6	-16.1	-16.2

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Reservoir												
W	1.5	-0.8	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.3	-0.7
AN	-1.8	-2.4	-2.5	-0.9	0.0	0.0	0.0	0.0	-0.1	-1.0	-2.0	-3.3
BN	-1.8	-2.3	-3.5	-3.5	0.0	0.0	0.0	0.0	-0.5	-1.2	-1.2	-1.6
D	2.7	2.1	-0.8	-0.8	-1.7	-0.7	-0.7	7.7	12.2	10.5	11.2	12.9
C	6.7	4.7	3.2	2.1	1.1	-0.6	0.8	5.1	12.9	8.6	7.4	9.6

Note: Negative numbers indicate that the Proposed Action would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

During dry and critical years, Shasta and Folsom reservoirs show an increase in reservoir storage during spring months. Lake Oroville shows a similar change in dry years. These changes are caused by the CVP and SWP storing water, when possible, until the transfer period for the Delta pumps becomes available in July. The transfer water is released from July through September. This type of operation would not be possible in all transfer years because of downstream temperature and flow requirements for fish.

Folsom Reservoir shows elevated reservoir levels for several additional months during dry and critical years because of upstream stored reservoir water transfers. Placer County Water Agency could transfer water through reservoir release, and this water would be stored in Folsom Reservoir until the buyers can convey this water to the end user. Water from Placer County Water Agency may go to East Bay Municipal Utility District (MUD), which could accept transfer water at its Freeport Diversion over a longer period than the CVP and SWP Delta export pumps. Therefore, water levels in Folsom could be elevated while water is stored and slowly released to East Bay MUD.

Reservoir storage during other times of the year (not April through September of a transfer year) is decreased because of streamflow depletion from groundwater substitution transfers. Refilling groundwater storage after a groundwater substitution transfer would decrease flows in neighboring streams. The CVP and SWP would have less water in key waterways (including the Sacramento, Feather, and American rivers). The CVP and SWP would either reduce Delta exports or release additional water from storage to account for those streamflow reductions. These changes would reduce water in storage; however, these reductions are small and less than one percent of the reservoir volumes.

CVP and SWP reservoirs within the Seller Service Area would experience only small changes in storage, which would not be of sufficient magnitude and frequency to result in substantive changes to water quality. Any small changes to water quality would not adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential effects on reservoir water quality would be less than significant.

Water transfers could change reservoir storage in non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts. Table 3.2-24 shows the changes in reservoir storage in the reservoirs that could participate in reservoir release transfers. These reservoirs would release additional water for transfers, so the reservoir storage would decline during and after a transfer (until the reservoir refills).

As described in the existing conditions, water in these facilities is of generally good quality. Collins Lake and French Meadows Reservoir are not identified as impaired for any water quality constituents. Camp Far West Reservoir, Hell Hole Reservoir, and Lake McClure are listed as impaired for mercury, which is from legacy mining operations. Mercury entered the system from upstream flows, and short-term changes in storage would not likely affect mercury within the reservoir. Therefore, changes to reservoir levels in non-Project reservoirs would have less than significant impacts on water quality.

Table 3.2-24. Changes in Non-Project Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Camp Far West Reservoir												
W	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-2.5	-2.5	-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-2.3	-2.5
C	-3.6	-3.6	-3.6	-3.6	-1.1	-0.7	-0.7	-0.7	-0.7	-4.3	-4.3	-4.3
Collins Lake												
W	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.8	-0.8	-0.8	-0.8	-0.2	0.0	0.0	0.0	0.0	-1.1	-1.7	-1.7
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Hell Hole and French Meadows Reservoirs												
W	-6.1	-6.1	-4.1	-1.8	-0.7	-0.6	-0.6	-1.2	-0.4	-0.4	-0.3	-0.1
AN	-22.3	-22.3	-22.3	-13.9	-1.8	0.2	0.2	0.2	0.2	0.2	0.1	0.1
BN	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-16.6	-16.7	-16.7	-13.4	-11.4	-7.9	-1.1	-4.9	-8.5	-12.5	-16.8	-20.4
C	-28.2	-28.5	-29.0	-29.0	-29.0	-29.0	-28.9	-34.5	-39.5	-44.5	-49.8	-55.2
Lake McClure												
W	-2.3	-2.3	-2.3	-2.3	0.0	0.0	-3.3	-4.8	-3.5	-2.0	-0.8	-0.2
AN	-15.0	-15.0	-15.0	-15.0	-15.0	-10.0	-17.7	-20.9	-12.8	-9.3	-6.4	-5.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	-9.1	-15.0	-15.0	-15.0	-15.0	-15.0
D	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-15.7	-21.9	-19.9	-17.8	-16.1	-15.2
C	0.0	0.0	0.0	0.0	0.0	0.0	-6.7	-10.3	-8.6	-6.6	-5.1	-4.5

Note: Negative numbers indicate that the Proposed Action would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could change flow rates in rivers within the Seller Service Area and could affect water quality. Based on modeling results, Table 3.2-25 provides changes in river flows in the Seller Service Area between the Proposed Action and the No Action/No Project Alternative.

Under the Proposed Action, long-term average flow rates in the Sacramento River at Freeport would be lower than flow rates under the No Action/No Project Alternative during October through June. Average monthly flow rates would decrease by less than 0.5 percent during this period because of streamflow depletion associated with groundwater substitution transfers (as described above). From July through September, long-term monthly average flow rates at Freeport would be higher under the Proposed Action compared with the No Action/No Project Alternative. Greater increases in flow rates would occur during dry and critical years because transfers would be released upstream for conveyance through the Delta. During critical years, average flow rates in July and August may increase by greater than 13 percent. Sacramento River flows at Wilkins Slough would follow the same trend, with minor decreases during non-transfer periods and increased flow during water transfers.

Long-term average monthly flow rates in the Feather River below Thermalito Afterbay and in the Lower Feather River would be similar to the flows under the No Action/No Project Alternative. Long-term monthly average flow rates at locations along the Feather River would increase during August, when flows would increase by 1.7 percent below Thermalito Afterbay and 1.8 percent in the Lower Feather River. This increase in flows in August would be the result of a release of transfer water. Slight variations in flow throughout the year result from required releases from Lake Oroville to address stream depletion. Increases in Feather River flow during August would be small and would not result in any adverse water quality impacts, but may have some small benefits.

Under the Proposed Action, average monthly flow rates along the Yuba River at Marysville would not change substantially from the No Action/No Project Alternative. Flow rates would increase by about 1.6 percent during July of dry and critical years when reservoir release transfers from Collins Lake are released downstream for conveyance through the Delta. During the rest of the year, flows would decrease by a maximum of 0.4 percent because of reservoir refill (the reservoir will capture additional flow to refill the empty storage after the transfer) and streamflow depletion. These small changes would not affect water quality in the Yuba River.

Average monthly flow rates in the Bear River at Feather River would remain similar to the No Action/No Project Alternative, with the exception of July and August. Flows in July and August would increase substantially (34 percent and 50 percent, respectively). Flows during August and September are extremely low in this reach of the Bear River, averaging only 12 and 17 cfs respectively. Although the Proposed Action would only increase flows by a maximum of 18 cfs, this is a substantial increase over the No Action/No Project Alternative. Increases in flows on the Bear River at the Feather River would occur during August and September in dry and critical years when storage and releases from Camp Far West Reservoir would occur due to transfer requirements; the remaining months would have almost no change except for the few months when the reservoir refills. These increases would not adversely affect water quality, and the increased summer flows may have small water quality benefits as they would have the potential to dilute pollutants.

Under the Proposed Action, long-term average monthly flow rates in the lower American River at H Street below Nimbus Dam would be slightly lower than the No Action/No Project Alternative during winter and spring months of January through June, by up to one percent. Under the Proposed Action, Reclamation may store water from transfers in Folsom Reservoir during April through October. During summer and fall months of July through October when stored reservoir water would be released, flow rates are expected to be higher, by up to 2.2 percent. The increases in flows in the lower American River would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural runoff. These changes in flow throughout the year are not substantial relative to the No Action/No Project Alternative. During the remainder of the year, when reservoir storage refills, the small decreases in river flows would be a very small percentage of river flows and would have less than significant effects on water quality.

Under the Proposed Action, flows in the Merced River at the confluence with the San Joaquin River would increase in April and May by 105 cfs (20.4 percent) and 59 cfs (7.2 percent), respectively, when water is released from stored reservoir release transfers. During winter months, as the reservoir refills, the river flows would decrease during winter months up to 1.3 percent. The decreases in flow would be small compared to overall river flows. The increased flow from the Merced River would carry high quality water into the San Joaquin River, which could dilute the constituents of conern in the San Joaquin River.

Overall, changes in flows in the Seller Service Area would not be of significant frequency and magnitude to affect water quality. Predicted changes in flow are not sufficient to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Therefore, water quality impacts associated with changes in flow in the Seller Service Area are expected to be less than significant.

Overall, the decreases in flow under the Proposed Action would be very small and would occur during the wetter months of October through June. They would not be of sufficient frequency or magnitude to adversely affect water quality or result in adverse effects to designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. The anticipated increases in flows under the Proposed Action would occur in July through September when transfer water would be released from upstream reservoirs to be conveyed through the Delta. The increases in flow could be beneficial to water quality, but are fairly small in comparison to average monthly flow rates and would be unlikely to result in substantive water quality improvements.

Table 3.2-25. Changes in River Flows between the No Action/No Project Alternative and the Proposed Action (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Freeport												
W	-18.8	-12.5	-99.8	-123.8	-94.9	-41.5	-30.6	-17.2	-31.9	-11.8	-9.0	-5.0
AN	-12.0	-40.9	-99.2	-401.2	-358.1	-259.7	-61.4	-131.4	-47.9	133.6	9.2	7.8
BN	0.0	0.0	0.0	-37.5	-94.3	-26.3	-21.6	-15.7	0.0	0.0	0.0	0.0
D	-36.4	-53.1	-42.7	-124.3	-66.0	-194.4	-156.9	-44.5	-57.9	832.7	1,072.2	208.4
C	-72.7	-61.7	-70.5	-98.7	-178.5	-146.6	-55.6	-52.2	-53.9	1,920.0	1,331.5	540.4
Sacramento River at Wilkins Slough												
W	-8.6	-5.0	-6.8	-9.5	-4.6	-3.3	-3.5	-2.3	-1.4	-2.3	-1.3	-1.7
AN	-8.3	-8.1	-24.8	-18.7	-15.9	-6.4	-7.0	-38.2	-2.5	7.4	7.3	7.4
BN	-4.5	-3.6	-3.4	-3.4	-3.3	-3.1	-4.1	0.0	0.0	-3.3	0.0	-3.0
D	-10.9	-13.5	-9.6	-9.8	-7.1	-6.6	-52.9	-33.4	-252.5	394.9	587.8	118.3
C	-21.4	-15.6	-14.7	-13.6	-8.6	-14.7	-0.1	-114.4	-274.3	1244.5	609.2	264.6
Feather River below Thermalito Afterbay												
W	6.6	-2.8	-12.1	-6.6	-32.7	0.0	0.0	0.0	3.0	4.0	9.4	9.0
AN	27.6	0.9	1.5	0.0	-31.7	-138.9	0.0	0.0	-8.0	92.9	-34.4	-25.1
BN	8.2	8.1	16.2	0.0	0.0	0.0	0.0	0.0	3.8	3.7	11.0	5.8
D	8.7	1.4	3.2	0.0	0.0	0.0	0.0	-105.1	-12.1	62.4	149.1	-70.0
C	9.2	10.2	15.0	0.0	4.6	1.9	9.4	-4.7	-42.1	-38.5	186.9	0.8
Lower Feather River												
W	-0.1	-9.7	-19.5	-20.3	-40.2	-11.4	-5.6	-5.2	-1.9	-0.7	5.1	4.8
AN	15.3	-11.1	-9.1	-52.2	-43.0	-166.6	-9.0	-61.4	-15.8	85.8	-41.1	-31.6
BN	4.4	4.4	12.7	-2.9	-3.0	-3.5	-3.6	-3.0	1.2	1.2	8.6	3.5
D	-1.8	-8.4	-5.6	-8.1	-7.8	-26.4	-1.7	-103.6	-11.8	127.4	230.0	-41.7
C	-9.9	-7.0	0.1	-14.5	-54.1	-17.7	1.2	-1.0	-35.1	161.8	273.4	50.8
Lower Yuba River												
W	-0.4	-0.9	-1.5	-0.9	-2.0	-6.3	-0.8	-0.7	-0.7	-0.6	-0.6	-0.6
AN	0.0	-1.0	-1.1	-1.2	-1.1	-19.1	-1.0	-54.0	-0.9	-0.9	-0.9	-0.9
BN	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
D	-0.3	-0.8	-0.7	-0.7	-0.7	-19.5	-0.5	0.0	0.0	18.9	6.0	-0.2
C	-0.6	-1.5	-1.5	-1.5	-1.5	-1.5	-0.1	-0.1	-0.1	50.4	0.0	0.0

Year Type	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Bear River at the Feather River												
W	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	34.4	3.4
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	0.0	58.1	0.0	0.0
All	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American River at H Street												
W	14.6	38.0	-36.9	-47.8	-22.3	-2.6	-1.3	8.4	-14.1	2.4	-1.6	2.5
AN	18.9	10.5	0.9	-164.1	-235.7	-34.9	-1.2	-1.3	0.7	26.7	30.5	35.2
BN	9.6	9.5	19.5	-0.4	-63.3	-0.5	-0.4	-0.5	7.6	10.6	-0.3	6.8
D	24.2	9.9	47.1	-53.0	-21.9	-73.7	-114.5	-63.7	-0.9	130.6	80.0	56.1
C	50.1	38.4	30.3	16.9	17.0	25.8	-23.3	19.4	-45.9	195.1	141.3	82.4
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	58.8	32.9	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	127.5	71.4	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	170.0	95.2	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	109.3	61.2	0.0	0.0	0.0	0.0
San Joaquin River at Vernalis												
W	0.0	0.0	0.0	0.0	-41.6	0.0	15.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	32.5	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	43.3	0.0	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	27.9	0.0	0.0	0.0	0.0	0.0

Note: Negative numbers indicate that the Proposed Action would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase river flows.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could change Delta outflows and could result in water quality impacts. Under the Proposed Action, long-term Delta outflows would be similar to the No Action/No Project Alternative. Outflows would generally increase during the transfer period because carriage water would become additional Delta outflow. The most substantial change in flow would occur in August when Delta outflows would increase by an average of 1.8 percent. Delta outflows would decrease slightly (by less than 0.3 percent) during the winter and spring compared to the No Action/No Project Alternative as reservoir storage and groundwater storage refill. These slight changes in flow would not affect water quality in the Delta.

Water transfers could change Delta salinity concentrations, resulting in water quality impacts. Changes in EC in the Delta are largely influenced by 1) increases in Sacramento River inflows which cause decreased EC and 2) increased SWP and CVP exports, which tend to increase EC. Based on water quality modeling results, minor changes in average monthly EC in the Delta occur between the No Action/No Project Alternative and the Proposed Action. Table 3.2-26 shows average monthly EC percent change from the No Action/No Project Alternative for the Proposed Action at the SWP intake to Clifton Court Forebay. Trends at CVP intakes were similar but with smaller magnitudes. Increases in EC are greatest (up to 4.2 percent) in July and August of critical and dry water years. Delta SWP and CVP exports are highest during the summer months of critical and dry water years, which increases EC near the diversion facilities. Decreases are greatest (4.3 percent) during September of critical water years because of Sacramento River flow increases compared to the No Action/No Project Alternative. Additional intake locations show similar trends in average monthly percent change in EC.

Table 3.2-26. Average Monthly Percent Change in EC from the No Action/No Project Alternative to the Proposed Action at SWP intake to Clifton Court Forebay

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.3	-0.2	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.8	-1.0	-0.3	0.1	0.0	-0.5	0.0	0.0	-0.6	0.0	0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.9	-0.9	-0.2	0.1	0.2	0.1	0.2	0.6	0.6	1.2	1.9	-1.6
C	-3.8	-2.2	-1.1	-0.7	-0.1	0.4	0.3	0.6	0.6	4.2	1.0	-4.3

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Chloride calculations were completed to convert values from EC. Bay-Delta standards dictate maximum mean daily chloride levels of 250 mg/L for all intake locations. Modeling results indicate that chloride concentrations are below the 250 mg/L threshold at all export locations.

The modeling efforts estimated X2 locations to determine the movement of salinity throughout the Delta. The "X2" water quality parameter represents the distance (in kilometers [km]) from the Golden Gate to the location of 2 ppt salinity concentration in the Delta. Larger values indicate higher salinity concentrations in the Delta, and smaller values indicate lower salinity concentrations. According to SWRCB criteria (SWRCB 1999), eastward changes in monthly average X2 position (positive values in our analysis) of 1.1 km are not significant in general, and in critically dry years an eastward movement of 3.0 km is not significant. Based on these criteria, all monthly changes in X2 were found to be are insignificant, as all monthly average differences are less than 1.1 km.

Overall, the Proposed Action would not cause any violation of Delta water quality standards; therefore, the impacts to water quality would be less than significant.

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. Reservoir release transfers from Merced ID could be diverted at these diversion facilities on the San Joaquin River or at CVP or SWP Delta pumping facilities. If Merced ID transfer water is diverted at these facilities, the districts could use the water in their districts and transfer their CVP water, or they could move the water through their districts into the Delta-Mendota Canal. Water quality at these diversions in the San Joaquin River is different than the water that is diverted from the Delta into the Delta-Mendota Canal. Banta Carbona ID is downstream of Vernalis, and water quality at Vernalis (Table 3.2-20) is similar to the Banta Carbona ID diversion location. West Stanislaus ID and Patterson ID are upstream of Vernalis, so Table 3.2-19 is more similar to the water quality at these diversion points.

The San Joaquin River has greater EC concentrations than those at the Delta diversion pumps (see Table 3.2-21). If this water travels through the diverting districts to the Delta-Mendota Canal, it has the potential to degrade the water quality of CVP diversions. However, the amount of water would be relatively small compared to the overall flow in the Delta-Mendota Canal. At most, the transfer would result in about 250 cfs entering the Delta-Mendota Canal from all three districts added together. The canal capacity is about 4,600 cfs in the northern portion. While the Delta-Mendota Canal may not be at maximum capacity during dry and critical years, the flows would still be great enough that the increased EC in the water entering the canal would likely not result in a substantive change to EC in the canal. The impacts to water quality in CVP deliveries would be less than significant.

3.2.2.4.2 Buyer Service Area

Transfers water would result in increased irrigation in the Buyer Service Area, which could affect water quality. Under the Proposed Action, surface water supplies in the San Joaquin Valley would increase. If this water were used to irrigate drainage impaired lands, increased irrigation could cause water to accumulate in the shallow root zone and could leach pollutants into the groundwater and potentially drain into the neighboring surface water bodies. Because the Proposed Action would be implemented to meet water needs during a potential shortage, it is likely that most water would be applied to permanent crops or crops planted on prime or important farmlands. As a result, farmers would continue to leave marginal land and drainage impaired lands out of production and use water provided by the Proposed Action for more productive lands.

The amount of transfer water that would be provided is minimal compared to existing applied irrigation water in the area. Further, many farmers in the drainage impaired areas have decreased drain water by improving irrigation efficiency and changing cropping patterns. The small incremental supply within the drainage-impaired service areas would not be sufficient to change drainage patterns or existing water quality, particularly given drainage management, water conservation actions and existing regulatory compliance efforts already implemented in that area. Therefore, the Proposed Action would not result in impacts to water quality in the Buyer Service Area as a result of crop irrigation.

Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts. Table 3.2-27 presents average end-of-month differences in combined SWP and CVP storage at San Luis Reservoir under the Proposed Action compared to the No Action/No Project Alternative. Storage under the Proposed Action would be less than the No Action/No Project Alternative for all months of the year because of decreased CVP and SWP exports associated with streamflow depletion from groundwater substitution transfers. San Luis Reservoir storage could decrease by as much as six percent (of water in storage in the No Action/No Project Alternative) during August of critical water years. Monthly storage changes during most year types would be less than three percent. These small changes in storage are not sufficient to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential storage-related effects on water quality would be less than significant for San Luis Reservoir.

Table 3.2-27. Changes in San Luis Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.4	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.7	-0.4	-0.2	0.2	0.0
AN	-14.3	-16.4	-16.6	-16.6	-10.2	-10.2	-10.2	-10.1	-10.1	-10.4	-10.3	-10.3
BN	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7	-18.7
D	-4.6	-6.1	-6.3	-7.4	-8.4	-8.5	-8.8	-7.1	-7.1	-7.7	-9.2	-13.6
C	-27.3	-31.0	-33.9	-36.2	-36.6	-37.6	-37.9	-28.1	-18.9	-14.5	-11.2	-19.1
All	-10.2	-11.8	-12.5	-13.2	-12.3	-12.5	-12.7	-10.2	-8.2	-7.4	-6.8	-9.2

3.2.2.5 Alternative 3: No Cropland Modifications

3.2.2.5.1 Seller Service Area

Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows. Groundwater substitution transfers would use groundwater for irrigation instead of surface water. Groundwater would mix with surface water in agricultural drainages prior to irrigation return flow reaching the rivers. Constituents of concern that may be present in the groundwater could enter the surface water as a result of mixing with irrigation return flows.

Alternative 3, similar to the Proposed Action, would result in a small amount of increased groundwater pumping compared to the overall surface water use in the Seller Service Area. Any constituents of concern would be greatly diluted when mixed with the existing surface waters applied. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. Section 3.3 provides additional discussion of groundwater quality. Groundwater substitution transfers would result in a less-than-significant impact on water quality.

Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts. Based on modeling efforts, changes in CVP and SWP reservoir storage Alternative 3 and the No Action/No Project Alternative are shown in Table 3.2-28. Changes in reservoir storage are primarily influenced by storing transfer water in April, May, and June of dry and critical years (until the Delta pumps can convey the water to the buyers) and streamflow depletion from groundwater substitution transfers.

Table 3.2-28. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Alternative 3 (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	-0.6	-0.6	-0.4	-0.1	0.0	0.0	0.0	-0.2	-0.3	-0.4	-0.5	-0.6
AN	-4.1	-4.1	-3.0	-2.4	-2.0	-2.0	-2.0	-0.1	-0.3	-0.5	-0.6	-0.8
BN	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.2	-1.4	-1.4	-1.6	-1.6
D	-1.9	-1.7	-1.7	-1.6	-1.6	-1.6	4.9	11.5	30.9	18.7	-2.9	-3.1
C	-4.1	-4.3	-4.3	-4.3	-4.6	-4.6	-2.0	11.9	34.6	0.0	-6.2	-6.2
Lake Oroville												
W	-3.1	-3.0	-2.2	-1.8	0.0	0.0	0.0	0.0	-0.2	-0.4	-1.0	-1.5
AN	-10.9	-10.9	-11.0	-11.0	-9.2	-0.7	-0.7	-0.7	-0.2	-5.9	-3.8	-2.3
BN	-2.5	-3.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.2	-4.5	-5.1	-5.5
D	-3.8	-3.8	-4.0	-4.0	-4.0	-4.0	-3.7	2.9	3.9	1.0	-8.2	-4.0
C	-10.0	-10.6	-11.6	-11.6	-11.8	-12.0	-12.1	-11.3	-8.4	-10.4	-16.1	-16.2
Folsom Reservoir												
W	1.5	-0.8	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.3	-0.7
AN	-1.8	-2.4	-2.5	-0.9	0.0	0.0	0.0	0.0	-0.1	-1.0	-2.0	-3.3
BN	-1.8	-2.3	-3.5	-3.5	0.0	0.0	0.0	0.0	-0.5	-1.2	-1.2	-1.6
D	2.7	2.1	-0.8	-0.8	-1.7	-0.7	-0.7	7.7	12.2	10.5	11.2	12.9
C	6.7	4.7	3.2	2.1	1.1	-0.6	0.8	5.1	12.7	8.7	7.4	9.6

Note: Negative numbers indicate that Alternative 3 would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

During dry and critical years, Shasta and Folsom reservoirs show an increase in reservoir storage during spring months. Lake Oroville shows a similar change in dry years. These changes are caused by the CVP and SWP storing water, when possible, until the transfer period for the Delta pumps becomes available in July. The transfer water is released from July through September. This type of operation would not be possible in all transfer years because of downstream temperature and flow requirements for fish.

Folsom Reservoir shows increased reservoir storage for several additional months during dry and critical years because of upstream stored reservoir water transfers. Placer County Water Agency could transfer water through reservoir release, and this water would be stored in Folsom Reservoir until the buyers can convey this water to the end user. Water from Placer County Water Agency may go to East Bay MUD, which could accept transfer water at its Freeport Diversion over a longer period than the CVP and SWP Delta export pumps. Therefore, water storage in Folsom could be elevated while water is stored and slowly released to East Bay MUD.

Reservoir storage during other times of the year (not April through September of a transfer year) is decreased because of streamflow depletion from groundwater substitution transfers. Refilling groundwater storage after a groundwater substitution transfer would decrease flows in neighboring streams. The CVP and SWP would have less water in key waterways (including the Sacramento, Feather, and American rivers). The CVP and SWP would either reduce Delta exports or release additional water from storage to account for those streamflow reductions. These changes would reduce water in storage; however, these reductions are small and less than one percent of the reservoir volumes.

CVP and SWP reservoirs within the Seller Service Area would experience only small changes in storage, which would not be of sufficient magnitude and frequency to result in substantive changes to water quality. Any small changes to water quality would not adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential effects on reservoir water quality would be less than significant.

Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts. Alternative 3 includes the same reservoir release transfers as the Proposed Action; therefore, the changes in reservoir storage in these facilities would be the same as those described above for the Proposed Action. As described in the existing conditions, water in these facilities is of generally good quality; therefore, changes to reservoir storage in non-Project reservoirs would have less than significant impacts on water quality.

Water transfers could change river flow rates in the Seller Service Area and could affect water quality. Differences in river flows between Alternative 3 and the No Project/No Action Alternative are shown in Table 3.2-29. Generally, the changes in river flows are very similar to those shown in the Proposed Action, and the reasons for the changes are similar. The peak changes during the transfer period are less in Alternative 3 because it has fewer overall transfers because cropland idling and crop shifting transfers are not included.

Table 3.2-29. Changes in River Flows between the No Action/No Project Alternative and Alternative 3 (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Freeport												
W	-18.8	-12.5	-99.8	-123.8	-94.9	-41.5	-30.6	-17.2	-31.9	-11.8	-9.0	-5.0
AN	-12.0	-40.9	-99.2	-401.2	-358.1	-259.7	-61.4	-131.4	-47.9	133.6	9.2	7.8
BN	0.0	0.0	0.0	-37.5	-94.3	-26.3	-21.6	-15.7	0.0	0.0	0.0	0.0
D	-36.4	-53.1	-42.7	-124.3	-66.0	-194.4	-156.9	-42.1	-54.3	711.8	925.9	160.8
C	-72.7	-61.7	-70.5	-98.7	-178.5	-146.6	-55.6	-50.5	-44.6	1,436.7	886.8	375.5
Sacramento River at Wilkins Slough												
W	-8.6	-5.0	-6.8	-9.5	-4.6	-3.3	-3.5	-2.3	-1.4	-2.3	-1.3	-1.7
AN	-8.3	-8.1	-24.8	-18.7	-15.9	-6.4	-7.0	-38.2	-2.5	7.4	7.3	7.4
BN	-4.5	-3.6	-3.4	-3.4	-3.3	-3.1	-4.1	0.0	0.0	-3.3	0.0	-3.0
D	-10.9	-13.5	-9.6	-9.8	-7.1	-6.6	-52.9	-33.4	-248.8	296.3	449.4	75.7
C	-21.4	-15.6	-14.7	-13.6	-8.6	-14.7	-0.1	-119.2	-273.6	715.6	251.9	102.3
Feather River below Thermalito Afterbay												
W	6.6	-2.8	-12.1	-6.6	-32.7	0.0	0.0	0.0	3.0	4.0	9.4	9.0
AN	27.6	0.9	1.5	0.0	-31.7	-138.9	0.0	0.0	-8.0	92.9	-34.4	-25.1
BN	8.2	8.1	16.2	0.0	0.0	0.0	0.0	0.0	3.8	3.7	11.0	5.8
D	8.7	1.4	3.2	0.0	0.0	0.0	0.0	-102.6	-12.1	48.0	149.1	-70.0
C	9.2	10.2	15.0	0.0	4.6	1.9	9.4	-4.7	-40.3	32.3	93.8	0.8
Lower Feather River												
W	-0.1	-9.7	-19.5	-20.3	-40.2	-11.4	-5.6	-5.2	-1.9	-0.7	5.1	4.8
AN	15.3	-11.1	-9.1	-52.2	-43.0	-166.6	-9.0	-61.4	-15.8	85.8	-41.1	-31.6
BN	4.4	4.4	12.7	-2.9	-3.0	-3.5	-3.6	-3.0	1.2	1.2	8.6	3.5
D	-1.8	-8.4	-5.6	-8.1	-7.8	-26.4	-1.7	-101.2	-11.8	105.1	222.2	-46.7
C	-9.9	-7.0	0.1	-14.5	-54.1	-17.7	1.2	-1.0	-33.3	203.3	182.9	42.1
Lower Yuba River												
W	-0.4	-0.9	-1.5	-0.9	-2.0	-6.3	-0.8	-0.7	-0.7	-0.6	-0.6	-0.6
AN	0.0	-1.0	-1.1	-1.2	-1.1	-19.1	-1.0	-54.0	-0.9	-0.9	-0.9	-0.9
BN	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
D	-0.3	-0.8	-0.7	-0.7	-0.7	-19.5	-0.5	0.0	0.0	18.9	6.0	-0.2
C	-0.6	-1.5	-1.5	-1.5	-1.5	-1.5	-0.1	-0.1	-0.1	43.7	6.7	0.0

Year Type	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Bear River at the Feather River												
W	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	34.4	3.4
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	0.0	48.8	9.2	0.0
American River at H Street												
W	14.6	38.0	-36.9	-47.8	-22.3	-2.6	-1.3	8.4	-14.1	2.4	-1.6	2.5
AN	18.9	10.5	0.9	-164.1	-235.7	-34.9	-1.2	-1.3	0.7	26.7	30.5	35.2
BN	9.6	9.5	19.5	-0.4	-63.3	-0.5	-0.4	-0.5	7.6	10.6	-0.3	6.8
D	24.2	9.9	47.1	-53.0	-21.9	-73.7	-114.5	-63.7	-0.9	130.6	80.0	56.1
C	50.1	38.4	30.3	16.9	17.0	25.8	-23.3	20.5	-44.3	191.3	142.5	82.4
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	58.8	32.9	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	127.5	71.4	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	170.0	95.2	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	109.3	61.2	0.0	0.0	0.0	0.0
San Joaquin River at Vernalis												
W	0.0	0.0	0.0	0.0	-41.6	0.0	15.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	32.5	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	43.3	0.0	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	27.9	0.0	0.0	0.0	0.0	0.0

Note: Negative numbers indicate that Alternative 3 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase river flows.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

The small changes expected in river flow rates in the seller's service area under Alternative 3 would not be of sufficient magnitude or frequency to result in adverse effects to designated beneficial uses, violate existing water quality standards, or substantial degrade water quality. Consequently, potential flow-related effects on water quality would be less than significant.

Water transfers could change flow rates in the Delta and could result in water quality impacts. Under Alternative 3, long-term Delta outflows would be similar to the No Action/No Project Alternative. The most substantial change would occur in August when Delta outflows would increase by an average of 1.4 percent. Outflows would decrease slightly by approximately 0.1-0.3 percent during the winter and spring when water demands are lower in the region. This slight change in Delta region outflows would have a less than significant effect on water quality.

Water transfers could change Delta salinity and could result in water quality impacts. Modeled impacts to EC, chloride concentrations, and X2 indicate that under Alternative 3, water quality impacts in the Delta would be less than those under the Proposed Action. As a result, impacts to water quality in the Delta region under Alternative 3 are less than significant.

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. Water quality impacts to the Delta-Mendota Canal would be the same as those described above for the Proposed Action. While the new water introduced to the Delta-Mendota Canal may have higher EC concentrations, the flow would be much smaller than the flows in the Delta-Mendota Canal. Therefore, the increased EC in the water entering the canal would likely not result in a substantive change to EC in the canal. The impacts to water quality in CVP deliveries would be less than significant.

3.2.2.5.2 Buyer Service Area

Transfer water would result in increased irrigation in the Buyer Service Area, which could affect water quality. Under Alternative 3, surface water supplies in the San Joaquin Valley would increase. Some of this water may be used to irrigate drainage impaired lands, but it is much more likely to be used to support permanent crops or high quality farmland. This impact would be the same as described for the Proposed Action. Therefore, Alternative 3 would have less than significant impacts to water quality in the Buyer Service Area as a result of crop irrigation.

Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts. Under Alternative 3, storage would be the same as that under the Proposed Action. These small changes in storage are not sufficient enough to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential storage-related effects on water quality would be less than significant for San Luis Reservoir.

3.2.2.6 Alternative 4: No Groundwater Substitution

3.2.2.6.1 Seller Service Area

Cropland idling transfers could result in increased deposition of sediment on water bodies. The effects of cropland idling transfers under Alternative 4 would be the same as described under the Proposed Action. Cropland idling would not result in substantial soil erosion or sediment deposition into waterways. Impacts to water quality would be less than significant.

Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff. The effects of cropland idling/crop shifting under Alternative 4 would be the same as described under the Proposed Action. Overall, the effect on water quality with respect to leaching and surface water runoff would be less-than-significant.

Cropland idling/shifting transfers could change the quantity of organic carbon in waterways. The effects of cropland idling/crop shifting under Alternative 4 would be the same as described for the Proposed Action. Cropland idling/shifting under Alternative 4 would not be expected to increase organic carbon in waterways, and therefore this impact would be considered less than significant.

Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts. Based on modeling efforts, changes in CVP and SWP reservoir storage Alternative 4 and the No Action/No Project Alternative are shown in Table 3.2-30. Changes in reservoir storage are primarily influenced by storing transfer water in April, May, and June of dry and critical years (until the Delta pumps can convey the water to the buyers). No impacts to Shasta Reservoir or Lake Oroville are predicted during other time periods. Folsom Reservoir is downstream of French Meadows and Hell Hole reservoirs, which has small effects on storage to re-regulate releases and later refill the reservoirs.

The small changes in average monthly storage volumes in reservoirs within the Seller Service Area would not be of sufficient magnitude and frequency to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential storage-related effects on water quality would be less than significant.

Table 3.2-30. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Alternative 4 (in 1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	17.6	8.8	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	46.1	7.4	0.0	0.0
Lake Oroville												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.3	-0.8	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.9	9.0	-4.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.6	6.4	0.0	0.0
Folsom Reservoir												
W	3.5	1.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
AN	-0.3	-0.5	-0.7	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
BN	0.2	0.3	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4.2	3.5	-0.1	-0.1	-1.0	0.0	0.0	5.3	8.9	9.5	11.7	13.5
C	8.5	7.2	5.7	4.6	3.6	1.9	0.3	3.6	9.1	8.2	10.0	12.1

Note: Negative numbers indicate that Alternative 4 would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir storage.

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts. Alternative 4 includes the same reservoir release transfers as the Proposed Action; therefore, the changes in reservoir storage in these facilities would be the same as those described above for the Proposed Action. As described in the existing conditions, water in these facilities is of generally good quality; therefore, changes to reservoir storage in non-Project reservoirs would have less than significant impacts on water quality.

Water transfers under Alternative 4 could change river flow rates in the Seller Service Area and could affect water quality. Changes in river flow rates between Alternative 4 and the No Action/No Project Alternative are shown in Table 3.2-31.

Table 3.2-31. Changes in River Flows between the No Action/No Project Alternative and Alternative 4 (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Freeport												
W	0.0	31.4	-33.5	-24.9	-20.7	-5.0	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	0.0	0.0	0.0	-172.8	-233.9	-50.0	0.3	-33.5	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	47.2	-52.2	-21.2	-89.0	-113.6	-6.1	-9.2	346.4	587.6	68.1
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	66.2	-16.6	1,293.2	804.6	369.5
Sacramento River at Wilkins Slough												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-75.3	280.6	280.6	89.1
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-32.1	-109.6	1,025.0	516.7	255.9
Feather River below Thermalito Afterbay												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.8	0.0	-98.5	219.6	-75.6
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-13.2	-62.2	104.6	0.0
Lower Feather River												
W	0.0	0.0	0.0	-6.3	0.0	-3.9	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	-16.8	0.0	-33.6	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	-16.8	0.0	-24.8	0.0	-28.8	237.2	-66.0
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	-13.2	65.6	123.8	12.4
Lower Yuba River												
W	0.0	0.0	0.0	0.0	0.0	-3.9	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-16.8	0.0	-33.6	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	-16.8	0.0	0.0	0.0	16.8	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	-7.4	0.0	-5.9	0.0	13.3	0.0	0.0

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bear River at the Feather River												
W	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.9	2.7	0.0
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	0.0	58.1	0.0	0.0
American River at H Street												
W	9.7	36.2	-28.6	-18.6	-20.7	-1.1	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	10.4	4.4	1.7	-132.1	-233.9	-33.2	0.3	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	20.8	11.7	57.6	-52.2	-21.2	-72.2	-113.6	-24.8	0.0	56.1	33.9	32.2
C	36.5	28.6	31.5	18.2	18.3	26.8	26.8	38.6	-7.4	98.0	59.6	55.8
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.6	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0
San Joaquin River at Vernalis												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.6	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0

Note: Negative numbers indicate that Alternative 4 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase river flows.

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Under Alternative 4, long-term average flow rates in the Sacramento River at Freeport would be up to 0.2 percent lower than flow rates under existing conditions during October through April. Long-term average flow rates at Freeport would be, at most, 1.8 percent higher than flow rates under the No Action/No Project Alternative during the summer months of May through September. Increases in flow during the summer months would be the result of increased reservoir releases. These increases in flow, however, would be slightly less than those resulting from the Proposed Action, as the Proposed Action would include additional flows from groundwater substitution. Sacramento River flows at Wilkins Slough show a similar trend.

Long-term average changes flow rates in the Feather River below Thermalito Afterbay and in the Lower Feather River would be less than under the Proposed Action. Long-term average monthly changes in flow rates in the lower American River at H Street would be less than under the Proposed Action due to the lack of groundwater substitution.

The effects of water transfers under Alternative 4 in the Lower Yuba, Bear, and Merced rivers are caused by reservoir release transfers, which would be the same as those described in the Proposed Action. The changes in flow would be similar to those described for the Proposed Action.

Overall, any changes in river flows under Alternative 4 would not be of sufficient magnitude or frequency to result in adverse effects to designated beneficial uses, violate existing water quality standards, or substantial degrade water quality. Consequently, potential flow-related effects on water quality in the rivers within the Seller Service Area would be less than significant.

Water transfers could change flows to the Delta and could result in water quality impacts. Under Alternative 4, the maximum changes in long-term Delta outflows are less than one percent and this would occur during the summer months (July through August) when transfers are moving through the Delta. Outflows would decrease slightly by approximately 0.1 percent during the winter and spring when water demands are lower in the region. This slight change in Delta region outflows would have a less than significant effect on water quality.

Water transfers could change Delta salinity and could result in water quality impacts. Modeled impacts to EC, chloride concentrations, and X2 indicate that under Alternative 4, water quality impacts in the Delta would be less than those under the Proposed Action. As a result, impacts to water quality in the Delta region under Alternative 4 are less than significant.

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. Water quality impacts to the Delta-Mendota Canal would be the same as those described above for the Proposed Action. While the new water introduced to the Delta-Mendota Canal may have higher EC concentrations, the flow would be much smaller than the flows in the Delta-Mendota Canal. Therefore, the increased EC in the water entering the canal would likely not result in a substantive change to EC in the canal. The impacts to water quality in CVP deliveries would be less than significant.

3.2.2.6.2 Buyer Service Area

Transfer water would result in increased irrigation in the Buyer Service Area, which could affect water quality. Under Alternative 4, surface water supplies in the San Joaquin Valley would increase. Some of this water may be used to irrigate drainage impaired lands, but it is much more likely to be used to support permanent crops or high quality farmland. This impact would be the same as described for the Proposed Action. Therefore, Alternative 4 would have less than significant impacts to water quality in the Buyer Service Area as a result of crop irrigation.

Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts. Under Alternative 4, storage would be the same as that under the Proposed Action. These small changes in storage are not sufficient enough to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential storage-related effects on water quality would be less than significant for San Luis Reservoir.

3.2.3 Comparative Analysis of Alternatives

Table 3.2-32 summarizes the potential water quality effects of each of the action alternatives and the No Action/No Project Alternative. The following text supplements the table by comparing the effects of the action alternatives and No Action/No Project Alternative.

Table 3.2-32. Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Changes in reservoir storage and river flows would not affect water quality in reservoirs within the Seller Service Area.	1	NCFEC	None	NCFEC
Changes in reservoir storage would not affect water quality in San Luis Reservoir.	1	NCFEC	None	NCFEC
Cropland idling transfers could result in increased deposition of sediment on water bodies.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the quantity of organic carbon in waterways.	2, 4	LTS	None	LTS
Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows.	2, 3	LTS	None	LTS
Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change river flow rates in the Seller Service Area and could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta outflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Water transfers could change Delta salinity and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal.	2, 3, 4	LTS	None	LTS
Use of transfer water in the Buyer Service Area could result in increased irrigation on drainage impaired lands in the Buyer Service Area which could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts.	2, 3, 4	LTS	None	LTS

3.2.3.1 No Action/No Project Alternative

Under the No Action/No Project Alternative, there would be no impacts from water transfers and no changes in river flows or reservoir storage; therefore, there would be no water quality impacts.

3.2.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

The Proposed Action would result in the most water being transferred overall; however the impacts on river flows and reservoir storage are minimal. There would not be any significant water quality effects from the Proposed Action.

3.2.3.3 Alternative 3: No Cropland Modification

Alternative 3 would result in slightly less overall water to transfer than the Proposed Action. The effects on water quality would be similar to the Proposed Action, but less in some reservoirs and river systems. Overall, there would not be any significant water quality impacts.

3.2.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would result in slightly less overall water to transfer than the Proposed Action. The effects on water quality would be similar to the Proposed Action, but less in some reservoirs and river systems. Overall, there would not be any significant water quality impacts.

3.2.4 Cumulative Effects

The timeframe for the water quality cumulative effects analysis extends from 2015 through 2024, a ten year period. The projects considered for the water quality cumulative condition are the SWP water transfers, the CVP M&I Water Shortage Policy (WSP), the Lower Yuba River Accord, and the San Joaquin River Restoration Program, described in more detail in Section 4.3. SWP transfers and the Lower Yuba River Accord could involve transfers in the Seller Service Area and, therefore, could affect water quality resources. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions. The San Joaquin River Restoration Program could increase flows and affect water quality in the San Joaquin River system.

In addition to the efforts described in Section 4.3, the Central Valley Salinity Alternatives for Long-Term Sustainability initiative (CV-SALTS) could affect water quality in the Central Valley. CV-SALTS is a stakeholder-driven effort to manage salinity and nitrates in the Central Valley, and it includes efforts to implement the TMDL for salinity.

The following sections describe potential water quality cumulative effects for each of the proposed alternatives.

3.2.4.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.2.4.3.3 Seller Service Area

Cropland idling transfers could result in increased deposition of sediment on water bodies. A combination of farming practices and soil types in the Seller Service Area reduce the potential of long-term water transfers to erode sediments from idled fields. SWP transfers could also include cropland idling of 86,930 AF, but these transfers would be on fields with similar crops (rice) and soil types. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to water quality.

Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff. Cropland idling/crop shifting would change irrigation practices and pesticide application. The changes in the quantity of irrigation water applied to the land could alter the concentration of pollutants associated with leaching and runoff, resulting in less runoff of potential constituents. SWP transfers could have similar effects as those described above for the Proposed Action. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact with respect to leaching and surface water runoff.

Cropland idling/shifting transfers could change the quantity of organic carbon in waterways. Both cropland idling and crop shifting would decrease agricultural runoff entering waterways, which could reduce one source of organic carbon. SWP transfers would have a similar effect. The overall reduction in agricultural runoff may not actually cause a quantifiable decrease in organic carbon because there are other sources and a variety of factors that contribute to organic carbon levels in waterways. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to organic carbon.

Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows. Groundwater substitution transfers would use groundwater for irrigation instead of surface water, which has the potential to change the constituents in agricultural runoff. SWP transfers through groundwater substitution (approximately 6,800 AF) could have the same effect. The amount of groundwater substituted for surface water in the cumulative condition would be relatively small compared to the amount of surface water used to irrigate agricultural fields in the seller areas. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to water quality associated with groundwater contributions to agricultural runoff.

Changes in CVP and SWP operations could affect reservoir storage and river flows. Long-term water transfers would increase reservoir storage April through September and decrease storage at other times of year. They would also increase river flows from July through September and decrease river flows at other times. Other cumulative programs could also affect CVP and SWP operations. SWP transfers would have similar operations, and would change reservoir storage and river flows at the same time as long-term water transfers. The Yuba Accord would increase river flows during potential transfers, which could also have similar timing. The M&I WSP would have minor effects to CVP operations in Folsom Reservoir (and negligible effects to other parts of the CVP system). These overall changes to the operations of reservoirs would still represent a very small change based on the size of the reservoirs and the river flows. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to water quality of reservoirs and rivers.

Changes in Delta outflows could result in water quality impacts. As described in the existing conditions, the Delta has number water quality constituents of concern. Past and current projects have affected Delta outflows and degraded water quality in the Delta. Several efforts, including CV-SALTS and other SWRCB actions, are working to improve water quality in the Delta in the future. SWP transfers and the Yuba Accord would have similar effects. These effects on Delta outflow would generally be small, but would be increasing outflow during dry periods of the year. These programs could also decrease Delta outflow during other times of year, but these times are generally during wet parts of the year when the decrease would not affect water quality. Because of existing degraded water quality conditions in the Delta, the combination of cumulative actions is considered to have significant impacts on water quality in the Delta. Long-term water transfers would increase Delta outflows slightly during the transfer period because carriage water would become additional Delta outflow, which would not adversely affect Delta water quality. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative water quality impacts would not be cumulatively considerable.

Changes in Delta inflows, outflows, and exports could affect Delta salinity. As discussed in existing conditions, salinity is a concern in the Delta because it can adversely affect municipal, industrial, agricultural, and recreational uses. Numerous projects and operations, including CVP and SWP operations, urban discharges, and agricultural discharge affect salinity in the Delta. SWP transfers, and the Yuba Accord would increase Sacramento River Delta inflow and increase Delta exports; these two actions have opposite effects on Delta salinity. Other programs, such as CV-SALTS, are working to improve water quality in the tributaries to the Delta. These programs would decrease salinity in Delta inflow, which would improve conditions within the Delta in the future. While the end results of these programs may not achieve the desired benefits, it is likely that gradual improvements would occur. Because of existing salinity concerns in the Delta, the combination of cumulative actions is considered to have significant impacts on salinity in the Delta. As shown in the water quality modeling, the Proposed Action would not substantially change the position of X2. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative salinity impacts in the Delta would not be cumulatively considerable.

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. If Merced ID transfer water is diverted at these facilities, the districts could use the water in their districts and transfer their CVP water, or they could move the water through their districts into the Delta-Mendota Canal. Lake McClure is listed as impaired for mercury due to resource extraction, but otherwise, water quality is generally good. As discussed in existing conditions, water quality in the San

Joaquin River is degraded from agricultural discharges, runoff, and wastewater discharges. The San Joaquin River has greater EC concentrations than those at the Delta diversion pumps. Some programs could improve water quality in the San Joaquin River in the future. CV-SALTS is working to reduce salinity in the river and its tributaries. Additionally, the San Joaquin River Restoration Program would increase flows from the upstream watershed into the San Joaquin River, which could provide high quality inflow to dilute constituents of concern in the system. Based on past and current projects, the combination of cumulative actions result in degraded water quality in the San Joaquin River. While the new water introduced to the Delta-Mendota Canal may have higher EC concentrations, the flow from the San Joaquin River into the Delta-Mendota Canal would be much smaller than the flows in the canal. Therefore, the cumulative impacts to water quality in CVP deliveries from San Joaquin River salinity would be less than significant.

Increased irrigation in the Buyer Service Area could affect water quality. Long-term water transfers could increase water supplies in the Central Valley and San Francisco Bay area. SWP transfers are generally to SWP contractors in southern California, but may also provide additional supplies to some of the same buyers. The Yuba Accord can also increase water supplies to these areas. The M&I WSP may result in decreases to water supplies for agricultural CVP contractors in the Central Valley.

Increased surface water supplies could be used to irrigate drainage impaired land. Increased irrigation could cause water to accumulate in the shallow root zone and could leach pollutants into the groundwater and potentially drain into the neighboring surface water bodies. Because of the severe supply limitations in the agricultural areas in the Buyer Service Area, increased supplies would likely be used for permanent crops or prime or important farmlands. As a result, farmers would continue to leave marginal land and drainage impaired lands out of production.

The amount of additional water supplies in the cumulative condition is minimal compared to existing applied irrigation water in the area. Therefore, the combination of cumulative actions is considered to have a less than significant impact on water quality in the Buyer Service Area as a result of crop irrigation.

3.2.4.2 Alternative 3: No Cropland Modification

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

3.2.4.3 Alternative 4: No Groundwater Substitution

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

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Section 3.3
Groundwater Resources

This section presents the existing conditions of groundwater resources within the area of analysis and discusses potential effects of the proposed alternatives on groundwater levels, land subsidence, and groundwater quality.

The descriptions and analyses presented in this section focus primarily on the effects of groundwater substitution transfers and cropland idling transfers on groundwater resources. Other transfer methods discussed in Chapter 2 (stored reservoir releases, crop shifting, and conservation transfers) would not adversely affect groundwater resources in the area of analysis. Several other sections analyze how groundwater-related changes could affect other resources, including:

- Section 3.1, Water Supply, analyzes how changes in groundwater levels have the potential to interact with surface water and potential effects to surface water supplies;
- Section 3.7, Fisheries, assesses how changes in groundwater/surface water interaction could affect aquatic resources;
- Section 3.8, Vegetation and Wildlife, determines if groundwater level changes could reduce water in the root zone and affect terrestrial vegetation; and
- Section 3.10, Regional Economics, analyzes changes in pumping costs associated with declining groundwater levels.

3.3.1 Affected Environment/Existing Conditions

This section presents the area of analysis (Section 3.3.1.1), describes the regulatory setting pertaining to groundwater resources in the area of analysis (Section 3.3.1.2), and describes the existing hydrologic and groundwater characteristics in the area of analysis (Sections 3.3.1.3).

3.3.1.1 Area of Analysis

The area of analysis extends from Shasta County in the northern portion of the Sacramento Valley to Kings County in the southern portion of the San Joaquin Valley and extends as far west as Santa Clara County. The area of analysis consists of the following groundwater basins and subbasins:

- Redding Area Groundwater Basin: Anderson subbasin
- Sacramento Valley Groundwater Basin: Colusa subbasin, West Butte subbasin, Sutter subbasin, Yolo subbasin, Solano subbasin, North and South American subbasins
- San Joaquin Valley Groundwater Basin: Merced subbasin and Westside subbasin
- Santa Clara Valley Groundwater Basin: Santa Clara subbasin
- Gilroy-Hollister Valley Groundwater Basin: Llagas subbasin

Figure 3.3-1 shows the area of analysis and the groundwater basins. The groundwater area of analysis is divided into Seller Service Area and Buyer Service Area.

The Seller Service Area for this resource section includes water districts that have groundwater pumping capabilities and have expressed an interest in groundwater substitution transfers. Groundwater substitution transfers are made by the selling agencies (listed in Table 2-5) that forego their surface water supplies and pump an equivalent amount of groundwater within the Central Valley groundwater basins.

The Buyer Service Area represents water districts that have expressed interest in transfers for purposes of this Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Districts interested in receiving transfers include East Bay Municipal Utility District (MUD), Contra Costa Water District (WD), and Participating Members of the San Luis & Delta-Mendota Water Authority (SLDMWA). See Table 2-6 for a detailed list of interested buyers.

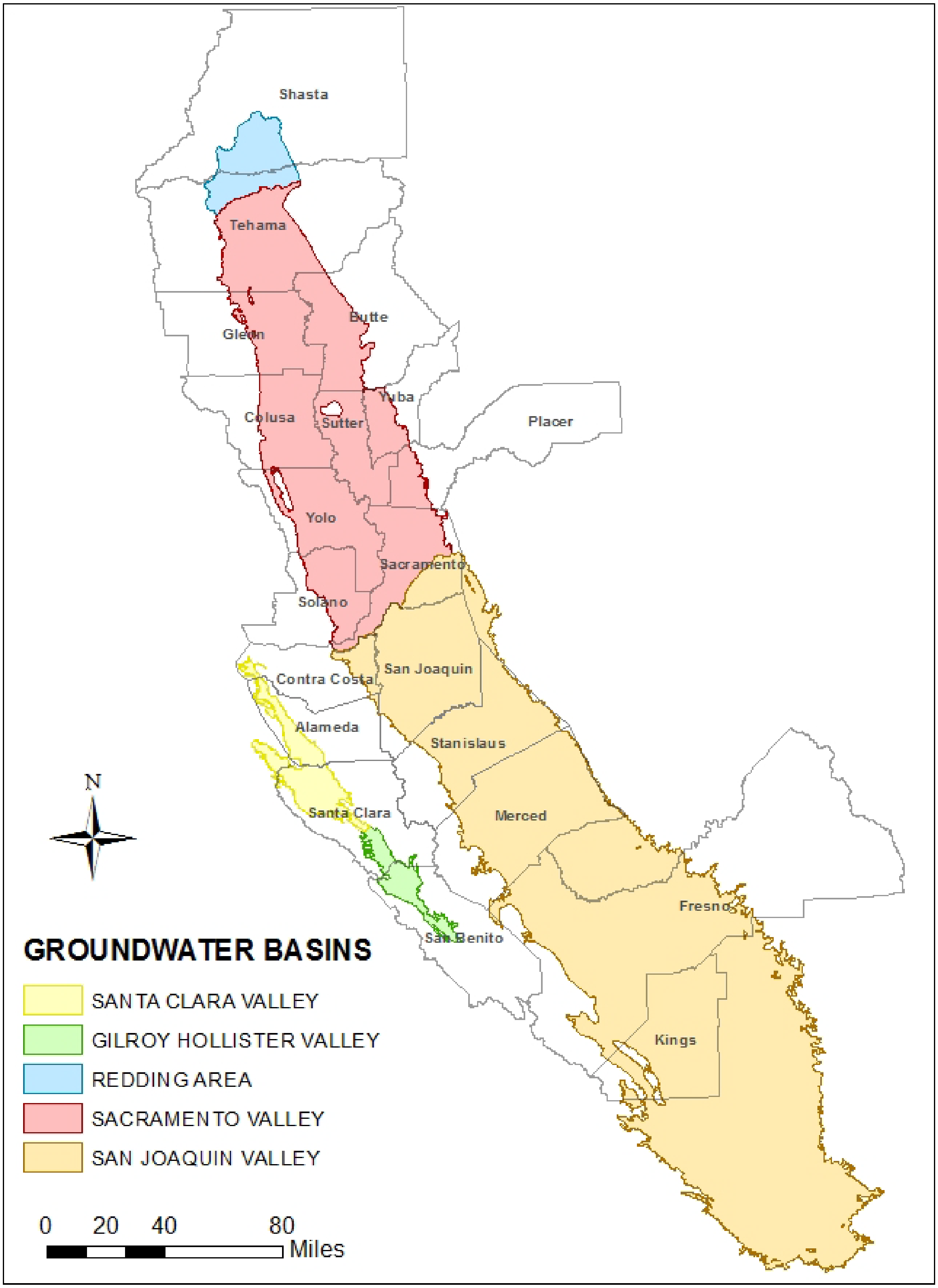

Figure 3.3-1. Groundwater Resources Area of Analysis

3.3.1.2 Regulatory Setting

All willing buying and selling agencies participating in this program will have to comply with applicable regulations: State regulations; Central Valley Project (CVP) and State Water Project (SWP) contractual requirements; and local regulations, as described below.

3.3.1.2.1 Federal Regulation

Reclamation approves water transfers consistent with provisions of the Central Valley Project Improvement Act (CVPIA) and State law that protect against injury to other legal users of water. According to the CVPIA Section 3405, the following principles must be satisfied for any transfer:

- Transfer may not violate the provisions of Federal or state law;
- Transfer may not cause significant adverse effects on Reclamation's ability to deliver CVP water to its contractors or other legal user;
- Transfer will be limited to water that would be consumptively used or irretrievably lost to beneficial use;
- Transfers cannot exceed the average annual quantity of water under contract actually delivered; and
- Transfer will not adversely affect water supplies for fish and wildlife purposes.

Reclamation will not approve a water transfer if these basic principles are not satisfied and will issue its decision regarding potential CVP transfers in coordination with the U.S. Fish and Wildlife Service, contingent upon the evaluation of impacts on fish and wildlife.

3.3.1.2.2 State Regulation

Groundwater use is subject to limited statewide regulation; however, all water use in California is subject to constitutional provisions that prohibit waste and unreasonable use of water (State Water Resources Control Board [SWRCB] 1999). In general, groundwater and groundwater-related transfers are subject to a number of provisions in the California Water Code (Water Code). Some of these provisions are listed below:

Water Code (Section 1745.10)

Section 1745.10 of the Water Code requires that for water transfers pursuant to Sections 1725[1] and 1735[2], the transferred water may not be replaced with groundwater unless the following criteria are met (SWRCB 1999):

- The transfer is consistent with applicable Groundwater Management Plans (GMPs); or
- The transferring water supplier approves the transfer and, in the absence of a GMP, determines that the transfer will not create, or contribute to, conditions of long-term overdraft in the groundwater basin.

Water Code (Section 1220)

Section 1220 of the Water Code regulates the direct export of groundwater from the combined Sacramento and Delta-Central Sierra Basins. It states that groundwater cannot be exported from these basins unless pumping complies with a GMP, adopted by the county board of supervisors in collaboration with affected water districts, and approved by a vote from the counties that lie within the basin. This excludes water seepage into groundwater from water supply project or export facilities, which may be returned to the facilities. In certain cases, the county board of supervisors may select a county water agency to represent the board.

In addition to these requirements, state well standards and local ordinances govern well placement, and the Water Code requires submission of well completion reports. Any groundwater substitution transfers would be subject to these regulations, as well as other applicable local regulations and ordinances.

Water Code (Section 1810) “no injury” provisions

Several provisions of the Water Code (including Sections 1702, 1706, 1725, 1735, and 1810, among others) provide that transfers cannot cause “injury to any legal user of the water involved.” Both surface and groundwater users are protected by these provisions as long as they are legal users of water.

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[1] Section 1725 of the Water Code pertains to short-term/temporary transfers of water under post 1914 water rights that involve the amount of water that would have been consumptively used or stored by the transferee in the absence of the change or transfer. Such changes or transfers are exempt from CEQA, but require findings of “no injury to other legal users” and “no unreasonable effects on fish and wildlife.”

[2] Section 1735 of the Water Code pertains to long-term transfers of water or water rights involving a change of point of diversion, place of use, or purpose of use. A transfer is considered long-term if it exceeds a period of one year.

Water Code (Section 10750) or Assembly Bill (AB) 3030

AB 3030, commonly referred to as the Groundwater Management Act, permits local agencies to develop GMPs that cover certain aspects of management. Subsequent legislation has amended this chapter to make the adoption of a management program mandatory if an agency is to receive public funding for groundwater projects, creating an incentive for the development and implementation of plans.

Water Code (Section 10753.7) or Senate Bill (SB) 1938

SB 1938, requires local agencies seeking State funds for groundwater construction or groundwater quality projects to have the following: (1) a developed and implemented GMP that includes basin management objectives[3] (BMOs) and addresses the monitoring and management of groundwater levels, groundwater quality degradation, inelastic land subsidence, and surface water/ groundwater interaction; (2) a plan addressing cooperation and working relationships with other public entities; (3) a map showing the groundwater subbasin the project is in, neighboring local agencies, and the area subject to the GMP; (4) protocols for the monitoring of groundwater levels, groundwater quality, inelastic land subsidence, and groundwater/surface water interaction; and (5) GMPs with the components listed above for local agencies outside the groundwater subbasins delineated by the Department of Water Resources' (DWR) California's Groundwater Bulletin 118 (Bulletin 118), published in 2003 (DWR 2003).

Water Code (Section 10920-10936 and 12924) or SB X7 6

SB X7 6, established a voluntary statewide groundwater monitoring program and requires that groundwater data collected be made readily available to the public. The bill requires DWR to: (1) develop a statewide groundwater level monitoring program to track seasonal and long-term trends in groundwater elevation; (2) conduct an investigation of the state's groundwater basins delineated by Bulletin 118 and report its findings to the Governor and Legislature no later than January 1, 2012 and thereafter in years ending in five or zero; and (3) work cooperatively with local Monitoring Entities to regularly and systematically monitor groundwater elevations to demonstrate seasonal and long-term trends. AB 1152, Amendment to Water Code Sections 10927, 10932 and 10933, allows local Monitoring Entities to propose alternate monitoring techniques for basins meeting certain conditions and requires submittal of a monitoring plan to DWR for evaluation.

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[3] BMOs are management tools that define the acceptable range of groundwater levels, groundwater quality, and inelastic land subsidence that can occur in a local area without causing significant adverse impacts.

Other Groundwater Regulations

Groundwater quality issues are monitored through a number of different legislative acts and are the responsibility of several different State agencies including:

- SWRCB and nine Regional Water Quality Control Boards (RWQCB) - responsible for protecting water quality for present and future beneficial use;
- California Department of Toxic Substances Control - responsible for protecting public health from improper handling, storage, transport, and disposal of hazardous materials;
- California Department of Pesticide Regulation - responsible for preventing pesticide pollution of groundwater;
- California Department of Public Health (CDPH) - responsible for drinking water supplies and standards;
- California Integrated Waste Management Board - oversees non-hazardous solid waste disposal, and
- California Department of Conservation - responsible for preventing groundwater contamination due to oil, gas, and geothermal drilling and related activities.

3.3.1.2.3 Local Regulation

Local GMPs and county ordinances vary by authority/agency and region, but typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, prevent subsidence and protect groundwater quality.

AB 3030, the Groundwater Management Act, encourages local water agencies to establish local GMPs. The Groundwater Management Act lists 12 elements that should be included within the GMPs to ensure efficient groundwater use, good groundwater quality, and safe production of water. Table 3.3-1 lists the current GMPs that apply to agencies that have expressed interest in participating in the Long-Term Water Transfers EIS/EIR.

Table 3.3-1. Local GMPs and Ordinances

Groundwater Basin	Potential Participating Agencies	GMPs, Agreements and County Ordinances
Redding Area	• Anderson-Cottonwood ID	• Shasta County AB 3030 Plan • Anderson-Cottonwood ID GMP
Sacramento Valley	• Conaway Preservation Group • Cranmore Farms • Eastside MWC • Glenn-Colusa ID • Natomas Central MWC • Pleasant Grove-Verona MWC • RD 108 • RD 2068 • Sycamore MWC • Te Velde Revocable Family Trust • Butte WD • Cordua ID • Garden Highway MWC • Gilsizer Slough Ranch • Goose Club Farms and Teichert Aggregates • Tule Basin Farms	• Glenn-Colusa ID GMP AB 3030 Plan • Glenn County GMP • Colusa County GMP • Reclamation District 108 GMP • RD 2068 GMP • Yolo County Water Management Plan • Butte County GMP • Yuba GMP
	• City of Sacramento • Sacramento County Water Agency • Sacramento Suburban WD	• Sacramento Groundwater Authority GMP • Sacramento County Water Agency GMP • Central Sacramento County GMP
San Joaquin Valley	• Merced ID • SLDMWA	• Merced ID AB 3030 Plan • Merced Groundwater Basin AB 3030 Plan • Merced County Wellhead Protection Program • Water Supply Plan and Update • Westlands Water District GMP
Santa Clara Valley	• East Bay MUD • Santa Clara Valley WD	• South East Bay Plain Basin GMP • Santa Clara Valley WD GMP

Source: DWR 2010a
Key:
AB = Assembly Bill
GMP = Groundwater Management Plan
ID = Irrigation District
MUD = Municipal Utility District
MWC = Mutual Water Company
RD = Reclamation District
SLDMWA = San Luis & Delta-Mendota Water Authority
WD = Water District

The following are descriptions of local regulations/ordinances which may need to be considered during a water transfer:

Colusa County Ordinance No. 615

This ordinance prohibits direct or indirect extraction of groundwater for transfer outside county boundaries without permit approval, except in certain circumstances. The permit approval process includes public and environmental reviews. Permits may only be approved after the environmental review determines that the Proposed Action would not result in the following: (1) overdraft or increased overdraft, (2) damage to aquifer storage or transmissivity, (3) exceedance of the annual yield or foreseeable injury to beneficial overlying groundwater users and property users, (4) injury to water replenishment, storage, or restoration projects, or (5) noncompliance with Water Code Section 1220. If Colusa County grants a three-year permit under Ordinance 615, the permit may also be subject to additional conditions to avoid adverse effects. Violators of this permitting process may be subject to a fine (Colusa County 1999). The ordinance does have an exemption process that would allow transfers to occur without obtaining a permit.

Yolo County Export Ordinance No. 1617

Yolo County Export Ordinance No. 1617 is similar to the Colusa County ordinance described above. Indirect or direct export of groundwater outside Yolo County requires a permit. In addition to review by the county, the Director of Community Development may review the permit application with other affected county departments, DWR, RWQCB, and any other interested local water agency neighboring the area of the proposed transfer. Following a California Environmental Quality Act (CEQA) environmental review and a public review, the Yolo County Board of Supervisors may grant the permit if the evidence suggests that the extraction would not cause (1) adverse effects to long-term storage and transmissivity of the aquifer, (2) exceedance of safe yield unless it is in compliance with an established conjunctive use program, (3) noncompliance with Water Code section 1220, or (4) injury to water replenishment, storage, or restoration projects. The Yolo County Board of Supervisors may impose additional conditions to the permit to ensure compliance with the aforementioned criteria. This ordinance subjects violators to fines (Yolo County 1996).

Water Forum Agreement (WFA)

The WFA consists of seven major elements designed to meet the following overall objective to: “Provide a reliable and safe water supply for the region’s economic health and planned development to the year 2030; and preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.” The WFA’s Groundwater Element encourages the management of the limited groundwater resources in three hydrogeologic areas within Sacramento County (Water Forum 1999). The WFA areas that could be affected by the proposed action include the areas termed as the North Area and Central Area. The major outcomes of this agreement included (Water Forum 1999):

- Formation of the Sacramento Groundwater Authority (SGA) and the American River Basin Cooperating Agencies (ARBCA); and

- A recommended sustainable yield of 131,000 acre-feet (AF) per year for the North Area and 273,000 AF per year for the Central Area.

Groundwater management negotiations in the Central area and the South area will continue.

SGA's primary mission is to protect the basin's safe yield, defined in the WFA, and water quality. Additional goals and objectives of the SGA include: (1) develop/facilitate a regional conjunctive use program consistent with the WFA; (2) mitigate conditions of regional groundwater overdraft; (3) replenish groundwater extraction; (4) mitigate groundwater contaminant migration; (5) monitor groundwater elevations and quality; and (6) develop relationships with State and Federal Agencies. The basin has approximately 600,000 AF of evacuated storage that could be exercised in such a program. The ultimate potential wet year in-lieu banking potential is about 100,000 AF per year, with a potential dry year surface water exchange potential of over 50,000 AF per year.

American River Basin Regional Conjunctive Use Program (ARBCUP)

A partnership between the SGA and the ARBCA resulted in the ARBCUP.

An outcome of the WFA, the ARBCUP intends to assist in meeting the WFA objectives, discussed above, by using the overdrafted basin in the North Area for groundwater banking. Groundwater recharge as part of the ARBCUP consists of either (1) direct recharge using surface water from the American River and/or Sacramento River or (2) in lieu of recharge in which surface water is substituted for groundwater. The ARBCUP includes a combination of the use of groundwater and surface water to maximize "banking" of both groundwater below ground and surface water in reservoirs. ARBCUP assists in maintaining the WFA American River environmental flow standards. When the ARBCUP was completed in 2008, the program increased water supplies by 20,000 AF per year (Regional Water Authority [RWA] 2012).

3.3.1.3 Affected Environment

3.3.1.3.1 Redding Area Groundwater Basin

The Redding Area Groundwater Basin is in the northernmost part of the Central Valley. Underlying Tehama and Shasta Counties, it is bordered by the Klamath Mountains to the north, the Coast Range to the west, and the Cascade Mountains to the east. Red Bluff Arch separates the Redding Area Groundwater Basin from the Sacramento Valley Groundwater Basin to the south. DWR Bulletin 118 subdivides the

Redding Area Groundwater Basin into six subbasins (DWR 2003). Figure 3.3-2 shows the Redding Area Groundwater Basin and Subbasins. The following section provides information on geology, hydrogeology, hydrology, groundwater production, groundwater levels and storage, land subsidence, and groundwater quality.

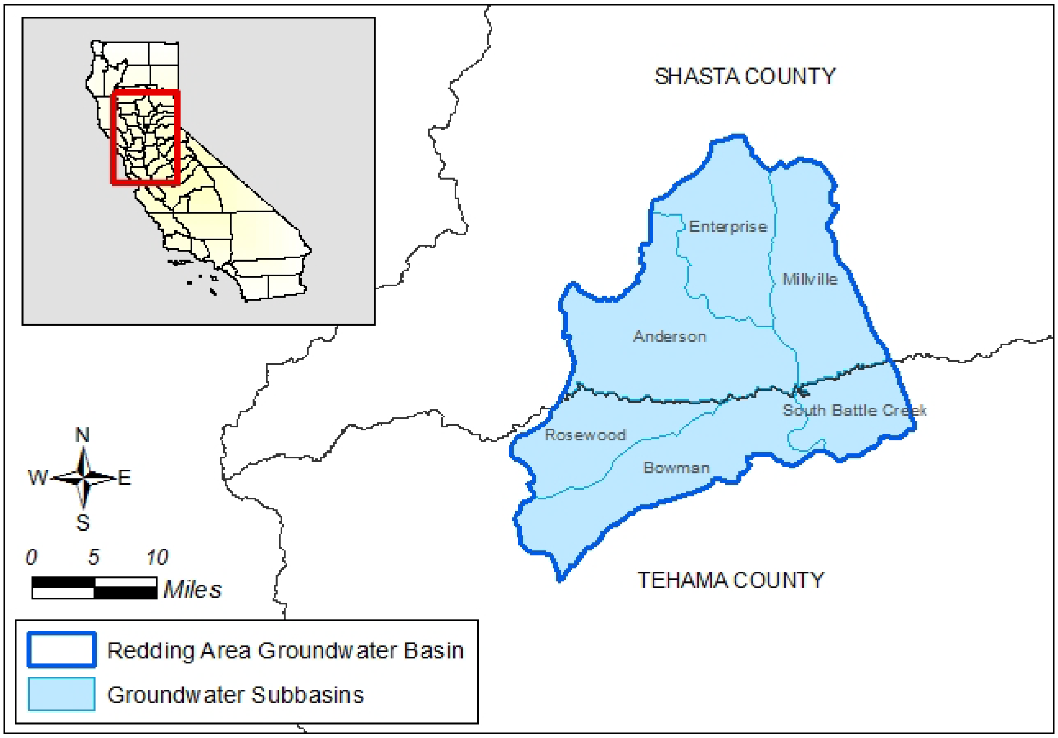


Figure 3.3-2. Redding Area Groundwater Basin and Subbasins

Geology, Hydrogeology, and Hydrology

The Redding Area Groundwater Basin is a sediment-filled, southward plunging symmetrical trough. The principal freshwater-bearing formation in the basin is formed by the simultaneous deposition of materials from the Coast and the Cascade Ranges. The Tuscan Formation in the eastern portion of the basin is derived from the Cascade Range volcanic sediments, and the Tehama Formation in the western and northwest portion of the basin is derived from Coast Range sediments. These formations are up to 2,000 feet thick near the confluence of the Sacramento River and Cottonwood Creek. The Tuscan Formation is generally more permeable and productive than the Tehama Formation (Shasta County Water Agency 2007).

Figure 3.3-3 shows generalized geologic cross sections looking from north to south across the Redding Area Groundwater Basin (Shasta County Water Agency 2007).

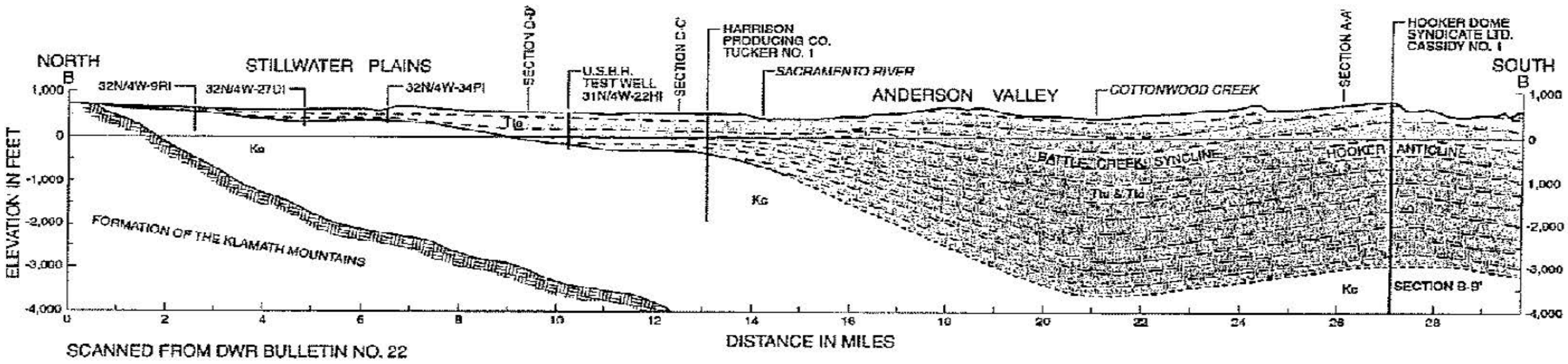
The principal surface water features in the Redding Area Groundwater Basin are the Sacramento River and its tributaries: Battle Creek, Cow Creek, Little Cow Creek, Clear Creek, Dry Creek, and Cottonwood Creek. Surface water and groundwater interact in many areas in the Redding Basin. In general, groundwater flows southeasterly on the west side of the basin and southwesterly on the east side, toward the Sacramento River. The Sacramento River is the main drain for the basin (DWR Northern District 2002). The Shasta County Water Resources Master Plan Phase 1 Report estimated the total annual groundwater discharge to rivers and streams at about 266,000 AF, and seepage from streams and canals into groundwater at 59,000 and 44,000 AF, respectively (CH2M Hill 1997 as cited in CH2M Hill 2003). Groundwater is typically unconfined to semi-confined in the shallow aquifer system and confined where deeper aquifers are present.

Groundwater Production, Levels and Storage

The watersheds overlying the Redding Basin yield an average of 850,000 AF of annual runoff (CH2M Hill 2003). Much of this water is potentially available to recharge the Redding Area Groundwater Basin and replenish water levels that have been depressed because of groundwater pumping. Applied irrigation water (from all sources) totals approximately 270,000 AF annually in the Redding Basin area (CH2M Hill 1997 as cited in CH2M Hill 2003). While the exact quantity of groundwater pumped annually from the Redding Area Groundwater Basin is not known, it has been estimated that approximately 55,000 AF per year of water is pumped from municipal and industrial (M&I) and agricultural production wells (CH2M Hill 2003). This magnitude of pumping represents approximately six percent of the average annual runoff.

Figure 3.3-4 shows Spring 2013 groundwater elevation contours within the Redding Area and Sacramento Valley Groundwater Basin. In general, groundwater flows inward from the edges of the basin and south, towards the Sacramento River in the Redding Area Groundwater Basin.

The storage capacity for the entire Redding Area Groundwater Basin is estimated to be 5.5 million AF for 200 feet of saturated thickness over an area of approximately 510 square miles (Pierce 1983 as cited in Bulletin 118; DWR 2003).



Source: Shasta County Water Agency, 2007

Figure 3.3-3. Generalized Geologic cross section of the Redding Area Groundwater Basin

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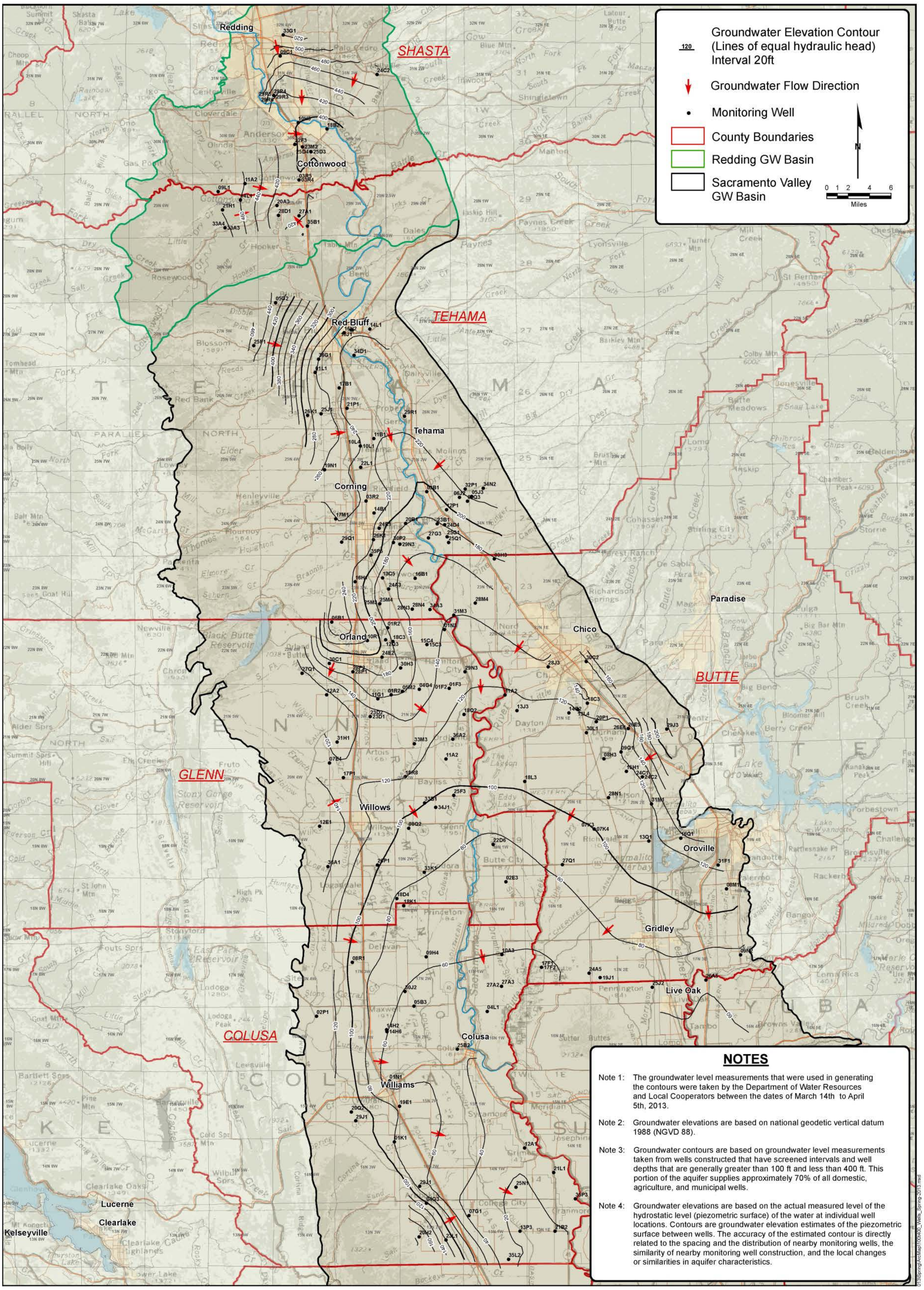

NOTES

Note 1: The groundwater level measurements that were used in generating the contours were taken by the Department of Water Resources and Local Cooperators between the dates of March 14th to April 5th, 2013.

Note 2: Groundwater elevations are based on national geodetic vertical datum 1988 (NGVD 88).

Note 3: Groundwater contours are based on groundwater level measurements taken from wells constructed that have screened intervals and well depths that are generally greater than 100 ft and less than 400 ft. This portion of the aquifer supplies approximately 70% of all domestic, agriculture, and municipal wells.

Note 4: Groundwater elevations are based on the actual measured level of the hydrostatic level (piezometric surface) of the water at individual well locations. Contours are groundwater elevation estimates of the piezometric surface between wells. The accuracy of the estimated contour is directly related to the spacing and the distribution of nearby monitoring wells, the similarity of nearby monitoring well construction, and the local changes or similarities in aquifer characteristics.

Source: DWR 2013

Figure 3.3-4. Redding Area and Sacramento Valley Spring 2013 Groundwater Elevation Contours

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Groundwater-Related Land Subsidence

Land subsidence has not been monitored in the Redding Area Groundwater Basin. However, there would be potential for subsidence in some areas of the basin if groundwater levels decline below historic low levels. The groundwater basin west of the Sacramento River is composed of the Tehama Formation; this formation has exhibited subsidence in Yolo County and the similar hydrogeologic characteristics in the Redding Area Groundwater Basin could be conducive to land subsidence.

Groundwater Quality

Groundwater in the Redding Area Groundwater Basin is typically of good quality, as evidenced by its low total dissolved solids (TDS) concentrations, which range from 70 to 360 milligrams per liter (mg/L). Areas of high salinity (poor water quality), are generally found on the western basin margins, where the groundwater is derived from marine sedimentary rock. Elevated levels of iron, manganese, nitrate, and high TDS have been detected in some areas. Localized high concentrations of boron have been detected in the southern portion of the basin (DWR Northern District 2002).

3.3.1.3.2 Sacramento Valley Groundwater Basin

The Sacramento Valley Groundwater Basin includes portions of Butte, Colusa, Glenn, Placer, Sacramento, Sutter, Solano, Tehama, Yuba and Yolo counties. The Sacramento Valley Groundwater Basin is bordered by the Red Bluff Arch to the north, the Coast Range to the west, the Sierra Nevada to the east, and the San Joaquin Valley to the south. Bulletin 118 further divides the Sacramento Valley Groundwater Basin into subbasins (DWR 2003). Figure 3.3-5 shows the Sacramento Valley Groundwater Basin and subbasins. The following section provides information on geology, hydrogeology, hydrology, groundwater production, groundwater levels and storage, land subsidence, and groundwater quality.

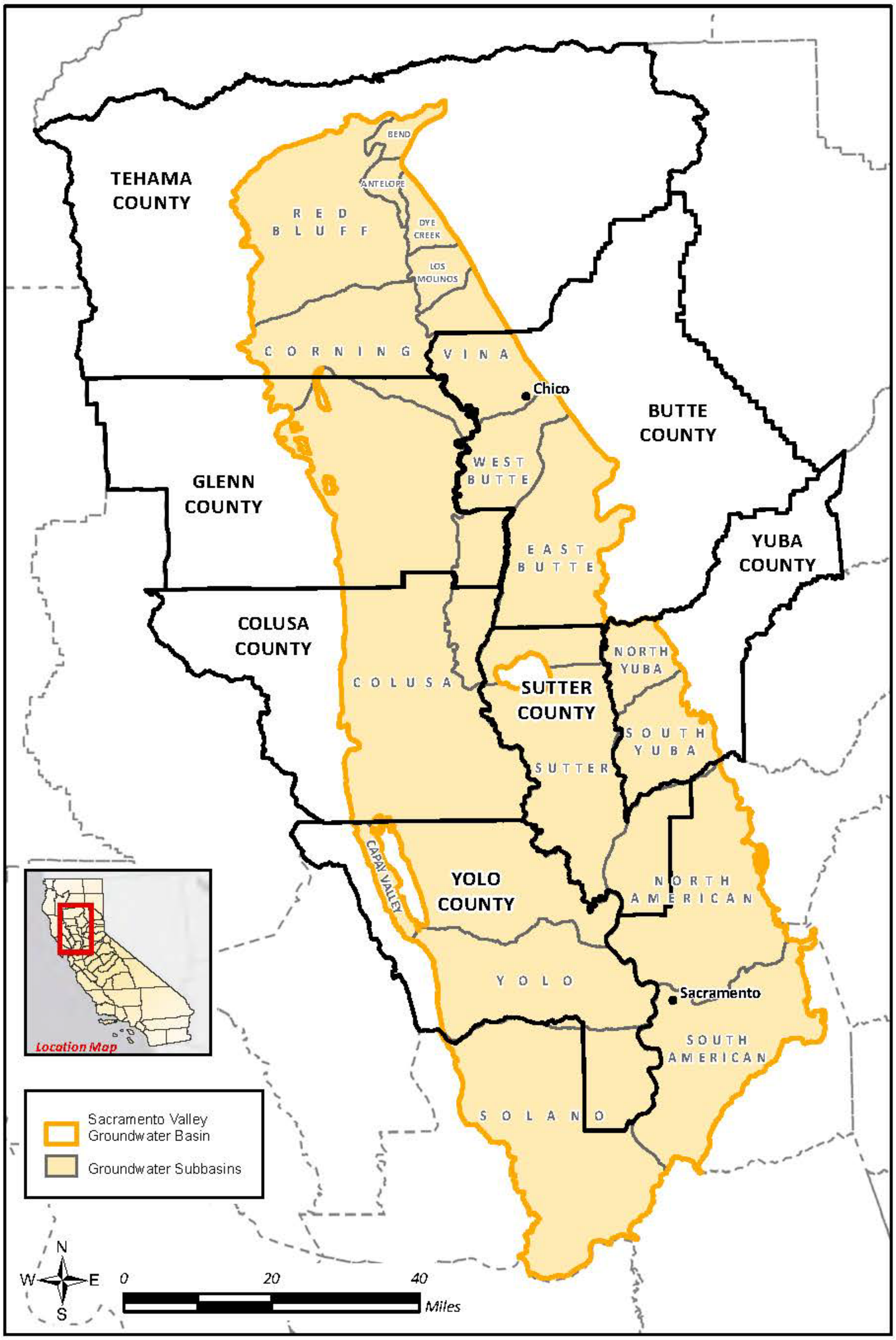


Figure 3.3-5. Sacramento Valley Groundwater Basin

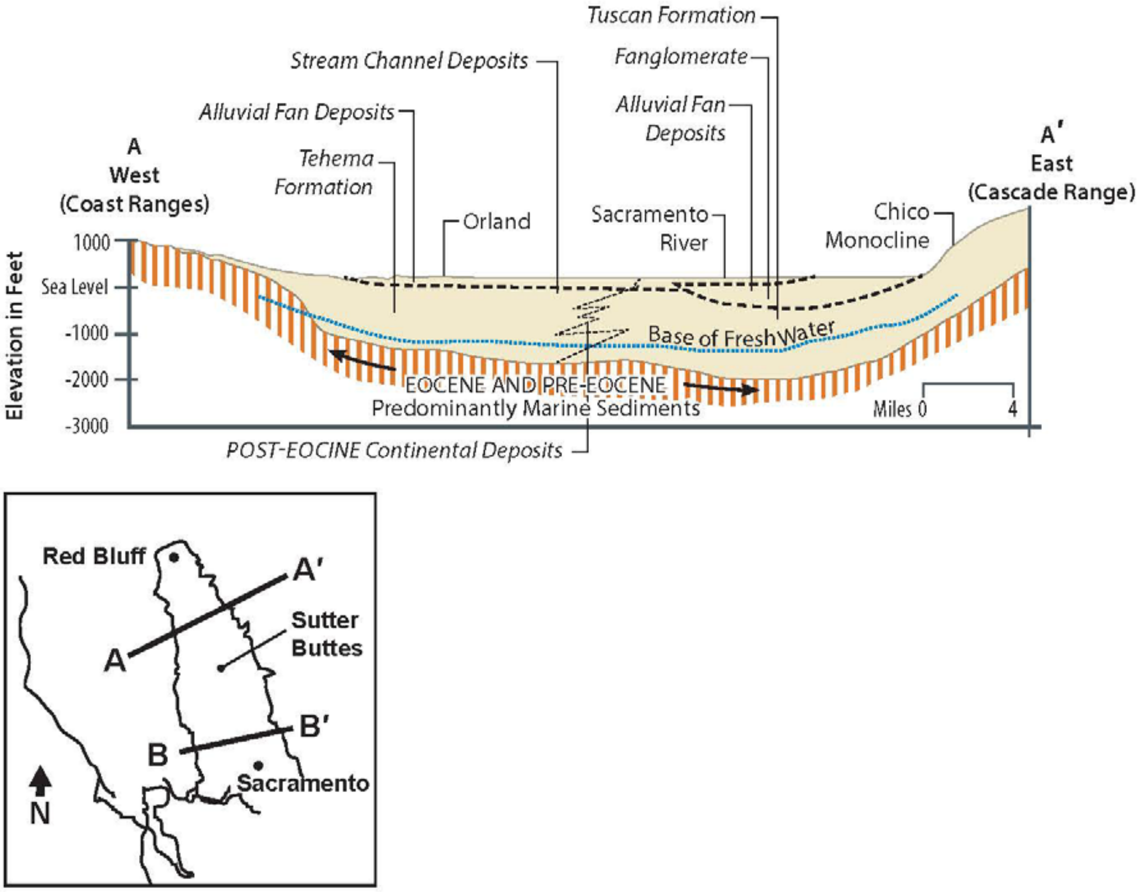
Geology, Hydrogeology, and Hydrology

The Sacramento Valley Groundwater Basin is a north-northwest trending asymmetrical trough filled with both marine and continental rocks and sediment. On the eastern side, the basin overlies basement rock that rises relatively gently to the Sierra Nevada, while on the western side the underlying basement rock rises more steeply to form the Coast Range. Overlying the basement rock are marine sandstone, shale, and conglomerate rocks, which generally contain brackish or saline water (DWR 1978). The freshwater-bearing formation in the valley comprises of sedimentary and volcanic rocks that have the ability to absorb, transmit and yield fresh water. The depth below ground surface (bgs) to the base of freshwater is approximately 1,150 feet in the northern portion of the Sacramento Valley and approximately 1,600 feet in the southern portion of the Sacramento valley (DWR 1978).

Along the eastern and northeastern portion of the basin are the Tuscan and Mehrten formations, derived from the Cascade and Sierra Nevada ranges. The Tehama Formation in the western portion of the basin is derived from Coast Range sediments. In most of the Sacramento Valley Groundwater Basin, the Tuscan, Mehrten, and Tehama formations are overlain by relatively thin alluvial deposits.

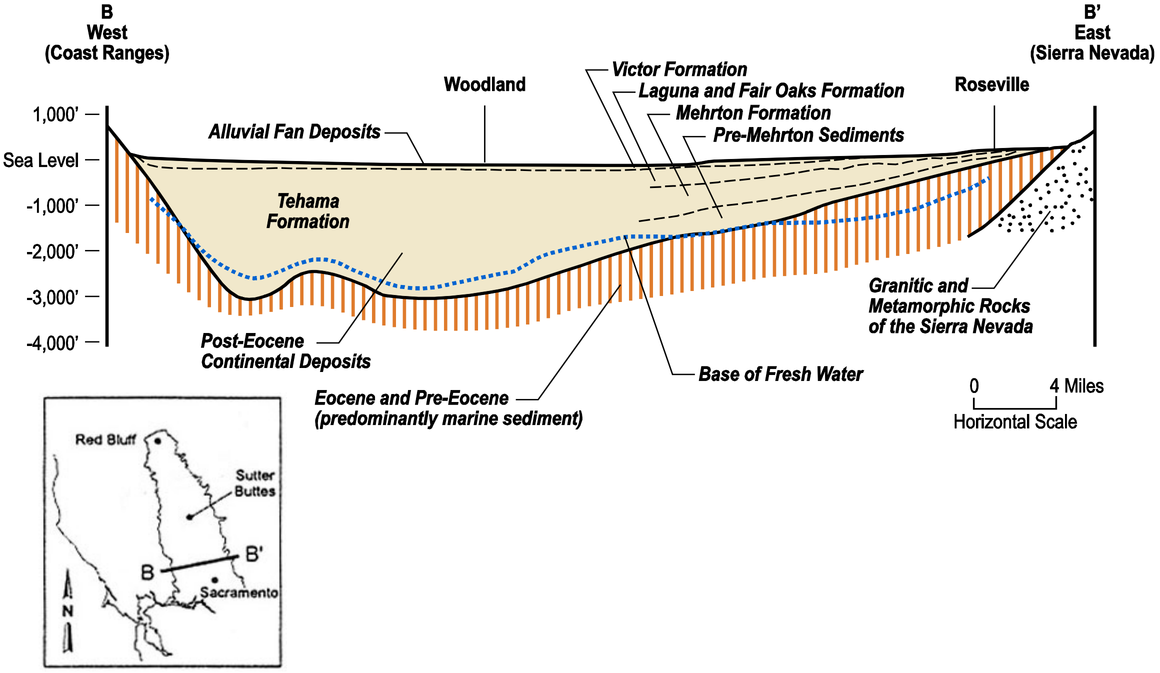
Freshwater is present primarily in the Laguna, Mehrten, Tehama, and Tuscan formations and in alluvial deposits that overly the deeper Eocene and Pre-Eocene marine deposits. Figure 3.3-6 and Figure 3.3-7 are generalized cross sections for the northern and southern portions of the Sacramento Valley Groundwater Basin, respectively. Groundwater users in the basin pump primarily from aquifers above the marine deposits.

Groundwater is recharged by deep percolation from rainfall infiltration, leakage from streambeds, lateral inflow along the basin boundaries, and landscape processes, including irrigation. The primary source of recharge has become deep percolation of irrigation water past crop roots, sometimes referred to as recharge from excess applied irrigation water. Of the average 13.3 million AF of groundwater recharged annually from 1962 to 2003, approximately 19 percent was from streamflow leakage and 79 percent was from the landscape processes, including recharge from excess applied irrigation water and from precipitation (Faunt 2009). Average annual precipitation in the Sacramento Valley Groundwater Basin ranges from 13 to 26 inches, with the higher precipitation of 46 inches occurring along the eastern and northern edges of the basin. Typically, 85 percent of the basin’s precipitation occurs from November to April, half of it during December through February in average years (Faunt 2009).



Source: DWR 1978

Figure 3.3-6. North Geologic Cross Section of the Sacramento Valley Groundwater Basin



Source: DWR 1978

Figure 3.3-7. South Geologic Cross Section of the Sacramento Valley Groundwater Basin

The main surface water feature in the Sacramento Valley Groundwater Basin is the Sacramento River which flows from north to south through the basin. The Sacramento River has several major tributaries draining the Sierra Nevada, including the Feather River, Yuba River, and American River. Stony Creek, Cache Creek, and Putah Creek drain the Coast Range and are the main west side tributaries of the Sacramento River. Surface water and groundwater interact on a regional basis, and gains and losses to groundwater vary spatially and temporally.

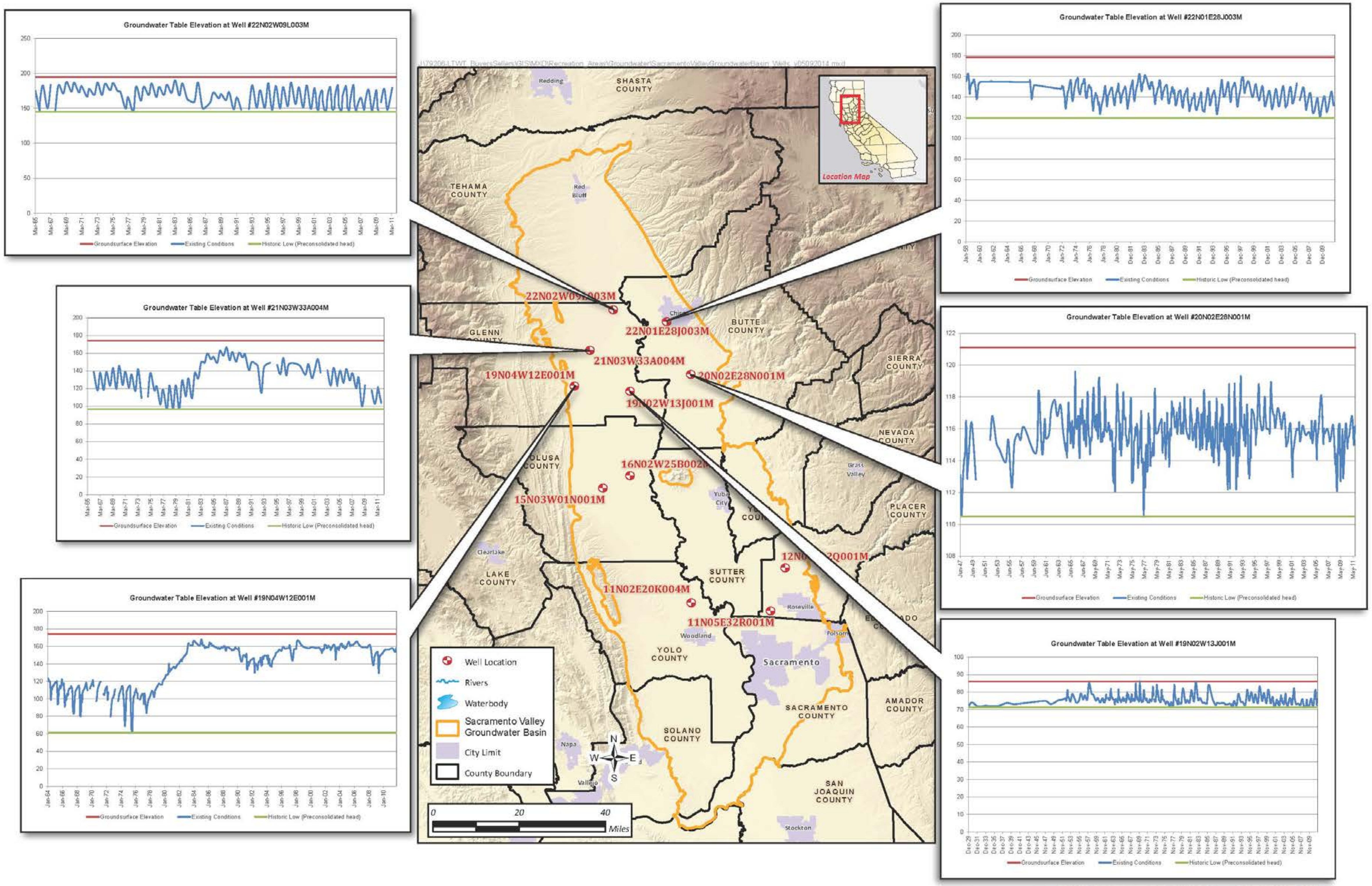
Groundwater Production, Levels, and Storage

Groundwater pumping can be generally grouped into agricultural and urban, which includes M&I sources. Agricultural groundwater pumping supplies water for the crops grown in the basin. Truck, field, orchard, and rice crops are grown on approximately 2.1 million acres; rice represents about 23 percent of the total acreage (DWR 2003 as cited in Faunt 2009). The water supply for growing rice relies on a combination of surface water and groundwater. Groundwater accounts for less than 30 percent of the annual supply used for agricultural and urban purposes in the Sacramento Valley (Faunt 2009). Urban pumping in the Sacramento Valley increased from approximately 250,000 AF annually in 1961 to more than 800,000 AF annually in 2003 (Faunt 2009).

DWR and other monitoring entities, as defined by SB X7 6 extensively monitors groundwater levels in the basin. The total depth of monitoring wells range from 18 to 1,380 feet bgs within the Sacramento Valley Groundwater Basin.

Figure 3.3-8 and Figure 3.3-9 show the location and groundwater elevation of select monitoring wells that portray the local groundwater elevations within the Sacramento Valley Groundwater Basin. Water levels at well 21N03W33A004M generally declined during the 1970s and prior to import of surface water conveyed by the Tehama-Colusa Canal. During the 1980s, groundwater levels recovered due to import and use of surface water supply and because of the 1982 to 1984 wet water years (DWR 2014a). Groundwater levels in well 15N03W01N001M (which is surrounded by agricultural lands) declined until 1978 and then recovered during the 1982-1984 wet years. After the 2008-2009 drought, water levels declined to historical lows. Water levels recovered quickly during 2010 and 2011, then after returned to the trend of long-term decline (DWR 2014a). Even though groundwater levels at wells 21N03W33A004M and 15N03W01N001M are generally showing a declining trend, groundwater levels in other wells in the basin have remained steady, declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods (See Figure 3.3-8 and Figure 3.3-9 for Groundwater Elevations within the Sacramento Valley Groundwater Basin).

Figure 3.3-4 shows Spring 2013 groundwater elevation contours within the Redding Area and Sacramento Valley Groundwater Basins. In general, groundwater flows inward from the edges of the basin and south, parallel to the Sacramento River in the Sacramento Valley. In some areas there are groundwater depressions associated with pumping that influence local groundwater gradients and flow direction. Prior to the completion of CVP facilities in the area (1964-1971), pumping along the west side of the basin caused groundwater levels to decline. Following construction of the CVP, the delivery of surface water and reduction in groundwater extraction resulted in a recovery to historic groundwater levels by the mid to late-1970s. Throughout the basin, individuals, counties, cities, and special legislative agencies manage and/or develop groundwater resources. Many agencies use groundwater to supplement surface water; therefore, groundwater production is closely linked to surface water availability. Climatic variations and the resulting surface water supply directly affect the demand and the amount of groundwater required to meet agricultural and urban water demands (Faunt 2009).



Source: DWR 2010b

Figure 3.3-8. Sacramento Valley Groundwater Basin Historic Groundwater Elevations

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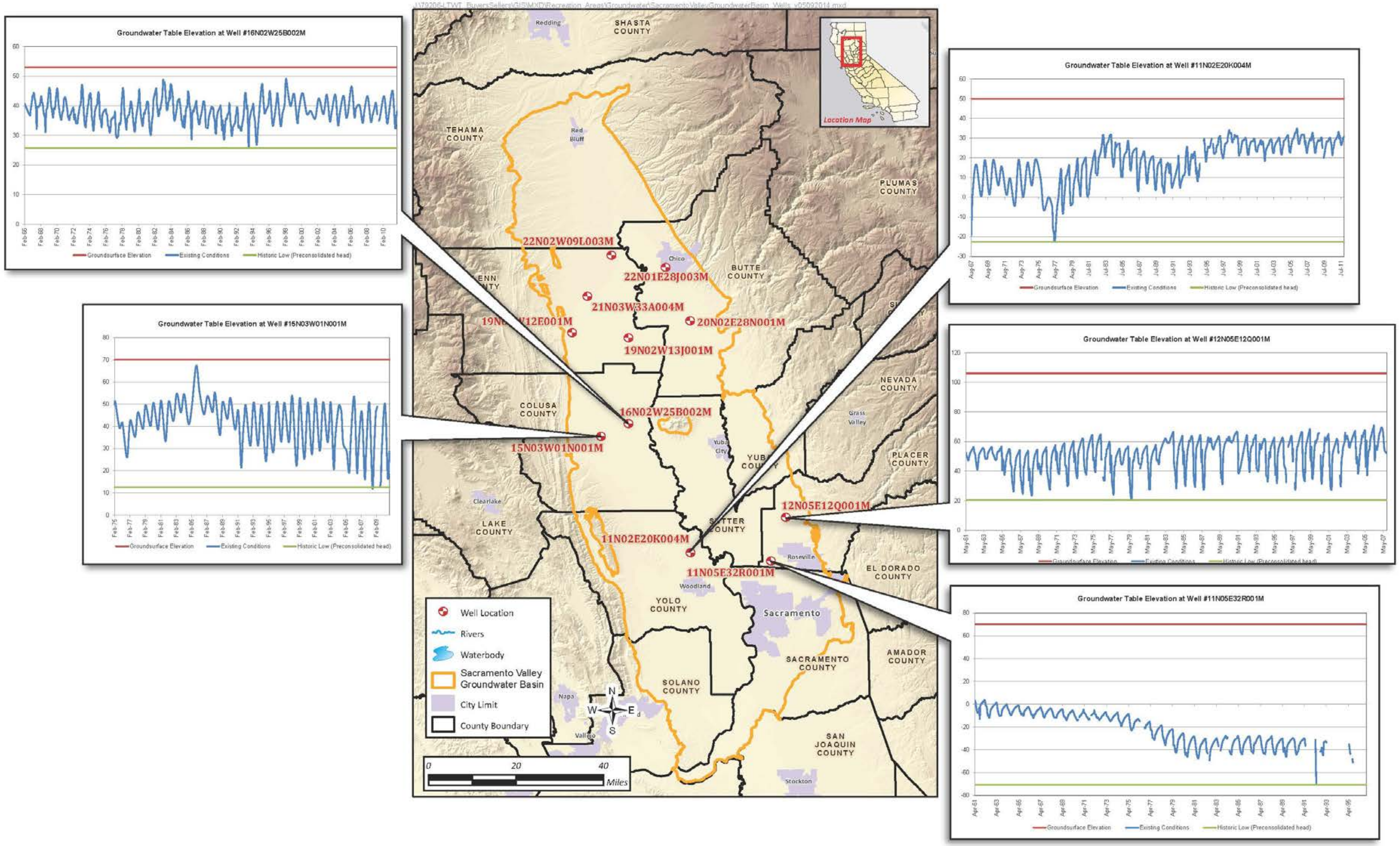

Source: DWR 2010b

Figure 3.3-9. Sacramento Valley Groundwater Basin Historic Groundwater Elevations

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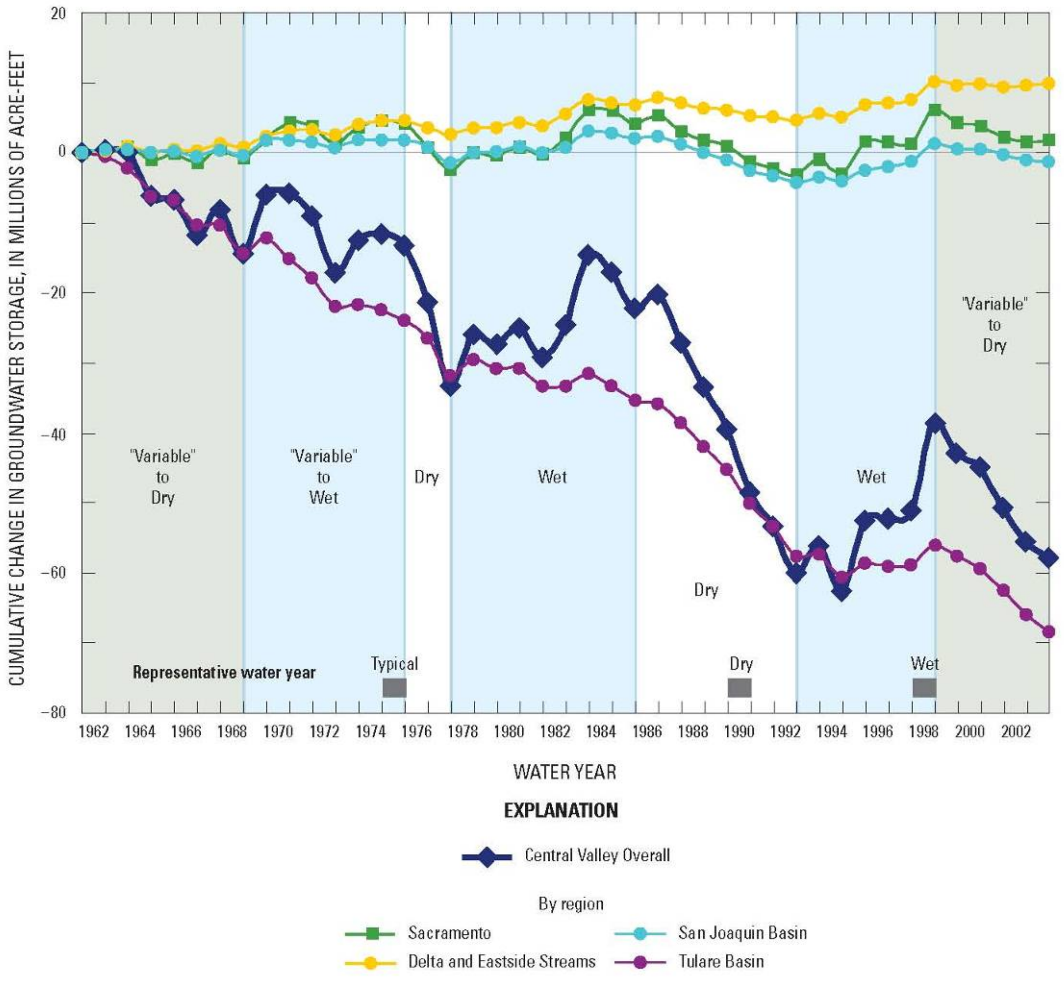
Figure 3.3-10 shows the simulated cumulative change in groundwater storage in the Sacramento Valley Groundwater Basin since 1962, along with the other major groundwater basins in the Central Valley of California. As shown in this figure, groundwater storage in the Sacramento Valley Groundwater Basin has been relatively constant over the long term. Storage tends to decrease during dry years and increase during wetter periods.



Source: Faunt 2009

Figure 3.3-10. Cumulative Annual Change in Storage, as simulated by the USGS's Central Valley Hydrologic Model

Groundwater-Related Land Subsidence

This section discusses land subsidence due to groundwater extraction. Groundwater-related land subsidence is a process that causes the elevation of the ground surface to lower in response to groundwater pumping occurring in the region. Non-reversible land subsidence occurs where groundwater extraction lowers groundwater levels causing loss of pore pressure and subsequent consolidation of clay beds in aquitards within a groundwater system. Subsidence is typically a slow process that occurs over a large area. Because of the slow rate of subsidence, the general appearance of the landscape may not change; however, subsidence can lead to problems with flood control and water distribution systems due to changes in elevation. Subsidence can reduce the freeboard of levees, allowing water to over top them more easily. It also can change the slope, and even the direction of flow, in conveyance and drainage systems, including canals, sewers, and storm drains. In addition, subsidence can also damage infrastructure, including building foundations and collapsed well casings.

Subsidence generally occurs in small increments during dry years when groundwater pumping lowers groundwater levels below historical lows in areas that are geologically susceptible because they have compressible clays. There are several methods used to measure land subsidence. Global Positioning System (GPS) surveying is a method used for monitoring subsidence on a regional scale. DWR is using this method to monitor subsidence in the Tulelake Basin, Glenn and Yolo counties, and the Sacramento-San Joaquin Delta. The GPS network consists of 339 survey monuments spaced about seven kilometers apart and covers all or part of ten counties within the Sacramento Groundwater basin (DWR 2008). It extends from northern Sacramento County eastward to the Bureau of Reclamation’s Folsom Reservoir network, southwest to DWR’s Delta/Suisun Marsh network, and north to Reclamation’s Shasta Reservoir network. The network is scheduled to be re-surveyed on a three-year frequency to measure elevation changes over time.

Vertical extensometers are a more site specific method of measuring land subsidence. DWR’s subsidence monitoring program within the Sacramento Valley Groundwater Basin includes 11 extensometer stations that are located in Yolo (2), Sutter (1), Colusa (2), Butte (3), and Glenn (3) counties. Figure 3.3-11 shows the areas within the Sacramento Valley Groundwater Basin that have experienced subsidence due to significant declines in groundwater levels as a result of increased groundwater pumping (DWR 2008).

Figure 3.3-11 shows the locations of DWR’s extensometers and extent of subsidence at the locations. Data from the GPS subsidence monitoring network and complementary groundwater levels in monitoring wells revealed a correlation between land subsidence and groundwater declines during the growing season (DWR 2008). DWR found that the land surface partially rebounds as aquifers recharge in winter (DWR 2008). Out of the 11 extensometers five show potential subsidence over time:

- 09N03E08C004M, in Yolo County within Conaway Ranch: DWR observed inelastic land subsidence estimated at approximately 0.2 feet from 2013 to 2014 (DWR 2014b). In comparison, slightly less than 0.1 feet of subsidence occurred over the previous 22 years (1991-2012);
- 11N01E24Q008M, in Yolo County near the Yolo-Zamora area: 0.5 to 0.6 foot decline from 1992 to present;
- 11N04E04N005M, in Sutter County: approximately 0.01 foot decline from 1994 to present;
- 21N02W33M001M, in Glenn County: 0.05 foot decline from 2005 to present; this extensometer is located in areas in which the Tehama Formation is mapped in the subsurface and indicates the potential for inelastic subsidence (West Yost Associates 2012); and
- 16N02W05B001M, in Colusa County: 0.04 foot decline from 2006 to present.

Historically, land subsidence occurred in the eastern portion of Yolo County and the southern portion of Colusa County, due to extensive groundwater extraction and geology. The earliest studies on land subsidence in the Sacramento Valley occurred in the early 1970s when the U.S. Geological Survey (USGS), in cooperation with DWR, measured elevation changes along survey lines containing first and second order benchmarks. As much as four feet of land subsidence due to groundwater withdrawal occurred east of Zamora over the last several decades. The area between Zamora, Knights Landing, and Woodland has been most affected (Yolo County 2009). Subsidence in this region is generally related to groundwater pumping and subsequent consolidation of compressible clay sediments.

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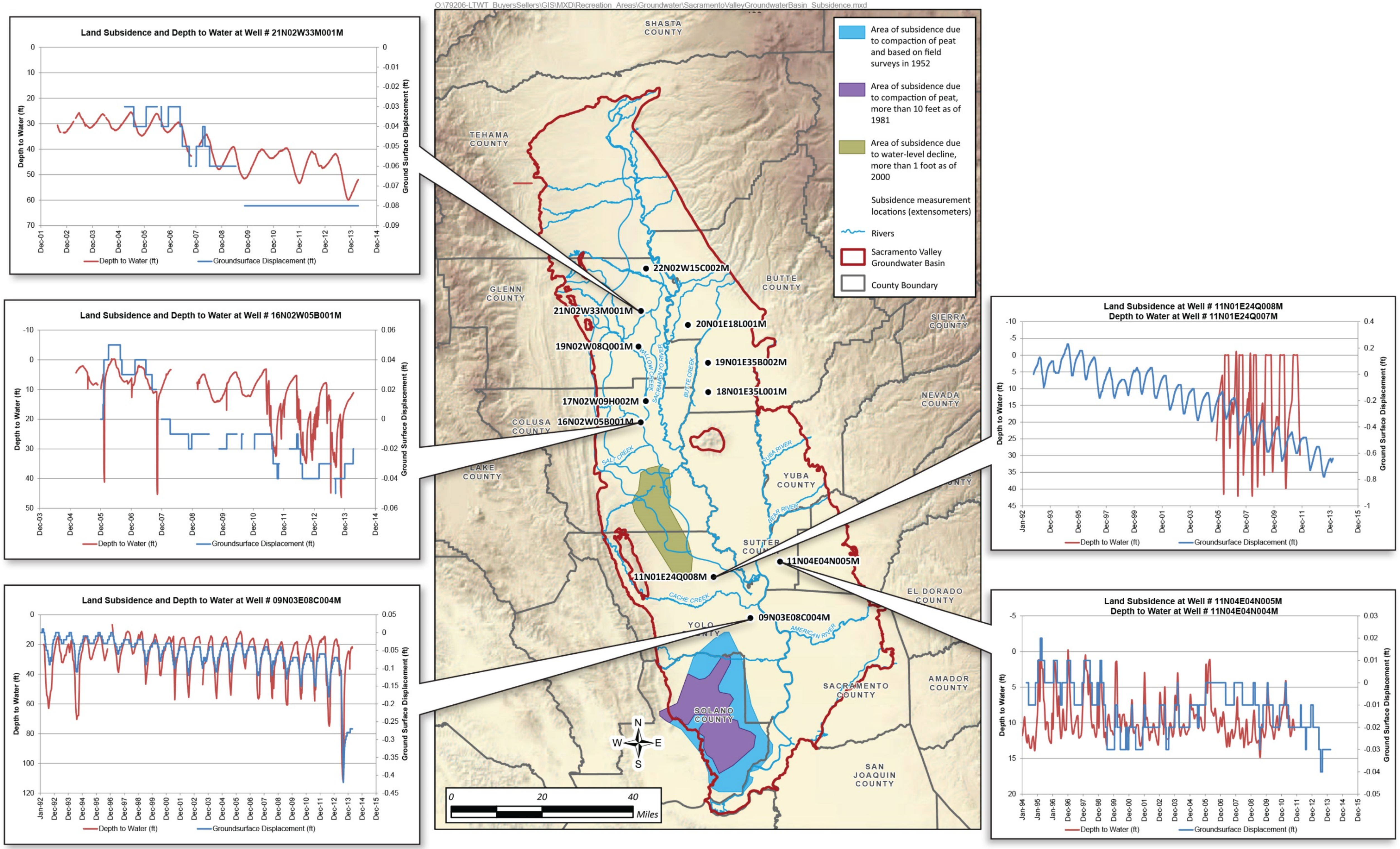

Source: DWR 2010b

Figure 3.3-11. Sacramento Valley Groundwater Basin Land Subsidence

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Groundwater Quality

Groundwater quality in the Sacramento Valley Groundwater Basin is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. However, there are some localized groundwater quality issues in the basin. In general, groundwater quality is influenced by stream flow and recharge from the surrounding Coast Range and Sierra Nevada. Runoff from the Sierra Nevada is generally of higher quality than runoff from the Coast Range because of the presence of marine sediments in the Coast Range. Specific groundwater quality issues are discussed below.

Within the Sacramento Valley, water quality issues may include occurrences of high TDS or elevated levels of nitrates, naturally occurring boron, and other introduced chemicals. The SWRCB's Groundwater Ambient Monitoring and Assessment (GAMA) Program's Priority Basin Project evaluated statewide groundwater quality and sampled 108 wells within the Central Sacramento Valley region and 96 wells in the Southern Sacramento Valley region in 2005 and 2006. Water quality data was analyzed for inorganic constituents (e.g., nutrients, radioactive constituents, TDS and iron/manganese); special interest constituents (e.g., perchlorate); and organic constituents (e.g., solvents, gasoline additives, and pesticides).

Inorganic Constituents

Arsenic and boron were the two trace elements that were most frequently detected at concentrations greater than the maximum contaminant level (MCL) within the basin. Arsenic was detected above the MCL in 22 percent of the primary aquifers. Boron was detected in seven percent of the primary aquifers. Aluminum, chromium, lead, and fluoride were also detected in concentrations above the MCLs, but in less than one percent of the primary aquifers. Concentrations of radioactive constituents were above the MCLs in less than one percent of the primary aquifers within the Central Sacramento Valley region. Most of the radioactivity in groundwater comes from decay of naturally occurring isotopes of uranium and thorium in minerals in the sediments of the aquifer (Bennett 2011a, 2011b).

Nutrient concentrations within the Central Sacramento Valley region were above the MCLs in about three percent of the primary aquifers. In the southern portion of the basin, nutrients were detected above the MCLs in about one percent of the primary aquifers (Bennett 2011a, 2011b).

CDPH and U.S. Environmental Protection Agency's (USEPA's) secondary drinking water standard for TDS is 500 mg/L, and the agricultural water quality goal for TDS is 450 mg/L. TDS concentrations were above these standards in about four percent of the primary aquifers in the central portion of the valley. TDS levels in the Sacramento Valley Groundwater Basin are generally between 200 and 500 mg/L. TDS levels in the southern part of the basin are higher because of the local geology (DWR 2003). Along the eastern boundary of the basin, TDS concentrations tend to be less than 200 mg/L, indicative of the low concentrations of TDS in Sierra Nevada runoff. Several areas in the basin have naturally occurring high TDS, with concentrations that exceed 500 mg/L. TDS concentrations as high as 1,500 mg/L have been recorded (Bertoldi 1991). One of these high TDS areas is west of the Sacramento River, between Putah Creek and the confluence of the Sacramento and San Joaquin Rivers; another is in the south-central part of the Sacramento Basin, south of Sutter Buttes, in the area between the confluence of the Sacramento and Feather Rivers.

Chloride concentrations, a component of TDS, were observed to be above the MCL in two percent of the primary aquifers. TDS concentrations between the recommended and upper limit[4] were detected in about 11 percent of the primary aquifers in the central portion of the valley. In the southern portion of the valley, TDS concentrations were greater than the upper limit (1,000 mg/L) in only about one percent of the primary aquifers and were between the recommended (500 mg/L) and upper limits (1,000 mg/L) in about 22 percent of the primary aquifers (Bennett 2011a, 2011b).

Organic Constituents

Volatile organic compounds (VOCs) are present in many household, commercial, industrial, and agricultural products used as solvents, and are characterized by their tendency to volatilize into the air. Solvents have been used for a number of purposes, including manufacturing and cleaning. Solvents were detected at concentrations greater than the MCLs in less than one percent of the primary aquifers throughout the basin. The solvent present at higher concentrations than the MCL was perchloroethylene. Gasoline additives were detected at higher concentrations in less than one percent of the primary aquifers throughout the basin. The gasoline additives detected at higher concentrations were benzene and tert-butyl alcohol (Bennett 2011a, 2011b). Additionally, groundwater wells around Chico have exceeded standards for VOCs (trichloroethylene and perchloroethylene) (City of Chico 2006).

Other VOCs (trihalomethanes and organic synthesis reagents) were not detected at concentrations above the MCLs in the primary aquifers (Bennett 2011a, 2011b).

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[4] The State of California has a recommended and an upper limit for TDS in drinking water. The recommended limit in 500 mg/L and the upper limit is 1,000 mg/L.

Special Interest Constituents

Perchlorate is an inorganic constituent that has been regulated in California drinking water since 2007. Perchlorate was not detected at concentrations above the MCLs in the primary aquifers (Bennett 2011a, 2011b).

DWR Monitoring

From 1994 to 2000, water quality data from 1,356 public supply water wells indicated that 1,282 wells, or 95 percent, met the primary MCLs for drinking water. In the remaining five percent, analysis detected at least one constituent above a primary MCL. Out of the five percent of samples that had a constituent over the MCL, the exceedences included 33 percent for nitrates, 32 percent for VOCs and semi-VOCs (mostly tetrachloroethylene, trichloroethylene, and benzene), 26 percent for inorganic compounds (mostly manganese and iron), five percent for radiological compounds (gross alpha 4), and four percent for pesticides (di(2-ethylhexyl)phthalate) (DWR 2003).

3.3.1.3.3 San Joaquin Valley Groundwater Basin

The San Joaquin Valley Groundwater Basin extends over the southern two-thirds of the Central Valley regional aquifer system and has an area of approximately 13,500 square miles. The northern portion of the San Joaquin Valley Groundwater Basin, shown on

Figure 3.3-12, extends from just north of Stockton in San Joaquin County to north of Fresno in Fresno County, covering approximately 5,800 square miles.

The southern portion of the San Joaquin Valley Groundwater Basin extends from the Fresno-Madera County line through Kings and Tulare counties into Kern County. The South San Joaquin Groundwater Basin covers approximately 8,000 square miles.

Geology, Hydrogeology, and Hydrology

The northern portion of the San Joaquin Valley Groundwater Basin is similar in shape to the Sacramento Valley Groundwater Basin and was formed by the deposition of several miles of sediment in a north-northwestern trending trough. The Sierra Nevada lies on the eastern side of the basin, and the Coast Range is to the west.

Figure 3.3-12. San Joaquin Valley Groundwater Basin