BUREAU OF RECLAMATION

Environmental Assessment

Sacramento River Settlement Contractors Drought Protection Program

Central Valley Project, California

Interior Region 10 – California-Great Basin

U.S. Department of the Interior

November 2024

Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms and Abbreviations

Term	Definition
AF	Acre-feet
ARB	California Air Resources Board
BMP	Best Management Practice
Btu	British Thermal Unit
CAAQS	California Ambient Air Quality Standards
CAL FIRE	California Department of Forestry and Fire Prevention
CARB	California Air Resources Board
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife
CFS	Cubic Feet per Second
CH4	Methane
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulation
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalents
CPUC	California Public Utilities Commission
CVP	Central Valley Project
CWA	Clean Water Act
DOI	U.S. Department of the Interior

EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
Delta	Sacramento-San Joaquin Delta
DOI	Department of the Interior
DWR	Department of Water Resources
GCID	Glenn-Colusa Irrigation District
GHG	Greenhouse Gas
GGS	Giant Garter Snake
GSP	Groundwater Sustainability Plan
GWB	Groundwater Basin
GWh	Gigawatt-Hour
GWP	Global Warming Potential
GWSB	Groundwater Subbasin
GWP	Global Warming Potential
HDPE	High-Density Polyethylene
HFC	Hydrofluorocarbons
ID	Irrigation District
IPCC	Intergovernmental Panel on Climate Change
IS	Initial Study
ITA	Indian Trust Asset
LTO	Long-Term Operations
LWT	Long-Term Water Transfers

MAF	Million Acre-Feet
MGD	Million Gallons Per Day
M&I	Municipal and Industrial
MT	Metric Ton
MUD	Municipal Utility District
MWI	Maxwell Intertie
N2O	Nitrous Oxide
NAA	No Action Alternative
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO2	Nitrogen Dioxide
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NSJCGBA	Northeastern San Joaquin County Groundwater Banking Authority
O3	Ozone
PFC	Perfluorocarbons
PM	Particulate Matter
Program	Drought Protection Program
PVC	Polyvinyl Chloride
Reclamation	Bureau of Reclamation
REU	Redding Electric Utility
RFFA	Reasonably Foreseeable Future Action

ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board
SCADA	Supervisory Control and Data and Acquisition
SCWA	Sacramento County Water Authority
SF6	Sulfur Hexafluoride
SGMA	Sustainable Groundwater Management Area
SLDMWA	San Luis and Delta-Mendota Water Authority
SRSC	Sacramento River Settlement Contractors
SWP	State Water Project
TAF	Thousand Acre-Feet
TCCA	Tehama-Colusa Canal Authority
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Loads
TRR	Terminal Regulating Reservoir
USC	United States Code
USDA	U.S. Department of Agriculture
USEIA	U.S. Energy Information Administration
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic
VA	Voluntary Agreement
VFS	Variable Frequency Drives
WD	Water District

1 Introduction

This Environmental Assessment (EA) was prepared by the U.S. Department of the Interior (DOI), Bureau of Reclamation (Reclamation) and satisfies the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [USC] §4231 et seq.), the Council on Environmental Quality (CEQ) implementing regulations (40 Code of Federal Regulations [CFR] §1500–1508), and the Department of the Interior's NEPA regulations (43 CFR Part 46).

This EA evaluates the potential environmental effects of entering into an agreement with the Sacramento River Settlement Contractors (SRSCs) to establish a drought protection program and implement drought resiliency actions. The Proposed Action includes commitments to reductions in SRSC diversions in years that meet certain criteria.

By implementing programs that support both short-term and long-term drought actions, Reclamation and the SRSCs intend to make commitments to measures to reduce releases and diversions of water that would otherwise be obtained from Shasta Reservoir to support management of the Central Valley Project (CVP) during critical drought years and provide durable water into the future.

1.1 Background

Reclamation's mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Reclamation is the largest wholesale water supplier in the United States, and the nation's second largest producer of hydroelectric power. Its facilities also provide substantial flood control, recreation, and fish and wildlife benefits.

The CVP consists of 20 dams and reservoirs that together can store nearly 12 million acre-feet (MAF) of water. Reclamation holds over 270 contracts and agreements with 245 agencies for water supplies that depend upon CVP operations. These contracts include Repayment Contracts, Exchange Contracts, Refuge Contracts, Settlement Contracts, and Water Service Contracts. CVP water allocations for agricultural, environmental/refuges, and municipal and industrial (M&I) users vary based on factors such as hydrology, runoff forecast, prior water right commitments, reservoir storage, required water quality releases, required environmental releases, and operational limitations.

Reclamation has settlement contracts executed with the SRSCs. The contracts were first signed in 1964, covering a 40-year term, and renewed in 2005 for another 40 years. The SRSCs' water supply is based upon the settlement of senior water rights on the Sacramento River downstream of Shasta Reservoir. The executed settlement contracts provide that contract totals will be reduced by 25% in a Shasta Critical Year. In accordance with the defined contract terms, a Shasta Critical Year determination and resulting reduction in SRSC contract supply is responsive to shortages in water supplies due to normal hydrologic conditions, climatic variability, and climate change.

Hydrologic conditions, climatic variability, consumptive use within the watershed, and regulatory requirements for operation of water projects commonly affect water supply availability in California. This variability strains water supplies, making advance planning for water shortages necessary and routine, while also presenting opportunities for advancing solutions for drought. In the past decades, Reclamation and water suppliers have coordinated on water management solutions that could be implemented to address drought impacts through drought mitigation and water conservation programs to address water management challenges in critical drought years.

In order to improve egg incubation conditions for winter-run Chinook salmon in the Upper Sacramento River during multi-year droughts, Reclamation proposes to enter into an agreement with the SRSC to establish a Drought Protection Program (Program). The Program would be implemented in two phases which provide for water reductions by the SRSC, in years that meet certain criteria based on hydrologic conditions, and investments in drought resiliency projects.

Funding to the SRSC to reduce diversions and idle/shift their crops and offset the need to divert surface water supplies through groundwater substitution and conservation efforts reduces the amount of water that is released from Shasta Reservoir and diverted by the SRSC. The Proposed Action would provide for additional flexibility in Reclamation's management of operation of the CVP during drought conditions.

1.2 Need for the Proposal

The purpose of the Proposed Action is to execute an agreement with the SRSCs that establishes programs to implement short-term and long-term drought response and water conservation actions. This action is needed to reduce the amount of water that is released from Shasta Reservoir and diverted by the SRSC to provide additional flexibility in Reclamation's management of operation of the CVP during critical drought conditions.

1.3 Geographic Scope

The geographic scope of the drought protection program extends throughout the service area of the SRSC (Figure 1-1). The SRSC service area spans the Sacramento River from Redding in the north to the City of Sacramento in the south within Shasta, Tehama, Butte, Glenn, Colusa, Sutter, Yolo and Sacramento counties. Although the SRSC service area is considered the full geographic scope of the action, not all SRSCs will be participating in the Program.

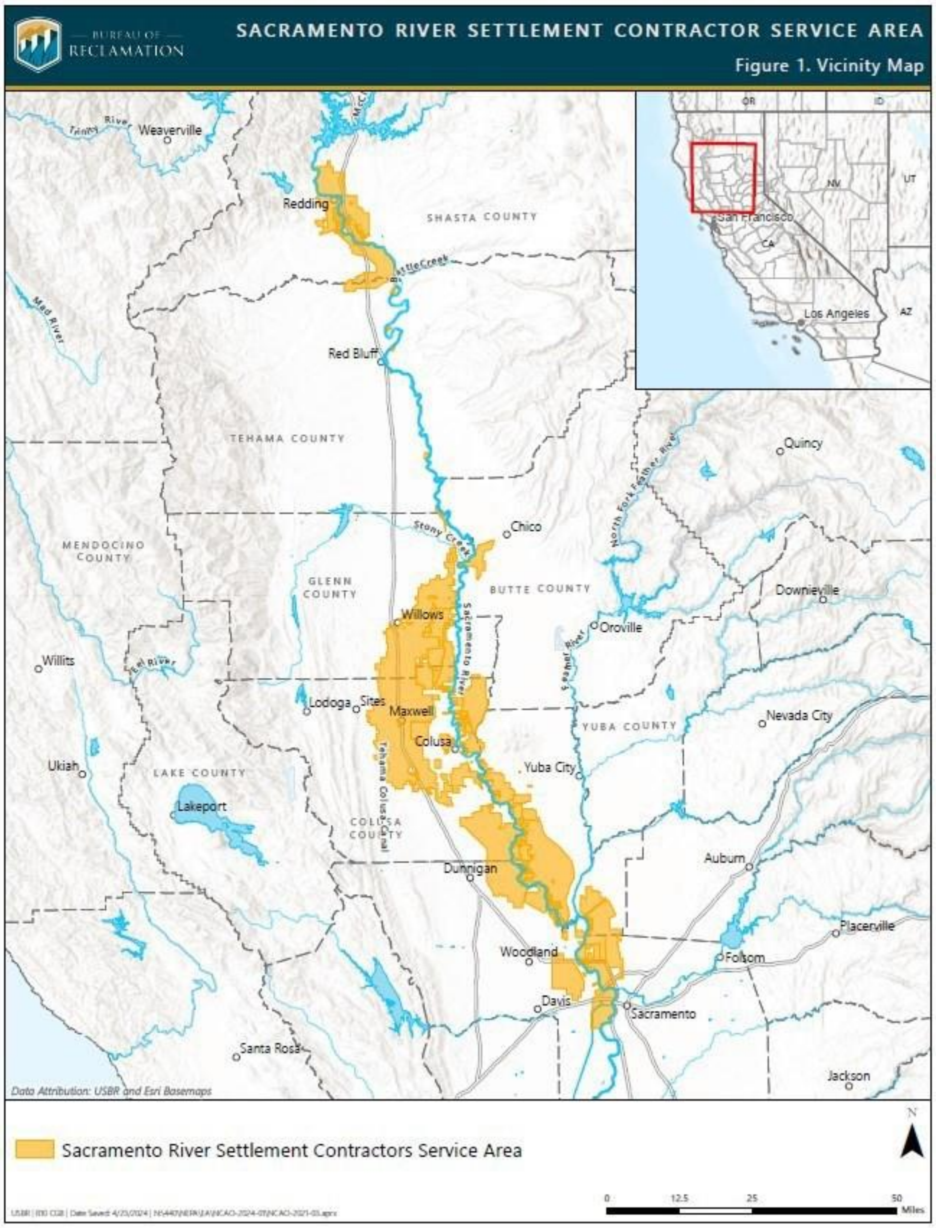

Figure 1-1. Map of Geographic Scope which encompasses the Sacramento River Settlement Contractor Service Area

1.4 Independent Related Activities

CEQ NEPA regulations provide for incorporating by reference general discussions from broader EISs and focusing on issues specific to the document being prepared (43 C.F.R. § 1501.12).

Reclamation, in accordance with DOI NEPA regulations 43 CFR § 46.120(d), should "make the best use of existing NEPA documents by supplementing, tiering to, incorporating by reference, or adopting previous NEPA environmental analyses to avoid redundancy and unnecessary paperwork." The related environmental documents associated with this action and listed in the sections below, contain analysis and assumptions that are appropriate for the analysis in this EA and are hereby incorporated by reference (43 CFR § 46.135).

1.4.1 2024 Long-Term Operations for the Central Valley Project and State Water Project

The Proposed Action is a separate action from the Long-term Operations of the Central Valley Project and the State Water Project that has independent utility.

Shasta Reservoir is the largest reservoir in the CVP and the State of California. It is relied upon for meeting multiple and often competing objectives throughout the State but has limited ability to meet these objectives in drought years. Reclamation operates Shasta Reservoir to target lower temperatures for endangered species at compliance locations in the Sacramento River (53.5° F versus 56°F), which has resulted in less flexibility in operations.

For analysis regarding effects on environmental resources of voluntary actions associated with the Shasta Framework that are being prescribed and memorialized as part of the Agreement, Reclamation incorporated by reference the following Environmental Impact Statement (EIS):

- 2024 Long Term Operation (LTO) of the CVP and State Water Project (SWP) Final EIS and Record of Decision

For potential effects that may occur to aquatic species and previously consulted on terrestrial species as a result of implementation of drought actions taken under the Proposed Action analyzed in this EA, Reclamation is incorporating by reference the 2024 Biological Opinions or the governing Biological Opinion(s) in place at the time of Proposed Action implementation:

- 2024 National Marine Fisheries Service Biological Opinion for the Reinitiation of Consultation on the LTO of the CVP and SWP.
- 2024 U.S. Fish and Wildlife Service Biological Opinion for the Reinitiation of Consultation on the Coordinated Operations of the CVP and SWP.

1.4.2 Sacramento River Settlement Contractor California Environmental Quality Act Compliance

On May 17, 2024, Glenn-Colusa Irrigation District (GCID) issued a California Environmental Quality Act (CEQA) Notice of Preparation (NOP) of Environmental Impact Report for the Water Reduction Program pursuant to its independent obligation to comply with the California Environmental Quality Act. GCID submitted its Draft Environmental Impact Report (DEIR) for public review on September 20, 2024, with the review concluding on November 4, 2024. In December 2024, GCID issued its Final Environmental Impact Report. A Notice of Determination was issued on December 30, 2024. GCID is serving as the lead agency for the SRSC for the proposed action also being analyzed in this environmental assessment**.**

While SRSC has obligations under both state and federal law, CEQA and the California Endangered Species Act do not apply to federal actions or to the Bureau of Reclamation. However, the SRSC's compliance pursuant to CEQA and CESA is addressing the same proposal and as such, there may be overlapping analyses, including potential mitigation. The mitigation measures described in this EA address the SRSC's mitigation obligations under both state and federal law, but references to any state commitments are separate and independent from the commitments required under federal law.

Reclamation recognizes that there may be differences in the analyses and conclusions which are a result of the differing standards under NEPA and CEQA, but is incorporating the analysis and assumptions contained in the EIR by reference. The EIR evaluates the same proposal evaluated in this EA, and the analyses and assumptions contained in the EIR are relevant to Reclamation's decision.

1.4.3 Long Term Water Transfers

Ongoing water transfers occur within the Sacramento Valley with reductions in diversions similar to those that may occur under the Proposed Action analyzed in the EA. Those water transfers involving Reclamation were analyzed under separate environmental documents. Specifically, the Long-Term Water Transfer (LWT) Final Environmental Impact Report/ Environmental Impact Statement (EIR/EIS) for transfers to San Luis & Delta-Mendota Water Authority (SLDMWA) and others from 2019 to 2024 (Reclamation and SLDMWA 2019) and the EA/Initial Study (IS) for Tehama-Colusa Canal Authority (TCCA) 2021 Water Transfers (Reclamation 2021).

- Long-Term Water Transfers EIS/EIR (2019 LWT EIS/EIR) and Record of Decision (ROD), May 7, 2021
- 2021 Tehama-Colusa Canal Authority In-Basin Water Transfers IS/EA and Finding of No Significant Impact, April 2021

Reclamation is undertaking new NEPA analysis concerning North-to-South water transfers. The environmental compliance process is in the preliminary stages with release of a Notice of Intent anticipated to occur in the coming months.

1.4.4 Healthy Rivers and Landscapes

State, Federal and local agencies are working to advance a watershed-wide approach to increase river flows, restore ecosystems and strengthen water supply reliability across the state.

Sacramento Basin flow and non-flow measures that are part of the Voluntary Agreements (VAs) would update and implement the Bay-Delta Water Quality Control Plan. The VAs include system-wide and tributary new flows, habitat restoration, and a governance and science program that would be deployed adaptively. Reclamation and DWR would take specific actions per the terms of the VAs and as analyzed in the 2024 Final EIS for LTO of the CVP and SWP. VA's that will be implemented under the discretion of the primary agencies listed (SRSCs, Feather River Contractors, Yuba County Water Agency, American River Parties, Mokelumne Parties, Putah

Creek Parties) will be analyzed independently in separate environmental compliance, as necessary and appropriate.

Voluntary Agreements offer a watershed-wide approach that includes new flows, habitat restoration, and a governance and science program that would be deployed adaptively and which may be coordinated with components of the Proposed Action identified in the EA.

2 Alternatives

2.1 No Action Alternative

The No Action Alternative may be described as the future circumstances without the Proposed Action that would result in no change from current management direction or level of management intensity. Under the No Action Alternative, Reclamation would not enter into the agreement with the SRSC and water would continue to be managed based on current contracts, allocations and management plans.

Under the No Action Alternative, Reclamation would operate consistent with the 2024 Preferred Alternative of the LTO FEIS (Reclamation 2024), and associated Endangered Species Act (ESA) consultations and decision documents. It is anticipated that Reclamation would sign a Record of Decision on the LTO FEIS in the coming weeks (i.e, December 2024); if a different decision than the 2024 preferred alternative is selected, Reclamation would revise this document. Under the No Action Alternative, Reclamation would continue water management in critical drought conditions with limited flexibility. It is reasonable to assume drought management would continue as described in the Shasta Framework. Prior to the Shasta Framework historical drought responses typically resulted in surface water diversions of approximately 60 percent of SRSC contract totals, although in 2022 water reductions resulted in diversions of 18 percent of SRSC contract totals.

By not entering into the agreement, actions by the SRSCs would remain voluntary and likely developed, if at all, after drought conditions begin. Water temperature management in the upper Sacramento River would continue to be very challenging in critically dry years with less carryover and less drought protection if the following year continued to be dry.

2.2 Proposed Action

2.2.1 Drought Protection Program

Under the Proposed Action, Reclamation is proposing to enter into an agreement between Reclamation and the SRSCs for the establishment of a Drought Protection Program (Program). Reclamation would fund the Agreement by providing $225 million upon execution of the Contract, in a one-time, non-refundable payment with funds available to Reclamation under the Inflation Reduction Act. An additional $25 million, made up of non-refundable payments of at least $2.5 million per year during the first 10 years following the first Year of this Contract, would be paid from other sources of funding available to Reclamation, subject to appropriations. The proposed agreement would support a reduction in releases and diversions that would be in addition to Article 5 shortages included in the Sacramento River Settlement Contracts. The proposed agreement would result in the SRSCs forgoing a larger percentage of their contract supply in specified drought years under two phases. In addition, the SRSC will engage in drought resiliency projects to reduce potential impacts due to reduced contract supply. The SRSC shall use at least 50.1% of the Inflation Reduction Act proceeds to invest in drought resiliency projects.

During years when the Program is implemented, critically dry conditions exist, the system is stressed, and water resources are not available to meet all demands. There is low confidence to meet targeted water temperatures for winter-run Chinook salmon egg incubation and future drought protection is at risk. In these dry years, Shasta Reservoir is expected to be operated primarily for meeting public health and safety (including salinity management in the Delta), obligations to senior water right holders under the SRSC, and minimum instream flows.

The Program would be implemented in a critical water year and is often within a series of drier years such as during a multi-year drought sequence. Under the conditions that would trigger a Program year, water temperature management is expected to be very challenging, and carryover is needed for drought protection if the following year continues to be dry. Under the Proposed Action the reduction in SRSC diversions will be contractual versus voluntary, therefore will occur with more certainty.

The Proposed Action has independent utility from water management of the CVP in that water management under the Agreement includes coordinating efforts, but the actual management of the water is not being evaluated in this EA. Reclamation would manage water in Shasta Reservoir in accordance with its legal authorities and operational obligations based on real-time conditions consistent with the 2024 LTO FEIS and ROD.

2.2.2 Program Phases

Under Phase 1 of the Program (February 2025 – February 2035), the SRSCs would collectively incur a reduced contract supply (resulting in reduced surface water diversions) of up to 500,000 acre-feet under their aggregated contracts in any year if the following four conditions are met by April 15 which are defined as Phase 1 Program Years:

- Forecasted end-of-April Shasta Reservoir storage is less than 3.0 million acre-feet;
- Forecasted end-of-September Shasta Reservoir storage is less than 2.0 million acre-feet;
- Combined actual and forecasted natural inflow to Shasta Reservoir from October 1 through April 30 is less than 2.5 million acre-feet; and
- Reclamation forecasts a Critical Year under the Settlement Contracts.

Based on modeling results, Phase 1 Program Years are anticipated to occur on average 0.66 times over a ten-year period. The maximum potential to occur is four times over a ten-year period similar to 1924 – 1933 with prolonged droughts. No occurrence would occur through many 10 plus year periods similar to years such as 1934–1976, 1978–1990, and 1992–2013. These results are based on Calsim model simulation under 2022MED climate and Alt2v2 operations and are not meant to represent historical conditions. Reductions in releases and diversions would be anticipated to occur in Phase 1 Program Years as shown in Table 2-1.

Table 2-1. Approximate Maximum Surface Water Diversion Reduction per SRS Contractor per Phase 1 Program Year

SRSC Contractor	Water Reduction acre- feet (AF) per Phase 1 Program Year)
Glenn-Colusa Irrigation District	197,555
Reclamation District No. 108	55,555
Sutter Mutual Water Company	54,118
Anderson-Cottonwood Irrigation	29,933
Natomas Central Mutual Water	28,783
Reclamation District No. 1004	17,097
Princeton-Codora-Glenn Irrigation	16,238
Provident Irrigation District	13,106
Conaway Preservation Group, LLC	9,785
Meridian Farms Water Company	8,381
Sycamore Family Trust	7,615
RRG Garden Properties, LLC	7,136
Pleasant Grove Verona Mutual Water	6,295
City of Redding	5,029
Maxwell Irrigation District	4,305
M&T Chico Ranch	4,300
Pelger Road 1700	2,411
Woodland-Davis	2,395
Other	29,964
Total	500,000

Under Phase 2 (February 2035 – February 2045), the SRSCs may voluntarily incur a reduced contract supply of up to 100,000 acre-feet under their aggregated contracts in any year if the following two conditions are met which are defined as Phase 2 Program Years:

- Combined actual and forecasted natural inflow to Shasta Reservoir from October 1 through April 30 is less than 2.5 million acre-feet; and
- Reclamation forecasts a Critical Year under the Settlement Contracts.

Based on modeling results, Phase 2 Program Years are anticipated to occur on average .88 times over a ten-year period. The maximum potential to occur is four times over a ten-year period, similar to 1924–1933 with prolonged droughts. No occurrence would occur through many 10 plus year periods, similar to years such as 1934–1976, 1978–1989, and 1995–2013. These results are based on Calsim model simulation under 2022MED climate and Alt2v2 operations and are not meant to represent historical conditions. Reductions in releases and diversions would be anticipated to occur in Phase 2 Program Years as shown in Table 2-2.

Table 2-2. Approximate Maximum Surface Water Diversion Reduction per SRS Contractor per Phase 2 Program Year

SRSC Contractor	**Water Reduction (AF per Phase 2 Program Year)**
Glenn-Colusa Irrigation District	39,511
Reclamation District No. 108	11,111
Sutter Mutual Water Company	10,824
Anderson-Cottonwood Irrigation	5,987
Natomas Central Mutual Water	5,757
Reclamation District No. 1004	3,419
Princeton-Codora-Glenn Irrigation	3,248
Provident Irrigation District	2,621
Conaway Preservation Group, LLC	1,957
Meridian Farms Water Company	1,676
Sycamore Family Trust	1,523
RRG Garden Properties, LLC	1,427
Pleasant Grove Verona Mutual Water	1,259
City of Redding	1,006
Maxwell Irrigation District	861
M&T Chico Ranch	860
Pelger Road 1700	482
Woodland-Davis	479
Other	5,992
Total	100,000

The contractors' use of their contract supplies is tracked monthly by Reclamation and provided on water account records they provide to each contractor. The monthly quantities by the largest SRSC are posted online in Reclamation's Table 28 and available on Reclamation's website.

2.3 Methods for Accomplishing Water Reductions

The contract supply reductions would be achieved by implementing surface water diversion reduction activities and investing in drought-resiliency projects. These activities are further described below. Under the Proposed Action, reduced surface water diversions would be required rather than voluntary under No Action.

2.3.1 Surface Water Diversion Reduction-Related Activities

2.3.1.1 Cropland Idling

Cropland idling occurs when water that would have been used for agricultural production is forgone. Under water reductions, the SRSC would divert less water supply from Reclamation and then would go through the process of allocating that water supply to landowners and lands within their respective service areas. Cropland idling could occur as a result of receiving less supply, since the SRSC would need to balance water supply and crop demand. Cropland idling would be temporary in nature and would not result in a permanent conversion of agricultural lands. Landowners would likely place fields back into production the following season.

The acreage of cropland idling would be calculated based on water application to crops which consists of both consumptive and non-consumptive uses. For rice in the Sacramento Valley, consumptive uses have ranged from 3.0 to 3.3 acre-feet per acre. Additionally, non-consumptive components of irrigation water are also needed, which may consist of irrigation delivery inefficiencies, soil types that effect groundwater recharge when water passes below the crop root zone, shallow groundwater moving laterally into non irrigated fields, uncapturable return flows, and other crop cultural practices. These components may require another additional 3.0–4.0 acre-feet per acre generally that is additive to the consumptive use component which results in a total water application factor of about 6.0–7.0 acre-feet per acre.

Additionally, there are SRSC canal conveyance losses which occur regardless of the amount of water supply. As water supply is reduced the conveyance loss becomes a larger percentage that must be deducted from the available water supply, with ranges from five to thirty percent of the water delivered from the SRSC points of diversion to landowner lands. Those conveyance losses will reduce the water available for cropping. Applying a range of 6.0 to 7.0 acre-feet per acre water application factor across the SRSC service area to the maximum 500,000 AF of Phase 1 Program Year, and the maximum 100,000 AF of Phase 2 Program Year of reductions in diversions results in a maximum of 71,429 to 83,333 acres and 14,285 to 16,667 acres of rice acreage anticipated to be idled as a result of the Proposed Action, as shown in Table 2-3 and 2-4, respectively. Applying a standard water application factor across the SRSC service area would not be consistent with the unique physical characteristics of each SRSC service area. Therefore, Tables 2-3 and 2-4 identify the maximum annual cropland idling acreage that the SRSC would incur as a result of the proposed Agreement, considering that each contactor may have an assumed water application factor that varies between 6 and 7 acre-feet per acre for rice.

Table 2-3. Maximum Annual Cropland Idling Acreages within Sacramento River Settlement Contractor Service Area Resulting from Phase 1

Phase	Sacramento River Settlement Contractor Max Reduction Volume (AF)	Assumed Water Application Factor (AF/acre)	Maximum Annual Idling Acreages for Rice
Phase 1	500,000	6.0–7.0	71,429–83,333

Table 2-4. Maximum Annual Cropland Idling Acreages within Sacramento River Settlement Contractor Service Area Resulting from Phase 2

Phase	Sacramento River Settlement Contractor Max Reduction Volume (AF)	Assumed Water Application Factor (AF/acre)	Maximum Annual Idling Acreages for Rice
Phase 2	100,000	6.0–7.0	14,285–16,667

2.3.1.2 Crop Shifting

For crop shifting, water is made available when farmers shift from growing a higher water use crop to a lower water use crop. The difference in evapotranspiration of applied water values would be the amount of water that is reduced. Water generated by crop shifting is difficult to account for. Farmers generally rotate among several crops to maintain soil quality, so water agencies may not know what type of crop would have been planted in a given year. To calculate water reduced from crop shifting, an estimate of what would have happened absent water reductions based on average water use during a 5-year baseline period would be made. The change in consumptive use between this baseline estimate and the lower water use crop determines the amount of acreage shifted to generate diversion reductions.

2.3.1.3 Groundwater Substitution

Groundwater substitution occurs when groundwater is pumped in lieu of diverting surface water supplies, thereby making the surface water available for other uses. Program participants that reduce surface water deliveries through groundwater substitution may choose to pump groundwater in lieu of or in addition to cropland idling/shifting. The maximum crop idling/shifting rice acreage described above may be reduced through groundwater substitution by the SRSC with up to 167,100 acre-feet and 33,420 acre-feet of groundwater anticipated to be pumped annually during Agreement Years in Phases 1 and 2 respectively. Agreement participants engaging in groundwater substitution would reduce surface water use from April through October.

2.3.1.4 Water Conservation

Water conservation includes actions to reduce the diversion of surface water by improving water conservation and irrigation efficiencies. Water conservation actions will be based on an effective water conservation and efficiency program based on the Regional Water Management Plan and/or individual contractor's water conservation plan as required under the applicable Contractors contract. For Contractors diverting less than 2,000 AF of project water, a written water conservation plan is not required, and water conservation actions would be based on state and local policies governing such actions.

2.3.2 Drought Resiliency Projects

Drought-resiliency projects are a broad range of actions intended to strengthen the resilience of the SRSC's water system and long-term water delivery capabilities. The resiliency projects will assist Reclamation and the SRSC with withstanding and recovering from climatic variability in order to support healthy aquatic and terrestrial ecosystems and create durable water savings while sustaining a more drought-resilient economy that retains its vitality. Drought-resiliency projects are expected to be constructed and implemented during Phase 1, but it is possible some may still be constructed in Phase 2. It is anticipated that with the implementation of drought resiliency projects, the need for the water reduction-related activities described in Section 2.3.1 (e.g., crop idling, groundwater substitution) may be reduced over time. The drought-resiliency projects would not involve the construction of any new large-scale development such as large structures, large-scale infrastructure, or roadways. The following non-exhaustive list of equipment are expected to be used to construct the proposed drought-resiliency projects as needed: excavators, roller-compactors, small cranes, dozers, backhoe loaders, concrete trucks, and hand-held tools.

The proposed drought-resiliency projects expected to be implemented as part of the Drought Protection Program include piping open ditches or canals, canal lining, canal automation through supervisory control and data acquisition, automated gates installation, on-farm improvements to irrigation, weirs or check structures, pipeline recirculation programs, new groundwater or deep aquifer wells, and conjunctive use program(s). Because these projects are in the very early stages of planning, they remain speculative regarding design, scope, and locations and are being considered programmatically. Appendix A, *Drought Resiliency Projects Technical Details* provides a description of the site preparation, excavation and regrading, pipeline recirculation installation, backfilling, demobilization, and operation.

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3 Affected Environment and Environmental Consequences

This section addresses the affected environment and environmental consequences of the Proposed Action when compared to the No Action Alternative.

3.1 Resources Eliminated from Further Analysis

The following resources were not analyzed in detail in this environmental assessment. As described in Code of Federal Regulations title 40, section 1501.2, an "agency shall identify environmental effects and values in adequate detail so the decision maker can appropriately consider such effects and values alongside economic and technical analyses." To meet this purpose, the following resources were not analyzed in detail because there would not be impacts to these resources, as explained below.

3.1.1 Transportation

Impacts on traffic and transportation are usually the result of actions that would either directly or indirectly increase road congestion, thereby potentially increasing travel times on roads, increasing emergency response times, or conflicting with local traffic or transportation plans. Such impacts are typically the result of the addition of new roads, new infrastructure that could lead to increased traffic or population growth, or construction activities that would generate additional truck traffic. The alternatives evaluated in this EA would not cause impacts on traffic and transportation because they are comprised of surface water diversion reduction-related activities that would not directly or indirectly affect traffic. The drought resiliency projects may contribute to a minor, temporary increase in construction vehicles only during the construction period. However, this minor increase would not induce additional traffic or interfere with existing traffic and transportation patterns especially in consideration of ongoing agricultural practices and associated operation and maintenance activities. Therefore, it is not anticipated that the No Action Alternative or the Proposed Action would result in impacts on traffic and transportation as the result of operation-related activities.

3.1.2 Utilities

Impacts on utilities are the result of actions that would directly or indirectly impact energy use (electricity and natural gas) and telecommunications or actions that would result in the relocation or construction of new or expanded electric power, natural gas, or telecommunication facilities that could cause environmental impacts. The alternatives evaluated in this EA would not cause impacts on utilities because they are comprised of surface water diversion reduction-related activities that would not directly or indirectly affect utilities. The drought resiliency projects may require connection to electricity and telecommunications systems. Siting of drought resiliency projects would avoid utilities. Although operation of drought resiliency projects would require connections to utilities to function utility companies would approve any modifications needed. Since the drought resiliency projects are anticipated to be small-scale construction projects that are common on the landscape, it is not anticipated that the No Action Alternative or the Proposed Action would result in impacts on utilities.

3.1.3 Population and Housing

Typically, impacts on population and housing are the result of actions that would induce population growth either directly or indirectly or actions that would displace large numbers of people and, therefore, necessitate the construction of additional housing in other locations.

Direct impacts would include actions that create additional housing. Indirect impacts include actions that create infrastructure that would induce or support population growth beyond current expectations. The alternatives evaluated in this EA would not cause impacts on population and housing because they are composed primarily of surface water diversion reduction-related activities and small-scale construction projects that would not directly or indirectly affect housing or residential populations or create new water supplies that are anticipated to accommodate growth. The alternatives would not create additional housing, provide infrastructure to support additional population, or displace existing populations necessitating the creation of housing in another location. Therefore, it is not anticipated that the alternatives would result in either direct or indirect population growth as the result of operations-related activities.

3.1.4 Hazards

Impacts on hazards such as wildfires and public health and safety are the result of actions that would increase undeveloped areas with extensive areas of non-irrigated vegetation and actions related to construction activities. Construction activities that disturb soil by digging, vehicles, cultivation, or wind and pose a risk of exposure from Coccidioidomycosis (Valley fever). There is potential for a slight increase of Valley Fever and wildfires due to increased idle fields from water reduction activities. The study area contains ongoing agricultural activities that introduce hazardous materials (e.g., pesticides, fertilizers, industrial waste) and potential hazards (e.g., creating conditions for the spread of vector-borne diseases from mosquitos (e.g., seasonal wetlands). The alternatives evaluated in this EA would cause a decrease in irrigated agricultural acreages in the study area under certain hydrologic conditions. Some crops that would be shifted may use more or less pesticides than others, but overall, there would be no substantial change in the use of hazardous materials as a result of crop shifting. Groundwater pumping and conservation activities would have no impact on use of hazardous materials. Construction of the drought-resiliency projects could involve the use of heavy equipment and entail activities that have the potential to ignite fires, such as the use of flammable and combustible materials.

Potential construction impacts would be reduced if appropriate Best Management Practices (BMPs) are implemented such as developing hazardous materials management plans and spill prevention and response plans. Since these impacts to the environment are considered minor, hazards will not be analyzed further in this EA.

3.1.5 Indian Trust Assets

Typically, impacts on Indian Trust Assets (ITAs) are the result of direct or indirect actions that would include interference with the exercise of a reserved water right, degradation of water quality where there is a water right, impacts to fish or wildlife where there is a hunting or fishing right, [and] noise near a reservation when it adversely impacts uses of reservation lands (Reclamation 2012). Groundwater pumping impacts are anticipated to be minor under the Proposed Action and would not be anticipated to decrease water supplies; affect the health of tribal members; or federally-reserved hunting, gathering, or fishing rights.

Although ITAs are not anticipated to be impacted based on the information known at this time, water reduction volumes, including groundwater substitution, may vary in different Agreement years depending on hydrologic conditions, uses of the water, funding, and other factors. Agreement participants and landowners within the SRSC may choose to do a combination of cropland idling, crop shifting, groundwater pumping, and/or conservation when contract reductions occur. These activities could change from Agreement Year to Agreement Year depending on many factors, including prior year operations and conditions, crop market prices, and current year operational costs. Once a project is identified which involves groundwater substitution and drought resiliency projects, ITA's that could be affected would be identified and potential impacts evaluated prior to project implementation.

3.2 Visual

3.2.1 Affected Environment

The Sacramento Valley is generally identified as the region extending upstream from the Sacramento area to the Redding metropolitan area. The Sacramento Valley extends from the northern mountainous areas to the flat, agricultural landscapes of the Central Valley at the lower elevations. The mountainous areas are characterized by rugged and deep river canyons and valleys that extend from jagged peaks to forested areas with pine and deciduous trees. Large rivers flow from the mountain areas through the foothills into the agricultural areas and communities along the valley floor. Oak woodlands are located at middle and lower elevations of the foothills and along riparian corridors on the valley floor.

Physical form and visual character are the result of the interaction of natural and engineered elements. Natural elements of topography, hydrology, vegetation, and climate create the physical context. Engineered elements, such as buildings, roads, infrastructure, and settlement patterns, are secondary elements that act on the natural physical context to establish a visual environment. Both the natural and engineered landscape features contribute to perceived views and the aesthetic value of those views.

The Study Area is dominated by agriculture, rural land uses, and water resources with more urban and suburban views in cities such as Redding. Views of the study area primarily consist of agricultural landscapes and associated facilities and equipment.

3.2.2 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis and drought resiliency projects would not be implemented. Cropland idling, cropland shifting, conservation activities, groundwater substitution, and small-scale construction projects already occur in the study area, therefore, the visual character of the No Action Alternative reflects that of the affected environment.

3.2.3 Proposed Action

3.2.3.1 Surface Water Diversion Reduction-Related Activities

The Proposed Action would require an increase in fallowed land and may cause minor impacts to the landscape character and scenic attractiveness of existing visual resources in Program Years compared to the No Action Alternative. Idled lands are visually similar to fallowed fields, which are generally typical features of agricultural landscapes as part of normal cultivation practices. Although these surface water diversion reduction-related activities could result in temporary increases in incremental visual changes, the Proposed Action would not be expected to substantially alter views or result in substantial, permanent changes or degradation to the visual character or quality of the study area's surroundings. The required reduction would be less than occurred in 2022, when water made available for diversion amounted to 18% of contract totals.

3.2.3.2 Drought Resiliency Projects

There could be short-term construction effects as a result of implementation of drought resiliency projects under the Proposed Action. These short-term effects would result from construction vehicles, trucks, and other construction equipment and activities that could temporarily affect the quality of visual resources and views during construction activities. While there may be minor visual changes from construction equipment and activities, these activities and types of equipment are similar to those already present as part of ongoing agricultural operations and maintenance activities regularly conducted in the study area (GCID 2024).

3.2.4 Mitigation Measures

No Avoidance and Minimization Measures, or additional Mitigation Measures have been identified.

3.3 Agricultural Land Use

Cropland idling and the drought resiliency projects would be the only surface water diversion reduction-related activity that may impact land use in the area of analysis. Implementation of crop shifting, groundwater substitution, and water conservation would not affect agricultural land uses and are not further discussed in this section. Neither alternative would affect other types of land uses (such as municipal, industrial, or forest lands); therefore, only agricultural land use is analyzed.

3.3.1 Affected Environment

The boundaries of the Proposed Action area follow the service areas for the SRSC along the Sacramento River. Agricultural land comprises most of the study area (GCID 2024). The Proposed Action would mostly occur within lands that are zoned as and used for agriculture and related facilities.

3.3.1.1 Land Use

The following table (Table-3-1) provides the approximate acres of agricultural land within each county within the SRSC service area.

Table 3-1. Approximate acres of Agricultural Land within the Sacramento River Settlement Contractor Service Area

County	Acres	Surrounding Counties	Acres of Agricultural Lands	Percent of County in Agricultural Lands
Butte	1,075,200	Tehama, Plumas, Glenn, Colusa, Sutter, and Yuba	474,282	44
Colusa	725,120	Glenn, Butte, Sutter, Lake, and Yolo	543,840	75
Glenn	842,880	Tehama, Butte, Lake, Mendocino, and Colusa	583,974	69
Sacramento	636,160	Sutter, Placer, El Dorado, Amador, Contra Costa, San Joaquin, Yolo, and Solano	256,617	40
Shasta	2,416,640	Siskiyou, Lassen, Tehama, and Trinity	169,127	7
N/A	N/A	Yolo, and Sacramento	N/A	N/A
Tehama	1,892,000	Shasta, Plumas, Trinity, Mendocino, Glenn, and Butte	613,654	32
Yolo	655,360	Colusa, Sutter, Sacramento, Solano, Lake, and Napa	557,056	85
Total	8,631,898	N/A	3,571,707	N/A

3.3.1.2 Agricultural Resources

Agricultural land comprises most of the Proposed Action area, with over 40 crops grown in the eight counties. Crops in the Proposed Action area include permanent crops, annual crops, or pasture.

Permanent crops are the lead revenue-generating agriculture commodities. These crops are typically perennial species that do not require annual replanting. Almonds, walnuts, apricots, cherries, grapes, olives, peaches, nectarines, pistachios, alfalfa, and pears are permanent crop types harvested in the project area. Annual crops consist of annual species, which are species that complete their life cycle within one growing season. These species often provide habitat resources in addition to economic value. Annual crops are listed as some of the highest value crops in the study area and include rice, grain, and seed crops such as corn, wheat, barley, soybeans, sunflowers, and most row crops, such as tomatoes, pumpkins, squash, beets, potatoes, yams, carrots, onions, garlic, turnips, and radishes. Rice is a flood-irrigated crop of seed-producing annual grasses. Rice fields are managed in a flooded state until harvesting time nears. Other cultivated crops include grain and seed crops, which are annual grasses that are grown in dense stands and include corn, wheat, barley, and others. Pasture crops are also mostly annual or perennial species. However, unlike permanent and annual crops, pasture crops are grown with the specific purpose of providing forage for livestock.

Year 2022 data was the most recent critical year data available for the eight counties which best represents the hydrological conditions when water reduction actions may be taken. In 2022, the total crop acreage in the project area was 453,569 acres (GCID 2024). The top five crops (based on acreages) in the study area were rice, walnuts, almonds, sunflowers, and tomatoes. Of the total crop acreage (453,569 acres), idle or unassigned croplands covered 280,260 acres (GCID 2024). Field crops, including rice and sunflowers, had the highest harvest acreages covering 79,556 acres or 17.5% of the total crop acreage in the project area in 2022 (GCID 2024). Other prominent crop categories included row crops, orchard crops, and pasture crops (GCID 2024). Colusa County contains the most crop acreage in the study area (GCID 2024).

Overall, the Sacramento River region saw a decrease of approximately 96,000 acres in Important Farmland within the 10-year period from 2008–2018 (California Department of Conservation 2023).

3.3.2 Rice Production

The Sacramento Valley, primarily north and west of the city of Sacramento, is dominated by agricultural land. The average area of rice production in the eight counties encompassing the study area from 1992 through 2023 was about 445,000 acres (Table 3-2; table updated by County annual crop report except for Colusa County from 1992-1998 where the numbers were carried forward from Table 10 of the 2019 U.S. Fish and Wildlife Service Biological Opinion on Long-Term Water Transfers 2019-2024). Total rice acreage varies based on economic conditions and farming practices. Crop rotation and fallowing are a standard rice farming practice that can reduce disease and improve soil and water quality. Since 1992, the acreage of planted rice in the study area has varied from a low of approximately 195,000 acres in 2022, to a high of over 586,000 acres in 2004.

The maximum annual decline of rice acreage was approximately 154,000 acres in 2022 (Table 4-3), but this was during ongoing critically dry hydrologic conditions. Rice acreage in most counties has increased since 1992, with the largest average increase being approximately 105,502 acres between 2022 and 2023 which represents a year with critically dry hydrology with the next largest average increase of 35,000 acres between 2015 and 2016, both in Colusa County.

Table 3-2. Estimated Sacramento Valley Rice Production (acres) from 1992-2023 by County

Year	Butte	Colusa	Glenn	Sac	Sutter	Yolo	Shasta	Total[1]	Total Annual Change
1992	78,700	94,800	78,700	920	73,780	21,680	1,450	350,030	--
1993	84,813	112,000	84,813	1,100	79,896	21,909	1,450	385,981	35,951
1994	95,100	123,000	95,100	1,300	102,589	20,917	1,550	439,556	53,575
1995	86,400	122,000	86,400	1,300	105,482	25,012	1,300	427,894	-11,662
1996	98,200	136,000	98,200	2,400	93,164	25,999	2,200	456,163	28,269
1997	98,500	137,000	98,500	8,206	90,437	25,800	2,400	460,843	4,680
1998	96,000	121,000	96,000	6,958	94,442	17,816	2,300	434,516	-26,327
1999	96,500	140,920	96,500	9,861	100,087	24,483	2,833	471,184	36,668
2000	98,000	147,270	98,000	7,606	107,704	36,229	3,500	498,309	27,125
2001	86,000	111,250	86,000	7,110	81,857	28,717	4,000	404,934	-93,375
2002	94,700	134,300	94,700	8,831	96,224	32,446	4,100	465,301	60,367
2003	92,500	127,350	92,500	10,768	93,654	37,303	3,600	457,675	-7,626
2004	150,000	150,130	105,000	9,851	121,131	45,655	4,500	586,267	128,592
2005	96,400	136,400	96,400	8,155	97,801	34,670	4,600	474,426	-111,841
2006	105,673	142,600	105,673	3,166	92,984	29,997	5,200	485,293	10,867
2007	101,634	148,550	101,634	2,935	108,241	32,660	5,500	501,154	15,861
2008	105,301	150,200	77,770	2,488	92,344	30,057	6,300	464,460	-36,694
2009	103,416	152,400	89,483	3,120	109,766	36,593	6,700	501,478	37,018
2010	93,800	154,000	88,209	4,184	115,449	41,372	4,300	501,314	-164
2011	95,043	149,460	84,932	3,478	111,741	42,476	5,000	492,130	-9,184

[1] Tehama County is not included in this table as there is no rice production recorded in this county in any year covered by this table.

Year	Butte	Colusa	Glenn	Sac	Sutter	Yolo	Shasta	Total[1]	Total Annual Change
2012	94,451	149,860	84,760	5,899	11,550	40,461	5,700	392,681	-99,449
2013	98,445	148,515	85,253	8,363	115,949	38,432	5,700	500,657	107,976
2014	77,800	111,113	73,318	8,589	75,903	39,325	5,600	391,648	-109,009
2015	87,700	100,475	68,400	8,260	88,591	23,000	5,500	381,926	-9,722
2016	95,045	135,355	77,400	8,840	113,084	35,800	5,800	471,324	89,398
2017	93,444	135,000	83,407	7,300	80,531	28,600	5,800	434,082	-37,242
2018	92,250	143,174	83,484	8,812	103,705	33,300	5,800	470,525	36,443
2019	96,772	142,256	82,306	7,889	126,820	34,700	5,200	495,943	25,418
2020	96,915	125,504	72,455	8,597	108,778	34,780	5,500	452,529	-43,414
2021	85,531	99,214	61,120	8,673	74,506	15,475	5,400	349,919	-102,610
2022	85,444	16,958	21,492	6,162	50,787	9,507	5,000	195,350	-154,569
2023	85,444	122,460	75,485	8,437	125,000	29,974	4,500	451,300	255,950
Average	95,185	128,766	85,106	6,236	95,124	30,473	4,321	445,016	N/A

3.3.2.1 Tribal Lands in the Sacramento River Region

Table 33 summarizes the tribal lands that could be affected by the Proposed Action and that are located within the county boundaries.

Table 3-3. Federally Recognized Tribes and Tribal Lands in the Sacramento River Region

County	Federally Recognized Tribe or Tribal Lands
Butte	Berry Creek Rancheria of Maidu Indians, Mooretown Rancheria of Maidu Indians, Mechoopda Indian Tribe of Chico Rancheria and Enterprise Rancheria of Maidu Indians of California
Colusa	Cachil Dehe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, the Kletsel Dehe Band of Wintun Indians
Glenn	Grindstone Indian Rancheria of Wintun-Wailaki Indians of California and Paskenta Band of Nomlaki Indians of California
Sacramento	Wilton Rancheria and the Buena Vista Rancheria of Me-Wuk Indians of California
Shasta	Pit River Tribe and Redding Rancheria
Sutter	None
Tehama	Paskenta Band of Nomlaki Indians of California
Yolo	Yocha Dehe Wintun Nation

Sources: Bureau of Indian Affairs 2023; Paskenta Band of Nomlaki Indians 2023.

3.3.3 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis and drought resiliency projects would not be implemented. Cropland idling, cropland shifting, conservation activities, groundwater substitution, and small-scale construction projects already occur in the study area.

3.3.4 Proposed Action

3.3.4.1 Surface Water Diversion Reduction-Related Activities

A maximum of 83,333 acres would be idled as a result of the surface water diversion reductions, which represents 2.3 percent of the total acreage of agricultural land within the study area.

Approximately 268,426 acres of rice are grown each year within the SRSC Service Area (Reclamation 2024) and approximately 445,016 acres of rice are grown on average each year in the eight counties (Table 3-2). Maximum cropland idling of 83,333 acres for rice could be approximately 31.6 percent of rice within the SRSC Service Area and 18.7 percent of the average annual rice production within the eight counties in the study area. Impacts from cropland idling would generally be expected to be temporary in nature as agricultural fields would remain viable after idling ceases and would not be expected to result in permanent conversion of agricultural lands. As described in Section 2.2.2, additional reductions in contract supply resulting from the Proposed Action anticipated to occur on average 0.66 times over the 10-year Phase 1 period with a maximum potential for there to be a Phase 1 Agreement Year four times over a 10-year period. Additional reductions in contract supply would be anticipated to occur on average 0.88 times over the 10-year Phase 2 period with a maximum potential for there to be a Phase 2 Agreement Year four times over a 10-year period. The Proposed Action surface water diversion reductions would not result in permanent conversions of agricultural lands or Important Farmland, to non-agricultural use.

Cropland shifting would involve converting historically planted higher-water-intensive crops like rice to lower-water-using crops, such as tomatoes, wheat, or safflower. In the scenario where a rice field were to shift to a tomato crop, the land would still have an agricultural use.

Landowners or cities would continue to use existing wells in addition to using new wells constructed as drought-resiliency projects (see Section 3.3.4.2) for irrigation or domestic purposes for groundwater substitution. Groundwater substitution would not result in converting croplands to non-agricultural uses. Conservation activities to reduce contract water loss would not result in temporary or permanent conversion of agricultural land.

Because surface water diversion reduction activities would be temporary in nature, crop idling would affect a small percentage of the overall agricultural land in the study area, no permanent conversions of Important Farmland acres would occur, and crop shifting, groundwater substitution and conservation activities would have no impact on agricultural lands, the Proposed Action's impacts would be similar on agricultural land use when compared to the No

Action Alternative. The required reduction would be less than occurred in 2022, when water made available for diversion amounted to 18% of contract totals.

3.3.4.2 Drought Resiliency Projects

Construction of the drought resiliency projects could result in the installation of structures to support water delivery infrastructure, an essential agricultural use, on lands currently used for agriculture. Structures associated with pipeline recirculation programs, new groundwater wells, and conjunctive use programs could occur on agricultural lands. Although the footprint of certain drought resiliency projects and permanent access areas would be permanently used for water delivery infrastructure to support agricultural uses, the remainder of the associated farmlands would remain available for agriculture. The purpose of the pipeline recirculation programs, new groundwater wells, and conjunctive use programs would be to improve water supply and maintain agricultural uses.

For other drought-resiliency projects, including piping open ditches or canals, on-farm improvements to irrigation systems, canal lining and modernization, installing weirs or check structures, and installing automated gates, the final construction footprint of these projects would be expected to occur in areas that are not used for planting (for example an existing ditch converted to a pipeline would not occur on actively farmed lands, but in an area that is already used for agricultural support infrastructure). All drought resiliency projects would require access and staging that could temporarily obstruct farmland but would not result in the permanent conversion of farmlands to non-agricultural uses.

3.3.5 Mitigation Measures

No Avoidance and Minimization Measures, or additional Mitigation Measures have been identified.

3.4 Hydrology and Water Quality

3.4.1 Affected Environment

3.4.1.1 Surface Water

Variability and uncertainty are dominant characteristics of California’s water resources. Precipitation is the primary source of California’s water supply (DWR 2018a). It varies greatly from year to year, as well as by season and location within the state. Unpredictability and geographic variation in precipitation that California receives make it challenging to manage available runoff to meet urban, agricultural, and environmental water needs. With climate change, precipitation patterns are expected to become even more unpredictable.

In an average water year, based on data from 2011–2015, California receives approximately 155 million acre-feet (MAF) of water from precipitation and imports from Colorado and Oregon, and Mexico (DWR 2018a). The total volume of water the state receives from precipitation can vary dramatically between dry and wet years. In 2011, a wet year, California received approximately

250 MAF of precipitation and in 2014, a critical year, California received approximately 100 MAF of precipitation (DWR 2018a). Additionally, most of the precipitation occurs between November and March in the northern portion of the state (DWR 2023).

During an average year, approximately two thirds of the precipitation that California receives is lost through evapotranspiration by trees and other vegetation, evaporation into the atmosphere, runoff, storage as effective precipitation, or through other outflows (DWR 2018b). Therefore, approximately one third of the precipitation remains available for use by urban, agricultural, and other environmental uses. However, the variability of annual precipitation in California and the differences in volumes of precipitation and runoff between different regions of the state makes it difficult to standardize water management between years (DWR 2018b). With climate change, precipitation patterns are expected to become even more unpredictable.

Due to hydrologic variability that ranges from dry summers and fall months to floods in winter and spring, water from precipitation in winter and spring must be stored for use in summer and fall.

Most of the study area includes agricultural land with water infrastructure and conveyance to supply land with irrigation water. Hydrology has been modified, influenced, and altered by agricultural practices that are supplied by the Sacramento River. In addition to agricultural practices, water is supplied to industrial, municipal, water quality, and wildlife purposes. While recent droughts, ending in 2023, have caused the driest hydrologic period on record in portions of the study area, causing impacts to hydrology, water deliveries, and agricultural operations, 2023 and 2024 have been more wet and seen recovery of some of these impacts.

3.4.1.2 Groundwater

Groundwater quality has the potential to be affected if groundwater flow patterns and elevations change due to changes in groundwater pumping. Changes in groundwater pumping quantities and locations, and subsequent changes in groundwater elevation may result in groundwater moving faster or slower, in an altered flow direction, or to a different well.

Increases or decreases in groundwater levels may also saturate or strand constituents in the soil matrix as the water table moves, thus changing the concentration of constituents in the groundwater. These changes in groundwater quality may result in either an increase or decrease in constituent concentrations depending on the local conditions and the water quality constituents present.

3.4.1.2.1 Sacramento Valley The study area includes the Redding Area Groundwater Basin (GWB) and the Sacramento Valley GWB. The Sacramento Valley GWB is one of the largest GWBs in the state and extends from Redding in the north to the Delta in the south (U.S. Geological Survey 2009). Approximately one- third of the Sacramento Valley’s urban and agricultural water needs are met by groundwater (DWR 2003). A portion of the water diverted for irrigation but not actually consumed by crops or other vegetation, or evaporated directly, becomes recharge to the groundwater aquifer or flows back to surface waterways. However, there are several locations showing early signs of persistent drawdown, suggesting limitations because of increased groundwater use in dry years. Locations of persistent drawdown include Glenn County, areas near Chico in Butte County, northern Sacramento County, and portions of Yolo County.. The water quality of groundwater in the Sacramento Valley is generally good. Several areas have localized aquifers with high nitrate, total dissolved solids (TDS), or boron concentrations. Land subsidence in the Sacramento Valley has resulted from inelastic deformation (nonrecoverable changes) of fine- grained sediments related to groundwater withdrawal. Areas of subsidence from groundwater level declines have been measured in the Sacramento Valley at several locations (DWR 2018c).

The Redding Area GWB extends from approximately Redding in Shasta County through the northern portions of Tehama County. The portions of the Sacramento Valley GWB in the Upper Sacramento Valley are located primarily in Tehama County, with small portions extending into Glenn County near Orland and Butte County near Chico in the south. The Redding Area GWB includes five GWSBs: Anderson, Bowman, Enterprise, Millville, and South Battle Creek (DWR 2021). The Anderson GWSB is one of the main groundwater units in the Redding Basin.

Groundwater levels in the unconfined and confined portions of the aquifer system fluctuate annually by two to four feet during normal precipitation years and up to 10 to 16 feet during drought years (DWR 2003). Tehama County overlies three GWSBs within the Redding Area GWB and seven GWSBs in the Sacramento Valley GWB. The South Battle Creek and Bowman GWSBs in the Redding Area GWB are in Tehama County within the study area. The Corning, Bend, Antelope, and Vina GWSBs in the Sacramento Valley GWB are located in Tehama County (DWR 2004, 2006). Groundwater levels in these GWSBs show a substantial seasonal variation because of high groundwater use for irrigation during the summer months.

Groundwater quality in the Redding Area GWB is generally good to excellent for most uses. Some areas of poor quality because of high salinity from marine sedimentary rock exist at the margins of the basin. Portions of the basin are characterized by high boron, iron, manganese, and nitrates in localized areas (DWR 2004). In general, groundwater in the Sacramento Valley GWB within Tehama County is of excellent quality, with some localized areas with groundwater quality concerns related to boron, calcium, chloride, magnesium, nitrate, phosphorous, and TDS (DWR 2004, 2006). In the vicinity of Antelope, east of Red Bluff, historical high nitrates in groundwater occur. Higher boron levels have been detected in wells located in the eastern portion of Tehama County.

Sustainable Groundwater Management Area (SGMA) prioritized the GWSBs in this area as medium priority except for the Bowman, Millville, and South Battle Creek GWSBs, which were prioritized as very low (DWR 2020).

3.4.1.2.2 Sacramento Valley (West of Sacramento River) The study area west of the Sacramento River includes three main groundwater GWSBs: Colusa, Yolo, and Solano (DWR 2021).

The Colusa GWSB is bordered by the Coast Ranges to the west, Stony Creek to the north, Sacramento River to the east, and Cache Creek to the south. The Colusa GWSB extends primarily in western Glenn and Colusa counties. Groundwater levels are fairly stable in this GWSB except during droughts (DWR 2013). Historically, groundwater levels fluctuate by approximately 5 feet seasonally during normal and dry years (DWR 2006, 2013). Groundwater quality for the Colusa GWSB is characterized by moderate to high TDS, with localized areas of high nitrate and manganese concentrations near the town of Colusa (DWR 2006, 2013). High TDS and boron concentrations have been observed near Knights Landing. High nitrate levels have been observed near Arbuckle, Knights Landing, and Willows. The final SGMA priority designation for the Colusa GWSB is high (DWR 2020).

The Yolo GWSB lies to the south of the Colusa GWSB, primarily within Yolo County. In general, groundwater levels are stable in this GWSB, except during periods of drought, and in certain localized pumping depressions in the vicinity of Davis, Woodland, and Dunnigan and Zamora (DWR 2004, 2015). Groundwater quality is generally good for beneficial uses except for localized impairments, including elevated concentrations of boron in groundwater along Cache Creek and in the Cache Creek Settling Basin area, elevated levels of selenium present in the groundwater supplies for the City of Davis, and localized areas of nitrate contamination (DWR 2004, 2015). In

Yolo County, as much as 4 feet of groundwater withdrawal-related subsidence has occurred since the 1950s. Recent levels of subsidence has reached 1.5 feet (DWR 2023). The Yolo GWSB final SGMA priority designation is high (DWR 2020). Groundwater levels are relatively stable but show substantial declines during drought cycles.

The Solano GWSB includes most of Solano County, southeastern Yolo County, and southwestern Sacramento County. Groundwater quality in the Solano GWSB is generally good and is deemed appropriate for domestic and agricultural use (DWR 2004, 2015). However, TDS concentrations are moderately high in the central and southern areas of the basin, with localized areas of high calcium and magnesium. The Solano GWSB final SGMA priority designation is medium (DWR 2020).

3.4.1.2.3 Lower Sacramento Valley (East of Sacramento River) The lower Sacramento Valley area is east of the Sacramento River and includes seven GWSBs: Butte, Wyandotte Creek, North Yuba, South Yuba, Sutter, North American, and South American (DWR 2021a).

The Butte GWSB is in Butte, Colusa, Glenn, and Sutter counties. Several groundwater depressions exist in the Chico area due to year-round groundwater extraction for municipal uses. High nitrates occur near the Chico area in the West Butte GWSB. There are localized areas in the GWSB with high boron, calcium, electrical conductivity, and TDS concentrations (DWR 2004, 2015). There are localized high concentrations of calcium, salinity, iron, manganese, magnesium, and TDS throughout the East Butte GWSB (DWR 2004, 2015). The SGMA designation for the Butte GWSB is medium priority (DWR 2020).

The Sutter GWSB is in Sutter County. In the Sutter GWSB, groundwater levels have remained relatively constant. The water table is very shallow and most groundwater levels in the GWSB tend to be within about 10 feet of ground surface (DWR 2006, 2015). Groundwater quality in the western portion of the Sutter GWSB includes areas with high concentrations of arsenic, boron, calcium magnesium bicarbonate, chloride, fluoride, iron, manganese, sodium, and TDS. In the southern portion of the GWSB, groundwater in the upper aquifer system tends to be high in salinity (DWR 2003, 2006). SGMA designated the Sutter GWSB as medium priority (DWR 2020). The North American GWSB underlies portions of Sutter, Placer, and Sacramento counties, including several dense urban areas. Concentrated groundwater extraction occurred east of downtown Sacramento for decades, which resulted in a regionally extensive cone of depression. In general, since around the mid-1990s to the late 2000s, water levels remained stable in the southern portion of the GWSB, and in some cases, groundwater levels are continuing to increase slightly in response to increases in conjunctive use and reductions in pumping near McClellan Air Force Base (Sacramento Groundwater Authority 2014). Groundwater levels in Sutter and northern Placer counties generally have remained stable; however, some wells in southern Sutter County have experienced declines (DWR 2006, 2015). Overall, groundwater levels are higher along the eastern portion of the North American GWSB and decline toward the western portion (City of Roseville et al. 2007). There is a groundwater depression in the southern Placer and Sutter counties near the border with Sacramento County.

The area along the Sacramento River extending from Sacramento International Airport northward to the Bear River contains high levels of arsenic, bicarbonate, chloride, manganese, sodium, and TDS (DWR 2006, 2015). In an area between Reclamation District 1001 and the Sutter Bypass, high TDS concentrations occur. In the deeper portions of the aquifer, the groundwater geochemistry indicates the occurrence of connate water from the marine sediments underlying the freshwater aquifer, which mixes with the fresh water. Water quality concerns because of this type of geology include elevated levels of arsenic, bicarbonate, boron, chloride, fluoride, iron, manganese, nitrate, sodium, and TDS (DWR 2003). SGMA designated the North American GWSB as high priority.

3.4.1.3 Water Quality

The California Regional Water Quality Control Board (RWQCB) Basin Plans and Integrated Reports assess and describe water quality conditions throughout the study area. All waters of the State have specific beneficial uses specified in State or Tribal water quality standards. The regional water quality control boards are charged with protecting these uses from pollution and nuisance. The use designations serve as a basis for establishing water quality objections and discharge prohibitions to protect the resource.

Under Section 303(d) of the Clean Water Act (CWA), states, territories, and authorized tribes are required to develop a ranked list of water quality-limited segments of rivers and other water bodies under their jurisdiction. Listed waters do not meet water quality standards even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that action plans, or Total Maximum Daily Loads (TMDLs), be developed to monitor and improve water quality. TMDL is defined as the sum of the individual waste load allocations from point sources, load allocations from nonpoint sources and background loading, plus an appropriate margin of safety. A TMDL defines the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards.

TMDLs can lead to more stringent National Pollutant Discharge Elimination System (NPDES) permits (CWA Section 402).

Out of the 38 listed waterbodies within the project area, 25 are on the 303(d) list as being impaired waters. The 25 waterbodies appearing on the 303(d) list as impaired waters and their pollutants of concerns are detailed in Table 3-4. Several pollutants listed in Table 3-4 can be directly or indirectly related to runoff from agricultural activities, including return water that runs off fields to irrigation drains.

Table 3-4. Waterbodies Listed in 2020-2022 Integrated Report for Clean Water Act Sections 303(d) Within the Project Area

Waterbody	County	Pollutants
Sutter Bypass	Sutter, Yolo	Mercury, Dissolved Oxygen
Tule Canal (Yolo County)	Yolo	Bacteria, Boron, Salinity
Willow Slough Bypass (Yolo County)	Yolo	Malathion, Boron, Bacteria, Selenium, Specific Conductivity, Toxicity, Chlorpyrifos, Diuron
Sacramento River (Cottonwood Creek to Red Bluff)	Shasta, Tehama	Mercury, Temperature, Toxicity
Sacramento River (Keswick Dam to Cottonwood Creek)	Shasta, Tehama	Toxicity, Temperature
Clear Creek (below Whiskeytown Lake, Shasta County)	Shasta	Mercury
Anderson Creek (Shasta County)	Shasta	Bacteria
Sacramento River (Knights Landing to the Delta)	Sutter, Yolo	Mercury, Temperature, Toxicity, Chlordane, DDT, Dieldrin, PCBs,
Willow Slough (Yolo County)	Yolo	Boron, Toxicity
Sacramento River (Red Bluff to Knights Landing)	Butte, Colusa, Glenn, Sutter, Tehama, Yolo	DDT, Dieldrin, Mercury, PCBs, Toxicity, Dissolved Oxygen
Natomas East Main Drainage Canal (aka Steelhead Creek, upstream of confluence with Arcade Creek)	Placer, Sacramento, Sutter	PCBs
Coon Creek, Lower (from Pacific Avenue to Main Canal, Sutter County)	Sutter	Bacteria, Toxicity, Dissolved Oxygen
Natomas Cross Canal (Sutter County)	Sutter	Mercury
Sycamore Slough (Yolo County)	Colusa, Yolo	Dissolved Oxygen
Colusa Basin Drain	Colusa, Glenn, Yolo	Azinphos-methyl (Guthion), DDT, Dieldrin, Mercury, Dissolved Oxygen, Pesticides
Stony Creek	Glenn, Tehama	pH, Toxicity, Chlorpyrifos

Waterbody	County	Pollutants
Walker Creek (Glenn County)	Glenn	Bacteria, Dissolved Oxygen, Toxicity, Chlorpyrifos
Butte Slough	Colusa, Sutter	Dissolved Oxygen, Toxicity, Dichlorvos
Butte Creek (Butte County)	Butte, Colusa, Glenn	Mercury
Big Chico Creek (Butte and Tehama Counties)	Butte, Tehama	Mercury, Bifenthrin, Chromium, Bacteria, Nickel, Dissolved Oxygen, Pyrethroids, Toxicity, pH
Little Chico Creek (Butte County)	Butte	pH
Spring Creek (Colusa County)	Colusa	Chlorpyrifos, Diazinon, Aldicarb, Dissolved Oxygen, Salinity, Toxicity,
Freshwater Creek (Little Valley to Salt Creek, Colusa County)	Colusa	Bacteria
Stone Corral Creek	Colusa	Dissolved Oxygen
Sand Creek (Colusa County)	Colusa	Dissolved Oxygen

Source: State Water Resources Control Board, 2022

3.4.2 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis and drought resiliency projects would not be implemented. Cropland idling, cropland shifting, conservation activities, groundwater substitution, and small-scale construction projects already occur in the study area, therefore, the No Action Alternative reflects the affected environment.

3.4.2.1 Surface Water

Under the No Action Alternative, surface water supplies would not change. The SRSC would continue to experience shortages under certain hydrologic conditions consistent with current policy, regulation, contracts, and agreements. SRSC have reduced diversions lower than 75% in each drought year since 2014. 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.

3.4.2.2 Groundwater

Under the No Action Alternative, groundwater pumping, a common agricultural practice, would be expected to continue on the same pattern as currently observed. Groundwater levels in the study area are generally stable, fluctuating seasonally except during drought which would be expected to continue under the No Action Alternative. The potential for groundwater level declines would continue. Groundwater quality would continue to be generally good throughout the study area for beneficial uses except for localized impairments. Since groundwater pumping would be expected to continue on the same pattern as currently observed, the potential for increased land subsidence would be the same as the affected environment.

3.4.2.3 Surface Water Quality

Existing surface water quality impairments in the study area are anticipated to continue under the No Action Alternative.

3.4.3 Proposed Action

3.4.3.1 Surface Water Diversion Reduction-Related Activities

3.4.3.1.1 Surface Water Each year, the SRSC divert water in accordance with their contracts. In years of critical drought, the contracts provide for a 25% reduction in supply. The Program would support a reduction in releases and diversions that would be in addition to Article 5 shortages included in the Sacramento River Settlement Contracts. The Program would result in the SRSC forgoing a larger percentage of their contract supply in specified drought years under two phases.

Under the Proposed Action, reductions of surface water supplies to the SRSCs in the amount of 500,000 AF and 100,000 AF in Phase 1 and Phase 2 Program Years, respectively. The Proposed Action would be anticipated to occur on average 0.66 times over the 10-year Phase 1 period with a maximum potential for there to be a Phase 1 Agreement Year four times over a 10-year period. Additional reductions in contract supply would be anticipated to occur on average 0.88 times over the 10-year Phase 2 period with a maximum potential for there to be a Phase 2 Agreement Year four times over a 10-year period. These reductions would be implemented during years when water supplies and reservoir storages are low, critically dry conditions exist, the system is stressed, and water resources are not available to meet all demands. In Program years, the SRSC may take actions to offset the need to divert surface water supplies including groundwater substitution, crop idling, crop shifting, and water conservation actions.

The reduction in diversions by the SRSC in Program Years is anticipated to result in a reduction of the amount of water that is released from Shasta Reservoir which would allow for additional flexibility in Reclamation's management of operation of the CVP during drought conditions and contribute to water temperature management.

Under the hydrologic conditions associated with the Program Years, impacts to downstream contractors would not be anticipated to change as a result of a reduction in diversions because water would be diverted and used by the SRSCs, and not available to downstream users.

The Proposed Action would result in similar reductions to surface water supplies when compared with the No Action Alternative. SRSC have reduced diversions lower than 75% in each drought year since 2014. Without the Proposed Action, actions taken by the SRSC to manage drought would be voluntary and reactionary. Under the Proposed Action drought management actions are transparent and planned for in advance. The required reduction would be less than occurred in 2022, when water made available for diversion amounted to only 18% of contract totals.

3.4.3.1.2 Groundwater In Program Years, groundwater substitution would be anticipated to be similar to groundwater pumping compared to the Shasta Reservoir Framework under the No Action Alternative. The required reduction would be less than occurred in 2022 when water made available for diversion amounted to only 18% of contract totals. Groundwater substitution pumping would affect groundwater levels and result in temporary declines of groundwater levels similar to the No Action Alternative. Groundwater in the study area occurs at various levels. Recent droughts have caused the driest hydrologic period on record in portions of the project area, impacting monitored groundwater levels. Water years 2023 and 2024 were significantly wetter years and included full water supply deliveries to the SRSC and storage in the CVP reservoirs recovered.

Generally, groundwater levels also recovered from impacts associated with recent droughts (GCID 2024). However, groundwater substitution activities could contribute to accelerated depletion of groundwater resources.

Groundwater substitution activities would be similar to the No Action Alternative. As in the past, a moderate decline in groundwater level is expected in the Sacramento Basin due to groundwater utilization during droughts; however, levels are expected to return to pre- drought conditions following wet years (Faunt 2009).

All groundwater pumping would need to be conducted in accordance with the existing regulatory setting and consistent with local Groundwater Sustainability Plans (GSPs) or where there are no GSPs, in accordance with SGMA.

Land subsidence is caused by the consolidation of certain subsurface soils when the pore pressure in those soils is reduced. In the Sacramento Valley, that reduction in pore pressure is usually caused by groundwater pumping that causes groundwater levels to fall below historical low levels. Average groundwater levels are generally expected to decrease, similar to the No Action Alternative, in Program Years and are not anticipated to be sustained year over year.

Portions of the Sacramento Valley are known to have historic subsidence and reductions in groundwater level may cause additional subsidence particularly portions of Colusa and Yolo counties, however, these areas are outside the SRSC service areas. The location and amount of subsidence is highly dependent on the local soil conditions and historical low groundwater levels in the area.

Inducing the movement or migration of reduced quality water into previously unaffected areas due to groundwater substitution pumping is not likely to be a concern unless groundwater levels and/or flow patterns are substantially altered for a long period of time. Groundwater substitution pumping under the Proposed Action would be similar to the No Action Alternative and limited to short-term withdrawals during the irrigation season, and during Program years, which modeling indicates will be relatively infrequent. Water users that use groundwater substitution to offset water reductions could experience changes in water quality as they switch from surface water to groundwater, which could be of reduced quality relative to the surface water supplies that are normally received. However, groundwater quality in the area is normally adequate for agricultural purposes.

Cropland idling would eliminate the applied water on idled fields. A portion of that applied water percolates into the groundwater aquifer; therefore, reducing applied water could result in a loss of recharge to the Sacramento Valley and Redding Groundwater basins. Rice is the crop anticipated to have the greatest amount of land idled under the Proposed Action and the No Action Alternative. Rice farming practices include a constant supply of irrigation water that remains on rice fields during the growing season. The land used for rice production, however, is typically underlain by soils with low permeability (such as clay). A substantial portion of the water applied to rice fields does not percolate to the underlying aquifer because of the underlying soils, but rather discharges to the surface drainage system. Because only a small portion of the applied water would have percolated to the groundwater table, the reduction in recharge is expected to be minimal as the total recharge to the basins occur through precipitation and runoff over the spring and winter months and would be unaffected by cropland idling.

3.4.3.1.3 Surface Water Quality Surface water diversion reduction-related activities, including cropland idling, cropland shifting, conservation, and groundwater substitution could result in some impacts to surface and groundwater quality under both the Proposed Action and the No Action Alternative. Cropland idling could result in increased deposition of sediment on waterbodies. Crop management practices and soil textures are key factors to determine erosion potential. The Proposed Action and the No Action Alternative could result in land idled in Butte, Colusa, Glenn, Shasta, Sutter, Sacramento, Tehama, and Yolo counties of between 71,429 to 83,333 acres in Phase 1 Program Years and between 14,285 to 16,667 acres in Phase 2 Program Years. 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.

Most soils within the study area have medium erodibility factor values (GCID 2024). However, most cropland idling is anticipated to occur in rice fields. 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. However, there could be different crop types idled such as alfalfa, corn, or tomato cropland which could be located on soil that have medium to high erodibility factor values, however the potential for impacts to nearby water and groundwater due to erosion would be similar compared to the No Action Alternative.

Under the Proposed Action, water reduction activities including cropland idling/shifting would occur, and changes in irrigation practices and pesticide application that could occur would be similar to the No Action Alternative. The required reduction is expected to be less than what occurred in 2022 when water made available for diversion amounted to only 18% of contract totals. The changes in the quantity of irrigation water applied to the land could alter the concentration of pollutants associated with leaching and runoff. Water would be applied to fields under the Proposed Action similarly to the No Action Alternative and, thus, the potential for leaching of salts and other pollutants would be likewise similar. In addition, the reduction in application of fertilizers and pesticides under the Proposed Action compared to the No Action Alternative would not be anticipated to result in a change of concentrations of nitrogen and phosphorus in surface water runoff. In cases of crop shifting, water users may alter the application of pesticides and other chemicals which could negatively affect water quality if allowed to enter area waterways. Since crop shifting would only affect currently utilized farmland under both the Proposed Action and the No Action Alternative, a substantial increase in agricultural constituents of concern is not expected.

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 reductions 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.

Groundwater substitution under both the Proposed Action and the No Action Alternative could introduce contaminants that could enter surface waters from irrigation return flows. 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. 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. 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. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses.

3.4.3.2 Drought Resiliency Projects

3.4.3.2.1 Surface Water Drought-resiliency projects that include elements that can disturb soils during construction may potentially contain contaminants such as pesticides, fertilizers, or arsenic that could percolate into the surface water. Additionally, the Proposed Action could involve temporary transport and handling of small quantities of hazardous substances (e.g., fuels and lubricants) during construction of the drought resiliency projects. If these fuels and lubricants were released into the surface water or groundwater during application or equipment refueling or maintenance, contamination and harm to the environment could occur. Potential construction impacts would be reduced if appropriate BMPs are implemented such as developing erosion and sediment control plans, hazardous materials management plans and spill prevention and response plans.

3.4.3.2.2 Groundwater Construction of the drought-resiliency projects would not affect groundwater recharge or lead to groundwater subsidence. Operation of new groundwater or deep aquifer wells and conjunctive use programs could affect groundwater recharge, similar to the potential impacts described in Section 3.4.3.1.2 on groundwater related to water reduction activities. Groundwater substitution activities could contribute to accelerated depletion of groundwater resources. The potential for adverse drawdown effects would increase as the amount of extracted water increased. However, because water made available through groundwater pumping is substantially more expensive than surface water, it is not reasonable to assume that farmers would choose to substitute groundwater at substantially higher levels than under the No Action Alternative. Moreover, prior to new well construction, evaluation for any additional environmental compliance would be required. Other drought-resiliency projects would likely result in increased surface water, but typically reduce seepage losses and reduce groundwater recharge, which could contribute to diminished groundwater supplies compared to the No Action Alternative. Similar to the potential impacts described in Section 3.4.3.1.2, land subsidence could also occur as a result of operating new groundwater wells. Other drought-resiliency projects would have limited impacts on land subsidence. Some drought-resiliency projects have the potential to improve groundwater quality such as piping open ditches or canals and canal lining could reduce seepage into the groundwater which can reduce contaminants leaching into the groundwater.

3.4.3.2.3 Surface Water Quality Drought-resiliency projects that include elements that can disturb soils during construction, may potentially contain contaminants such as pesticides, fertilizers, or arsenic that could percolate into the surface water which could result in minor impacts to surface water quality that are temporary and localized. Some drought-resiliency projects also have the potential to improve surface water quality over the long-term. Piping open ditches or canal and canal lining provide a closed and protected system for transporting water. Closed systems minimize the exposure of water to external contaminants such as pollutants, sediment, and microorganisms. Additionally, pipelines are less prone to damage from storms, floods, and other natural disasters that could introduce contaminants into the water supply. Similarly, with reduced seepage, canal lining would reduce the likelihood of contaminants leaching from the soil into the water, resulting in improved surface water quality.

3.4.4 Mitigation Measures

The mitigation measures below rely on entities other than Reclamation to implement the measures. Because Reclamation does not have authority to implement this measure, Reclamation cannot ensure that it will be implemented. If it is implemented, it will reduce impacts on hydrology and water quality.

- Mitigation Measure HYD-1: Implement Erosion and Spill Control Measures for Drought-Resiliency Projects. To ensure that contaminants are not accidentally introduced into irrigation ditches and canals, the following measures will be implemented during construction of drought-resiliency projects. For drought-resiliency projects involving over an acre of land disturbance, a NPDES Construction Stormwater General Permit will be obtained, and a construction Stormwater Pollution Prevention Plan (SWPPP) will be prepared.
- Mitigation Measure HYD-2: Install and Operate Groundwater Wells in Accordance with GSPs for all Groundwater Pumping Activities undertaken under the Agreement. The installation of any new groundwater wells and the operation of existing and new groundwater wells will be in accordance with targets and requirements set by applicable GSPs managed by Groundwater Sustainability Agencies, or where there are no GSPs, in accordance with SGMA, in the project area.

3.4.4.1 Independent Programs

The following Independent Programs have been identified that could provide potential assistance with mitigation. These programs have independent compliance or will prior to implementation:

- WaterSMART - Through WaterSMART Grants, Reclamation provides financial assistance to water managers for projects that seek to conserve and use water more efficiently, implement renewable energy, investigate and develop water marketing strategies, mitigate conflict risk in areas at a high risk of future water conflict, and accomplish other benefits that contribute to sustainability in the western United States. Cost-shared projects that can be completed within two or three years are selected annually through a competitive process. Three categories of WaterSMART Grants are offered through separate funding opportunities: Water and Energy Efficiency Grants; Small-Scale Water Efficiency Projects; and Water Marketing Strategy Grants.
- Calfed Water Use Efficiency - The Water Use Efficiency Program includes actions to assure efficient use of existing and any new water supplies developed by this program. Efficiency actions can alter the pattern of water diversions and reduce the magnitude of diversions, providing ecosystem benefits. Efficiency actions can also result in reduced discharge of effluent or drainage, improving water quality. The Water Use Efficiency Program builds on the work of the existing Agricultural Water Management Council and California Urban Water Conservation Council process, supporting and supplementing those processes through planning and technical assistance and through targeted financial incentives (both loans and grants). The Water Use Efficiency Program has identified potential recovery of currently irrecoverable water losses of over 1.4 million acre-feet of water annually by 2020 as a result of CALFED actions. CALFED identifies measurable goals and objectives for its urban and agricultural water conservation program, water reclamation programs and managed wetlands programs.

3.5 Biological Resources

3.5.1 Affected Environment

Much of the Sacramento River from Shasta Dam to Redding is deeply entrenched in bedrock, which precludes development of extensive areas of riparian vegetation (Reclamation 2013). The upper banks along these steep-sided, bedrock-constrained segments of the upper Sacramento River are characterized primarily by upland communities, including woodlands and chaparral. Outside the river corridor, other vegetation communities along the upper Sacramento River include riparian scrub, annual grassland, and agricultural lands.

The river corridor between Redding and Red Bluff once supported extensive areas of riparian vegetation (Reclamation 2013). Agricultural and residential development has permanently removed much of the native and natural habitat. Riparian vegetation now occupies only a small portion of floodplains. Willow and blackberry scrub and cottonwood- and willow-dominated riparian communities are still present along active channels and on the lower flood terraces, whereas valley oak-dominated communities occur on higher flood terraces. Although riparian woodlands along the upper Sacramento River typically occur in narrow or discontinuous patches, they provide value for wildlife and support both common and special-status species of birds, mammals, reptiles, amphibians, and invertebrates.

Along the Sacramento River below Red Bluff, riparian vegetation is characterized by narrow linear stands of trees and shrubs, in single- to multiple-story canopies. These patches of riparian vegetation may be on or at the toe of levees. Riparian communities in this region include woodlands and riparian scrub.

From Red Bluff to Colusa, the Sacramento River contains point bars, islands, high and low terraces, instream woody cover, and early-successional riparian plant growth, reflecting river meander and erosional processes (Reclamation 2013). Major physiographic features include floodplains, basins, terraces, active and remnant channels, and oxbow sloughs. These features sustain a diverse riparian community and support a wide range of wildlife species including raptors, waterfowl, and migratory and resident avian species, plus a variety of mammals, amphibians, and reptiles that inhabit both aquatic and upland habitats.

Downstream of Colusa, the Sacramento River channel changes from a dynamic and active meandering one to a confined, narrow channel (Reclamation 2013). Surrounding agricultural lands encroach directly adjacent to the levees, which have cut the river off from most of its riparian corridor, especially on the eastern side of the river. Most of the levees in this reach are lined with riprap, allowing the river no erodible substrate, and limiting the extent of riparian vegetation and riparian wildlife habitat.

Lands affected by the SRS contracts consist of agricultural lands in the vicinity of Sacramento River. Valley, seasonally flooded agriculture, particularly rice fields, provide important foraging habitat for a variety of animal species. Rice fields in the Sacramento Valley which, along with natural wetlands, support waterfowl migrating along the Pacific Flyway. Flooded agriculture within the Sacramento Valley accounts for approximately 57 percent of the food resources available to waterfowl (Petrie and Petrick 2017). Rice fields provide foraging, resting, breeding, and wintering habitat for shorebirds and wading birds, in addition to providing foraging habitat for raptors. Flooded agricultural fields also provide important foraging, refuge, and dispersal habitat for numerous reptile, amphibian, and mammal species. Migratory birds protected by the Migratory Bird Treaty Act also rely on agricultural fields for habitat in the Central Valley.

Rice fields within the study area provide habitat for giant garter snake, western pond turtle, tricolored blackbird, and a variety of migratory waterfowl and wading birds such as snow goose, tundra swan, greater white-fronted goose, black-necked stilt, and least sandpiper. Row crops and alfalfa (if present) in this area provide habitat for a variety of birds and mammals including Swainson’s hawk, white-tailed kite, meadow vole, and California ground squirrel. Freshly cultivated fields, before crop development, provide habitat for mountain plover, horned lark, and Swainson’s hawk.

Riparian and wetland vegetation associated with refuges depend on surface waters to inundate their habitats during the summer. Portions of national wildlife refuges and wildlife management areas occur within or near the study area. Reduced deliveries after seasonal rainfall could result in less growth of wetland vegetation in the summer and fall. When rainfall occurs the following winter, wetland vegetation would resume a growth pattern matching rainfall quantity, which is consistent with how wetlands evolve naturally under seasonal and annual variations in precipitation.

Reduced water allocation in deliveries to a preserve after the end of seasonal rainfall in an Agreement Year could result in a less robust growth of wetland vegetation in the summer and fall. When rainfall occurs the following winter, wetland vegetation would resume a growth pattern matching rainfall quantity, which is consistent with how wetlands evolve naturally under seasonal and annual variations in precipitation. It is assumed that preserve managers may pump from their groundwater wells or using other surface waters to augment water used to sustain wetland vegetation areas. Crop shifting would not alter or affect wetland habitats in the study area.

3.5.2 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis and drought resiliency projects would not be implemented. Agricultural land uses would be similar to those in the affected environment, and land use practices would be similar to recent levels. The average annual rice acreage farmed in Glenn, Colusa, Butte, Yolo, Shasta, Sutter, Tehama, and Sacramento counties is approximately 445,000 acres (Table 3-2).

Cropland idling, cropland shifting, conservation activities, groundwater substitution, and small-scale construction would be expected to continue.

Under the 2024 Shasta Framework, the reduced volume of available water would be applied to all SRS Contractors collectively and individual contractor reductions may vary based on agreements and transfers between different SRS Contractors. In these years, previously described SRS Contractor voluntary actions under their resolution may not be possible due to the very limited supply. It is also unlikely that water would be made available in these years as they are typically critical water year types. During these years, Reclamation would coordinate with US Fish and Wildlife Services (USFWS) to maintain summer deliveries of Level 2 supplies to Sacramento Valley CVPIA refuges to provide essential dry year habitat for Giant Garter Snake, Western Pond Turtle, Tricolored blackbirds and migratory waterfowl in a manner consistent with refuge contracts and agreed upon operational priorities. If conditions remain dry through the fall Reclamation and USFWS would coordinate on how to address instream flow objectives, lake levels and refuge needs. Reclamation would continue to utilize level 4 to supplement supplies for refuges in drier years when storage and coldwater pool are limited.

3.5.3 Proposed Action

3.5.3.1 Surface Water Diversion Reduction-Related Activities

Responding to surface water diversion reductions through cropland idling/shifting actions as a result of water reduction activities could alter the amount of wildlife habitat associated with seasonally flooded agriculture and associated irrigation waterways similarly to the No Action Alternative. Based on proposed surface water diversion reduction-related activities, the maximum amount of rice acreage that could be idled would be 83,333 acres throughout the study area. The required reduction would be less than occurred in 2022 when water made available for diversion amounted to only 18% of contract totals. The reduction in available habitat in rice fields and the associated reduction in the availability of waste grains and prey items as forage to wildlife species that use seasonally flooded agriculture for some portion of their lifecycle, particularly migratory birds that use rice fields during winter migration would be similar to the No Action Alternative. Reclamation has submitted a Biological Assessment (Attachment B) to USFWS for the potential effects not previously consulted upon and are not part of the Endangered Species Act environmental baseline.

Idling seasonally flooded agricultural fields has the potential for habitat fragmentation, as idling large parcels of land could impede the movement of wildlife from one area to another, inhibiting normal wildlife migration and dispersal of individuals, and potentially dissociating habitats for roosting from those for foraging. The decision to idle or shift a field under both the Proposed Action and the No Action Alternative would be made early in the year. So, for species that migrate into the area seasonally (mainly birds), those arriving in the spring would not be impacted as they would select suitable habitat upon their arrival. For year-round residents (i.e., pond turtle and giant garter snake) the potential impacts would be greater.

3.5.3.1.1 Federally Protected Species

3.5.3.1.1.1 Giant Garter Snake Giant garter snakes require aquatic habitat during their active phase, extending from spring until fall. During the winter months, giant garter snakes are dormant and occupy burrows in upland areas. Giant garter snakes have the potential to be affected by the Proposed Action through cropland idling/shifting and the effects of groundwater substitution on small streams and associated wetlands. Idling/shifting of upland crops and water conservation actions are not anticipated to affect giant garter snakes, as they do not provide suitable habitat for this species. Although the preferred habitat of giant garter snakes is natural wetland areas with slow moving water, giant garter snakes will use rice fields and their associated water supply and tailwater canals for foraging and escape from predators, particularly where natural wetland habitats are not available. Because of the historic loss of natural wetlands, rice fields and their associated canals and drainage ditches have become important habitat for giant garter snakes within agricultural areas.

The Proposed Action is expected to result rice land idling/shifting acreage similar to agricultural practices under the No Action Alternative. Limited data exists on the actual distribution and occurrence of the giant garter snakes within Central Valley rice lands, and it is difficult to anticipate the level of effects the Proposed Action would have on giant garter snakes compared to the No Action Alternative because of the challenges associated with quantifying and monitoring giant garter snake ecology. Giant garter snakes are known to use rice fields seasonally, along with the canals that supply water to and drain water from rice fields. An in-depth discussion of potential impacts to giant garter snake as a result of implementation of the Program is included in Appendix B, Biological Assessment. Cropland idling/shifting resulting from surface water diversion reductions are expected to incrementally contribute to idling of rice acreage, thereby reducing available habitat for the species. Cropland idling/crop shifting could idle up to a maximum of approximately 83,333 acres of rice fields. This represents approximately 31.6 percent of rice within the SRSC Service Area and 18.7 percent of the average annual rice production within the eight counties in the study area (Table 3-2).

Cropland idling/crop shifting could incrementally reduce the availability of wetland areas in rice fields and canals during a Program Year. Rice fields are typically planted and flooded beginning in April and would usually be available for giant garter snakes as they become active with the onset of warmer air temperatures and leave their overwintering hibernacula. Depending on the timing and amount of water diverted from the Sacramento River, rice fields might not be available when and where giant garter snake would typically utilize them (USFWS 2024). A reduction in rice production will likely make snakes relocate to other areas to find available foraging areas and giant garter snakes would likely be exposed to other predators such as raccoons, skunks, otters, coyotes, and raptors if giant garter snakes were forced into more dry upland terrestrial habitats with limited cover due to the lack of available emergent aquatic habitat or semi aquatic habitat such as rice agriculture. Giant garter snake young of the year require these aquatic habitats for sufficient cover from predators and primarily for prey availability. Prey such as small fish, smaller amphibians (such as tree frogs and bullfrog tadpoles), and invertebrates are more numerous in these shallow water environments and can provide giant garter snake neonates with sufficient prey base.

The bulk of the giant garter snake's population occurs in the Sacramento Valley (California Department of Fish and Wildlife (CDFW) 2024; USFWS 2024). Because giant garter snakes in the study area are within an active rice growing region that experiences variability in rice production and farming activities, they are already subject to these risks in the absence of the Proposed Action. The Proposed Action has the potential to subject more snakes to the stressors related to habitat availability; however, based on the overall status of the species range-wide, the anticipated fraction of actual habitat temporarily affected through crop idling/shifting in the study is relatively low. Additionally, measures to reduce impacts related to the water reduction activities include coordination with the USFWS, maintaining water in canals and drains, when possible, which maintains movement corridors and habitat associated with cover, and foraging, and ensuring there is no lapse in funding, subject to appropriations, of the ongoing monitoring would also be implemented.

Natural and managed seasonal wetlands and riparian communities often depend on interactions between surface water and groundwater for part or all of their water supply. However, managed wetland and agricultural habitats in the study area that provide giant garter snake habitat do not typically depend on this interaction to maintain suitable habitat conditions. Also given the nature of soils in these environments, it is unlikely that a direct linkage between the deeper groundwater basin and surface water in marshes exists. Therefore, groundwater substitution actions are not expected to have a substantial effect on natural communities, including freshwater emergent vegetation. Impacts to giant garter snake from groundwater substitution actions would be minor.

3.5.3.1.1.2 Northwestern Pond Turtle Northwestern pond turtle can utilize irrigation ditches and rice fields as aquatic habitat and adjacent uplands and levees as upland habitat. They may also use small streams and reservoirs for habitat. Actions that result in the desiccation of aquatic habitat could result in the turtle migrating to new areas, which in turn puts them at an increased risk of predation.

Cropland idling/shifting actions could reduce habitat for northwestern pond turtle within irrigation canals and ditches associated with idled rice fields. As described in the giant garter snake discussion, above, cropland idling/shifting is expected to primarily affect rice acreage, with up to 83,333 acres idled in response to reduced surface water diversions. There is potential for decreased water flows in irrigation and return ditches associated with seasonally flooded agriculture such as rice fields because these distribution systems would no longer be delivering water to the fields being idled. Northwestern pond turtles potentially utilize these waterways and associated upland areas for forage, shelter, nesting, estivation, overwintering, and dispersal. Because the population of pond turtles in rice field landscapes is expected to use irrigation canals as their primarily habitat, impacts on the species resulting from surface water diversion reduction-related activities that affect water availability within these canals could occur.

Measures to reduce impacts related to the surface water diversion reduction-related activities include maintaining water in canals and drains, when possible, which maintains habitat associated with forage, shelter, nesting, estivation, overwintering, and dispersal would also be implemented.

Groundwater substitution actions could affect northwestern pond turtle through reduction in the flows of smaller streams in the study area. Reduced flows could negatively impact suitable habitat for this species both in the streams themselves, and the wetlands and riparian habitats associated with them. Water levels naturally fluctuate depending on year type and timing of discharge, and sections of creeks dry up in dry or critical years. Northwestern pond turtles require permanent water and may visit these waterways temporarily when they have flow. The reduction of flow caused by the groundwater substitution would not substantially reduce habitat for the Northwestern pond turtle and would not substantially affect habitat connectivity, because under the No Action Alternative and affected environment, creeks are subject to substantial variability in flow, including periodic drying of reaches, and changes in groundwater levels would have a relatively small effect on this variation and the temporary Northwestern pond turtle habitat in these streams. Groundwater substitution actions under the Proposed Action would have minor impacts similar to the No Action Alternative on northwestern pond turtle because changes in flows in small streams would have a small effect on Northwestern pond turtle habitat availability and would not substantially interfere with habitat connectivity.

3.5.3.1.1.3 Special-Status Bird Species and other Migratory Birds Surface water diversion reduction-related activities within the study area would not alter water availability to National Wildlife Refuges and State Wildlife Areas because these areas have dedicated water allocations. Because no direct habitat modification is proposed, no direct impacts on riparian or other sensitive natural community would result from surface water diversion reduction-related activities. However, surface water diversion reduction-related activities under the Proposed Action and the No Action Alternative that result in idled rice fields could indirectly impact wetland vegetation communities within irrigation canals. Changes in water availability within canals could substantially reduce the amount of emergent wetland and riparian communities within rice field areas. Surface water diversion reduction-related activities could result in impacts to greater sandhill crane, black tern, purple martin, long-billed curlew, tricolored blackbird, white-faced ibis, yellow-headed blackbird, and other special-status and migratory birds by reducing available nesting, foraging, and roosting habitat through cropland idling and groundwater substitution.

Birds within the study area can be associated with both upland croplands and/or seasonally flooded agriculture (e.g., rice). Greater sandhill crane and long-billed curlew are the species that would be affected by idling/shifting upland crops, although both use seasonally flooded agricultural fields, as well. Black tern, purple martin, tricolored blackbird, white-faced ibis, and yellow-headed blackbird would be affected by idling seasonally flooded agriculture. The Proposed Action would result in the idling/shifting of up to 83,333 acres of seasonally flooded agriculture (primarily rice), similar to the No Action. This corresponds to a reduction of approximately of approximately 31.6 percent of rice within the SRSC Service Area and 18.7 percent of the average annual rice production within the eight counties in the study area (Table 3-2). Associated with this reduction in planted acreage are the potential loss of water within adjacent agricultural supply and return canals, which could affect habitats associated with these canals, Reducing seasonally flooded acreage in the Sacramento Valley could reduce summer forage for greater sandhill crane, long-billed curlew, tricolored blackbird, white-faced ibis, black tern and purple martin, yellow-headed blackbird, and other migratory birds, as well as potential nesting habitat for black terns and other migratory birds.

Idling fields or crop shifting may affect the wintering distribution patterns of migratory birds in agricultural areas due to reduced forage availability on idled or crop shifted fields. Although birds would disperse as their food source diminishes, crop idling and/or crop shifting could affect the timing of dispersal and could negatively affect those individuals that have not had sufficient time to prepare for winter migration (i.e., hyperphagia - dramatic increase in appetite and food consumption). Farmers in the Sacramento Valley only flood-up a fraction of the cropland planted; typically around 60 percent in normal water years (Miller et al 2010, Central Valley Joint Venture 2006) and as little as 15 percent in critically dry years (Buttner 2014). In Program Years, surface water diversion reductions may result in a reduction of winter forage for migrating birds, but similar reductions would also occur under the No Action Alternative. The location of cropland idling may also affect the use of historic roost sites for certain species.

Groundwater substitution could reduce flows in small streams and wetlands associated with areas of groundwater withdrawal and in downstream areas under both the Proposed Action and the No Action Alternative. Reduced stream flows could result in stress on the riparian community and reduce riparian habitat suitability for the species and reduce the amount of available habitat. The exact amount and location of groundwater pumping is not known at this time. This analysis is based on the maximum amount of groundwater pumping that could happen from both existing and new wells combined. Impacts to biological resources as a result of streamflow depletion may occur; however, these would only occur locally and temporarily as the Agreement would only be in effect during Agreement Years, which are anticipated to occur an average of once every 10 years. Moreover, groundwater pumping is subject to regulation under SGMA, which requires adherence to basin management objectives identified in applicable GSPs and that local agencies consider and protect habitat dependent on groundwater when managing groundwater resources in their subbasins or, where there are no GSPs, groundwater pumping would be conducted in accordance with SGMA. It is reasonable to assume that compliance with local GSPs or, where there are no GSPs, in accordance with SGMA would further ensure that impacts are minimized.

3.5.3.1.1.4 Special-Status Plants An increase in cropland idling/shifting in response to reduced water diversions could result in decreased flows in irrigation canals and return ditches adjacent to seasonally flooded agriculture (e.g., rice fields). These canals and ditches provide moderately suitable habitat for several special-status plant species. Changes in water availability within canals could substantially reduce or eliminate the limited amount of habitat for special-status plants within rice field areas. Potential impacts to special-status plant species could result if changes in the composition and function of wetland and/or riparian plant communities occur as a result of water reduction activities. To accomplish reduced water diversions, there is anticipated to be similar utilization of groundwater in Program years to irrigate crops compared to the No Action Alternative. Due to the complex interaction between groundwater and surface water, negative impacts could result from a reduction in creek flows to downstream wetland and riparian habitats. Decreased surface flows could potentially impact downstream natural communities, such as seasonal wetland and managed wetland habitats, which are reliant on creek and river flows for all or part of their water supply. Direct or indirect impacts to special status plant species are not anticipated due to pumping from established wells within agricultural areas.

3.5.3.2 Drought Resiliency Projects

3.5.3.2.1 Federally Protected Species

3.5.3.2.1.1 Giant Garter Snake and Northwestern Pond Turtle Drought resiliency projects and associated construction activities in suitable habitat may impact Giant Garter Snake (GGS). Ditch/canal work with physical alterations to the conveyance feature could have potential impacts on GGS or northwestern pond turtle if they occur in the project area. Piping open ditches or canals between rice fields, canal lining and modernization, and automated canal gates could potentially disturb or directly affect GGS or northwestern pond turtle during their installation and use. Installation of weirs or check structures or other drought- resiliency projects that would be situated in irrigation infrastructure could potentially directly affect GGS or northwestern pond turtle if they are present during construction. Ongoing operations and maintenance of the drought-resiliency projects would generally be consistent with the affected environment. An in-depth discussion of potential impacts to giant garter snake as a result of implementation of the drought resiliency projects is included in Appendix B, Biological Assessment. The conservation measures related to the drought resiliency projects include implementation of an erosion control plan, conducting desktop GGS habitat evaluations, conducting pre-construction surveys, as needed, and implementing GGS avoidance measures.

3.5.3.2.1.2 Special-Status Bird Species and other Migratory Birds Drought resiliency projects and associated construction staging, and access routes may be situated on agricultural lands, other developed or undeveloped lands, or in irrigation ditches or canals. Drought resiliency projects have the potential to cause temporary disturbance of upland habitat or result in the removal of existing native and non-native mature trees in the project area. Removal of mature trees may impact roosting, foraging, and nesting sites for migratory bird species or raptors within and adjacent to project areas. Site grading, excavation, and construction activities associated with these projects could directly impact, temporarily affect, or displace potential special status bird species nesting. Construction has the potential to result in accidental spills if equipment and staging is improperly managed. Various contaminants, such as fuel oils, grease, and other petroleum products used in construction activities, could be introduced into farmlands, conveyance systems or adjacent habitats either directly or through surface runoff. Ongoing operations and maintenance of the drought-resiliency projects would generally be consistent with the affected environment in the study area.

3.5.3.2.1.3 Special-Status Plants There is no potential for special status plant species to occur on agricultural lands, but there is potential for these species to occur on non-agricultural lands with generally undisturbed habitat. If a drought-resiliency project is sited on non-agricultural lands with generally undisturbed habitat, potentially present special status plants could be impacted from construction activities.

3.5.4 Mitigation Measures

The following Additional Mitigation has been identified:

- **Mitigation Measure BIO-1**: Conduct Desktop Special Status Wildlife Species, Plant Species, and Aquatic Resources Evaluation for Drought-Resiliency Projects. Prior to implementing a drought-resiliency project that involves grading, vegetation removal, or other form of construction in irrigation and drainage canals or upland areas outside of established agricultural croplands with a history of discing, planting, and maintenance, a qualified biologist will conduct a desktop evaluation of the site using digital web-based aerial photography. The purpose of the desktop evaluation will be to determine the potential for special status wildlife and plant species habitat or aquatic resources subject to regulation by the USACE, RWQCB, or CDFW to occur on site. A qualified biologist will also perform a review of the USFWS Information for Planning and Consultation, CNDDB, CNPS, and Calflora databases to identify known records or potential for special status plant or wildlife species to occur in the project vicinity. If through this assessment, the biologist determines that potential habitat for special status wildlife or plants or jurisdictional aquatic resources exist, then site-specific survey(s) will be conducted per MM-BIO-2, MM-BIO-3, MM-BIO-4, MM-BIO-5, and MM-BIO-6, as applicable.
- **Mitigation Measure BIO-2**: Conduct Special Status Plant Species Surveys and Avoidance for Drought-Resiliency Projects. If the drought-resiliency project site survey indicates that the project site contains suitable habitat for special-status plant species, surveys using USFWS, CDFW, and California Native Plant Society protocols will be conducted by a qualified biologist. If present, special-status plant species will be flagged for avoidance. If avoidance is not possible, USFWS and/or CDFW will be consulted to determine the appropriate approach for minimizing impacts to special-status plant species and compensating for unavoidable impacts, and the project proponents will implement all necessary minimization and compensation measures.
- **Mitigation Measure BIO-3**: Conduct Special Status Wildlife Species Surveys and Avoidance for Drought-Resiliency Projects. If the drought-resiliency project site survey indicates that the project site provides habitat for special-status wildlife, site-specific pre-construction surveys using USFWS and/or CDFW protocols will be conducted by a qualified biologist. If special-status wildlife species are actively using an area within the site, work shall not be permitted to occur within 100 feet until the animals have left on their own or, if necessary, are relocated in accordance with MM-BIO-5. Setback areas will be flagged. A qualified biologist shall be present during construction to monitor construction activities.
- **Mitigation Measure BIO-4**: Conduct Nesting Bird Species Surveys and Avoidance for Drought-Resiliency Projects. If the drought-resiliency project site survey indicates that the project site provides habitat for nesting birds that may be affected by construction and construction would occur between March 1 and September 15, pre-construction nesting bird surveys (two site visits at least one week apart) will be conducted by a qualified biologist within 14 days prior to construction to detect the presence of nesting birds. If an active nest is found, then the qualified biologist will establish an appropriate buffer (minimum 100 feet for non-raptors and 250 feet for raptors) based on site-specific factors such as the topography, the type of work to be performed, natural visual and/or

auditory barriers between the nest and proposed work area, and the species. If work must be performed within the established buffer zone, a qualified biologist should monitor the nest prior to work activities to determine baseline nesting behaviors. Work shall be permitted to occur within the buffer zone with a qualified biologist present to monitor the work for signs of disturbance, to adjust (increase) the buffer size as needed, and to exercise stop work authority if nest disturbance is observed. No further work may occur within the buffer zone until nesting birds have fledged from nests on their own. Setback areas will be flagged.

- **Mitigation Measure BIO-5**: Implement General Biological Resources Protection Measures during Drought-Resiliency Project Construction. The construction contractor and operations personnel shall implement the following general biological resources protection measures during drought-resiliency project construction:
    - Limit construction and operations activities to daylight hours to the extent feasible. If nighttime activities are unavoidable, then workers shall direct all lights for nighttime lighting into the work area and shall minimize the lighting of natural habitat areas adjacent to the work area.
    - Vegetation clearing will be limited to only those areas necessary for construction.
    - Excavated and stockpiled soils will be placed outside of designated special status species habitat.
    - Dispose of cleared vegetation and soils at a location that will not create habitat for special status wildlife species.
    - Dispose of food-related and other garbage in wildlife-proof containers and remove the garbage from the project area daily during construction.
    - Store all construction-related vehicles and equipment in the designated staging areas.
    - Construction-related vehicles and equipment will not exceed a 20 mile-per-hour speed limit at the construction site, staging areas, or on unpaved roads.
    - The qualified biologist will provide the contractor with worker environmental awareness training.
    - Prior to the initiation of work each day, the contractor will inspect construction pipes, culverts, or similar features; construction equipment; or construction debris left overnight in areas that may be occupied by special-status species that could occupy such structures prior to being used for construction.
    - Avoid wildlife entrapment by completely covering or providing escape ramps for all excavated steep-walled holes or trenches more than 1 foot deep at the end of each construction work day.

- Capture and relocation of trapped or injured wildlife listed under ESA or CESA can only be performed by personnel with appropriate state and/or federal permits. Any sightings and any incidental take (mortality) shall be reported by the SRSC to CDFW via email within one working day of the discovery.

- **Mitigation Measure BIO-6**: Implement GGS Avoidance Measures for Drought-Resiliency Projects. If the need for a drought-resiliency project site survey is identified as part of MM-BIO-1, and the initial assessment indicates that that the project site provides habitat for GGS, avoidance measures must be implemented to avoid GGS during construction.
    - Construction activities within GGS habitat will be restricted to between May 1 and October 1, to the extent feasible. If work must be conducted within GGS habitat between October 2 and April 30, two GGS pre-construction surveys will be conducted in any area within 200 feet of GGS aquatic habitat by a qualified biologist.
- **Mitigation Measure BIO-7**: Obtain Incidental Take Authorization for Take of Listed Species from Drought-Resiliency Project Impacts. If species avoidance is not expected to be possible through implementation of MM-BIO-1, MM-BIO-3, MM-BIO-4, MM-BIO-5, or MM-BIO-6, USFWS will be consulted to determine the appropriate approach for minimizing impacts to special-status wildlife species and compensating for potential incidental take. Incidental take authorization will be obtained for take of listed species resulting from construction of a drought-resiliency project.
- **Mitigation Measure BIO-8**: Tree Replanting Requirements for Drought-Resiliency Projects. Avoid native tree removal where practicable through adjustments to the alignment of ditches, pipelines, or other construction features. If protected or heritage native tree removal is not avoidable, local county requirements for replacement would be prescribed at the ratio specified in their general plan.
- **Mitigation Measure BIO-9**: Timing Requirements for Discing in Fallow Fields During Agreement Years. If discing occurs in idled croplands during an Agreement Year, the following will be adhered to:
    - Between February 15 and September 15, discing will occur when vegetation is on average 12 inches or less in height.
    - Between September 15 and February 15, discing may occur without vegetation height restriction.
- **Mitigation Measure BIO-10**: Maintain Minimum Water Depth in Irrigation and Drainage Canals in the following Key Areas During Agreement Years.
    - Butte Creek between Upper Butte Basin and Gray Lodge Wildlife areas
    - Colusa Basin drainage canal between Delevan and Colusa National Wildlife Refuges
    - Gilsizer Slough

    - Colusa Drainage Canal
    - Land side of the Toe Drain along the Sutter Bypass
    - Willow Slough and Willow Slough Bypass in Yolo County
    - Hunters and Logan Creeks between Sacramento and Delevan National Wildlife Refuges
    - Lands in the Natomas Basin
    - To the extent practicable, irrigation and drainage canal water depths in areas that are considered important GGS populations will be similar to years when the Agreement is not in effect or, where information on baseline water depths is limited, at least 2 feet deep.
- **Mitigation Measure BIO-11**: Obtain Required Permits and Implement Wetland Mitigation for Drought-Resiliency Projects. If impacts to wetlands and waters cannot be avoided, then required permits, potentially including permits from the USACE, RWQCB, and CDFW would be obtained and complied with.
- Mitigation Measures HYD-1 and HYD-2 have also been identified as additional mitigation and are described above in Section 3.4.4.

3.6 Regional Economics

3.6.1 Affected Environment

3.6.1.1 Agricultural Economics

California is the highest producer (by value) of agricultural commodities in the United States. California accounted for over 11.8% of the nation's total agricultural value (cash farm receipts) in 2021 (California Department of Food and Agriculture 2022). According to the California Department of Food and Agriculture's 2021-2022 Agricultural Statistics Review (2022), in 2021 the San Joaquin Valley Region counties accounted for approximately 59% ($36.1 million) of the agricultural produce (by value) in California. Sacramento Valley counties accounted for approximately 13% ($7.9 million).

3.6.1.2 Groundwater Costs

Section 3.4.1.2, describes existing groundwater conditions in the study area. The area of analysis for the groundwater costs analysis includes the counties overlying the Sacramento Valley Groundwater Basin and the Redding Groundwater Basin. Groundwater pumping costs are related to depth to groundwater, pump efficiencies, and power costs. Pumping costs tend to increase during drought as more water is pumped and average depth to water increases.

Groundwater costs also include costs to deepen wells or drill new wells. The costs for deepening or drilling a well can vary widely depending on many factors, such as depth, diameter, well use (potable vs. irrigation), and construction materials. There are also permitting costs.

3.6.2 No Action Alternative

Under the No Action Alternative, water users in the study area would continue to face water shortages under certain hydrologic conditions consistent with policy, regulation, contracts, and agreements. Crop production would not decrease in the study area. In general, irrigated acreages and agricultural economies in the study area under the No Action Alternative would be similar to the current affected environment. Growers would continue to idle some land temporarily and would continue to rotate other previously idled land back into production as common land management practices. These farming practices cause normal variations in employment, labor income, and output.

Under the No Action Alternative, water users in the study area would continue to use surface water supplies, rather than pump groundwater except under certain hydrologic conditions where shortages occur, consistent with the Shasta Reservoir Framework. Groundwater levels would continue to fluctuate per water year type; therefore, groundwater pumping costs and nearby well owners would not change.

3.6.3 Proposed Action

3.6.3.1 Surface Water Diversion Reduction-Related Activities

Under the Proposed Action, surface water diversion reduction-related activities including cropland idling and crop shifting as well as groundwater substitution, and conservation would be anticipated to be utilized similar to the No Action Alternative. Unlike the No Action Alternative, water users would be compensated for surface water diversion reduction-related activities by participating in the Program. The compensation would be expected to offset the reductions in employment, labor income, and economic output for business and households linked to agricultural activities.

Groundwater substitution would be anticipated to be utilized similarly as the No Action Alternative to respond to water reductions. Groundwater levels would not be affected; therefore, groundwater pumping costs and nearby well owners would not change.

3.6.3.2 Drought Resiliency Projects

Construction actions related to implementation of drought resiliency actions under the Proposed Action would temporarily increase construction-related employment and spending in the regions with construction sites. Construction would be anticipated to temporarily benefit the regional economy by increasing employment, labor income, and revenue during the construction period.

3.6.4 Mitigation Measures

No Avoidance and Minimization Measures, or additional Mitigation Measures have been identified.

3.7 Environmental Justice

Under NEPA at §1508(1)(m), Environmental justice is defined as "*the just treatment and meaningful involvement of all people, regardless of race, color, nation of origin, Tribal affiliation, or disability in agency decision-making and other Federal activities that affect the human health and environment so that people:*

1) Are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural system barriers; and

2) Have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices."

Executive Order 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All, defines environmental justice as the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other federal activities that affect human health and the environment.

The concept of environmental justice as applied here is that minority and low-income people should not be disproportionately affected by economic and quality of life effects from implementation of the Proposed Action. Proposed cropland idling and crop shifting could affect farm labor employment by temporarily reducing the amount of agricultural land in production and the number of farmworkers needed to work on agricultural fields while implementation of drought resiliency projects may temporarily increase the number of other low-income employment opportunities. Groundwater substitution, and water conservation activities would not result in environmental justice effects; therefore, these measures are not further discussed in this analysis.

3.7.1 Affected Environment

The area of analysis is the SRSC service area which includes Butte, Colusa, Glenn, Sacramento, Shasta, Tehama, Sutter, and Yolo counties.

3.7.1.1 Minority Populations

According to the 2021 ACS five-year dataset, the Sacramento Valley Region had a total population of 3,196,192 in 2021 (U.S. Census Bureau 2023a). Approximately 45% of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race. Table 35 shows the minority population distribution for the individual counties within the Sacramento Valley Region and for the State of California. Although the minority population in the region as a whole accounted for less than 50% of the total region population, minority populations accounted for 50% or more of the total county population in Colusa, Sacramento, Sutter, and Yolo counties. Thus, these counties are further evaluated for environmental justice impacts.

Table 3-5. Minority Population Distribution in the Sacramento Valley Region in 2021

Area	Total Population (individuals)	Race - White	Race - Black/ African American	Race - Native American and Native Alaskan	Race - Asian	Race - Native Hawaiian and Other	Race - Some Other	Race - Two or More Races	Race - Hispanic or Latino Origin	Race - White, Not Hispanic or Latino	Race - White, Not Hispanic or Latino
Butte County	217,884	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	70.3%	29.7%
Colusa County	21,780	68.8%	1.7%	1.3%	0.9%	0.1%	13.1%	14.1%	60.5%	34.0%	66.0%
Glenn County	28,675	75.0%	0.6%	2.4%	3.5%	0.1%	13.3%	5.1%	42.9%	50.1%	49.9%
Sacramento County	1,571,767	77.8%	1.8%	1.1%	5.0%	0.3%	5.4%	8.5%	17.4%	42.9%	57.1%
Shasta County	181,935	83.3%	1.1%	2.3%	3.3%	0.1%	2.6%	7.3%	10.7%	78.0%	22.0%
Sutter County	99,080	58.5%	1.9%	1.4%	16.4%	0.6%	8.2%	13.1%	31.9%	44.1%	55.9%
Tehama County	65,345	80.6%	0.9%	1.3%	1.8%	0.1%	6.7%	8.5%	26.3%	66.4%	33.6%
Yolo County	216,703	63.3%	2.6%	0.7%	14.5%	0.5%	6.6%	11.9%	32.1%	45.2%	54.8%

Source: U.S. Census Bureau 2023a.

[a] Total Minority is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race, not counting people who are white and not Hispanic or Latino. The calculation is performed by subtracting the White, not Hispanic or Latino Origin group from the Total Population.

[b] The potential of double counting exists as there may be individuals who identify as of Hispanic and Latino origin and of a certain race.

3.7.1.2 Poverty Levels

As shown in Table 36, 12.9% of the population in the Sacramento Valley Region was below the poverty level (U.S. Census Bureau 2023b). Neither the region as a whole nor any of the counties within it are considered "poverty areas."

Table 3-6. Population below Poverty Level in the Sacramento Valley Region, 2017–2021

Area	Total Population[a]	Population Below Poverty Level–Total	Population Below Poverty Level–Percentage
Butte County	212,593	37,731	17.7%
Colusa County	21,585	2,807	13.0%
El Dorado County	188,914	16,394	8.7%
Glenn County	28,368	4,272	15.1%
Nevada County	100,880	10,567	10.5%
Placer County	396,956	27,629	7.0%
Plumas County	19,293	2,287	11.9%
Sacramento County	1,550,537	205,590	13.3%
Shasta County	178,903	25,365	14.2%
Sutter County	98,017	12,383	12.6%
Tehama County	64,517	11,597	18.0%
Yolo County	209,165	36,036	17.2%
Yuba County	78,774	11,939	15.2%
Region Total	3,148,502	404,597	12.9%
State Total	38,701,352	4,741,175	12.3%

Source: U.S. Census Bureau 2023b.

[a] Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals.

3.7.2 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis and drought resiliency projects would not be implemented. There would continue to be shortages under certain hydrologic conditions consistent with current policy, regulation, contracts, and agreements. Shortages may result in water users taking voluntary actions to offset reduced water supply which could include crop idling, crop shifting, or other actions. Therefore, there would be no effect to low income and minority populations from the No Action Alternative.

3.7.3 Proposed Action

3.7.3.1 Surface Water Diversion Reduction-Related Activities

Cropland idling could reduce farm worker jobs, by temporarily taking farmland out of production and decreasing demand for farm labor leading to an increased risk to local rural agricultural communities. Though uncertain, the use of supplemental groundwater, changes in agricultural practices, application of on-farm crop insurance program, use of Natural Resources Conservation Service (NRCS) programs, and other potential state and federal programs and activities are expected to be implemented thereby reducing risks to populations within the study area. Table 3-2 presents the estimated maximum annual cropland idling acreage which are largely anticipated to be rice fields under the Proposed Action. A maximum of 83,333 acres could be idled under the Proposed Action, which is similar to the fluctuations in production under the No Action Alternative.

Farm worker job losses as a result of cropland idling are anticipated to be within historic annual fluctuation in farm worker employment. All farm worker effects of the Proposed Action would be temporary and limited to Program Years which are anticipated to occur on average 0.66 times over the 10-year Phase 1 period with a maximum potential for there to be a Phase 1 Agreement Year four times over a 10-year period. Additional reductions in contract supply would be anticipated to occur on average 0.88 times over the 10-year Phase 2 period with a maximum potential for there to be a Phase 2 Agreement Year four times over a 10-year period. Cropland idling under the Proposed Action would not result in an adverse and disproportionately high effect to farm workers when compared to the No Action Alternative.

For crop shifting, water users would switch from a higher water use crop to a lower water use crop, such as wheat. In general, crop shifting would have smaller labor effects relative to cropland idling, because the water user continues to produce a crop and must hire farm labor. Water users would also continue to purchase inputs and services for crop production, which would support additional jobs throughout the regional economy. Therefore, crop shifting under the Proposed Action would not result in impacts on minority and low-income populations compared to the No Action Alternative. The required reduction would be less than occurred in 2022 when water made available for diversion amounted to 18% of contract totals.

3.7.3.2 Drought Resiliency Projects

Construction of drought resiliency projects requiring heavy equipment (e.g., front loaders, dump trucks, excavators, cranes) that uses hazardous materials (e.g., fuels, lubricants, solvents) could create a hazard to the public and environment through the accidental release of those hazardous materials. However, spill prevention and control measures would be implemented which would contribute to minimizing the risk for potential hazards.

Under the Proposed Action, implementation of drought resiliency projects is expected to increase the number of small-scale construction activities within the project area. Water users would purchase supplies and services related to construction and implementation of the drought resiliency projects which would support additional jobs throughout the regional economy and may temporarily increase the number of low-income employment opportunities.

Therefore, drought resiliency projects would not be anticipated to result in impacts on minority and low-income populations compared to the No Action Alternative and may provide beneficial effects.

3.7.4 Mitigation Measures

No Avoidance and Minimization Measures, or additional Mitigation Measures have been identified.

3.8 Air Quality

3.8.1 Affected Environment

This section describes the area of analysis and ambient air quality and conditions in the study area. The discussion in this section is organized by the study area and associated air basins. The counties, air basins and air quality management districts in California, including those in the study area, do not specifically align (California Air Resources Board 2023a, 2023b). The study area which encompasses the SRSC's Service Area and includes Shasta, Tehama, Glenn, Butte, Colusa, Sutter, Yolo, and Sacramento counties are located within the Sacramento Valley Air Basin. Winters are wet and cool, and summers are hot and dry. When air stagnates or is trapped by an inversion layer in the valley, ambient pollutant concentrations can reach or exceed ambient air quality standards. On-road vehicles are the largest source of smog-forming pollutants, and particulate matter (PM) emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (California Air Resources Board 2013a).

Air quality conditions and potential impacts are evaluated and discussed qualitatively. The following subsections briefly describe the existing air quality environmental setting for the Sacramento Valley Air Basin. The counties within the air basin are presented in Table 37, along with nonattainment designations to characterize existing ambient air quality. Nonattainment designations indicate that concentrations of pollutants measured in ambient air exceed the applicable Federal and State Ambient Air Quality Standards. As shown in Table 37, many of the counties included in the action area are designated as nonattainment for the federal and/or state ozone and particulate matter standards. Particulate matter issues may be exacerbated under dry conditions because when irrigation water supplies are decreased, there is increased potential for the formation and transport of fugitive dust.

For the three years of 2019–2021, which are the most recent years for which complete data are available, monitoring data indicated the following (California Air Resources Board 2023c):

- Concentrations of 8-hour ozone (O3) , 1-hour O3, 24-hour PM2.5, and 24-hour PM10 have exceeded the National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS).
- Measured concentrations of nitrogen dioxide (NO2) have complied with the NAAQS and CAAQS.
- Monitored sulfur dioxide and lead concentrations are very low.

Table 3-7. Areas and Pollutants Designated as Nonattainment for Federal and State Ambient Air Quality Standards in the Sacramento River Region

County	Air Basin	Air Quality Management District	Federal Nonattainment Designations[1]	State Nonattainment Designations[2]
Shasta	Sacramento Valley	Shasta	–	Ozone
Tehama	Sacramento Valley	Tehama	Ozone (Tuscan Buttes)	Ozone, PM10
Glenn	Sacramento Valley	Glenn	–	PM10
Butte	Sacramento Valley	Butte	Ozone	Ozone, PM10
Colusa	Sacramento Valley	Colusa	–	PM10
Sutter	Sacramento Valley	Feather River	Ozone	Ozone, PM10
Yolo	Sacramento Valley	Yolo-Solano	Ozone, PM2.5	Ozone, PM10
Sacramento	Sacramento Valley	Sacramento Metro	Ozone, PM2.5	Ozone, PM10

Sources: U.S. Environmental Protection Agency 2023; California Air Resources Board 2023a.

Notes: AQMD = Air Quality Management District; Bay Area = San Francisco Bay Area; PM2.5 = particulate matter of 2.5 microns diameter and smaller; PM10 = particulate matter of 10 microns diameter and smaller

[1] Areas designated as nonattainment by U.S. Environmental Protection Agency related to National Ambient Air Quality Standards as of March 31, 2023.

[2] Areas designated as nonattainment by California Air Resources Board related to California Ambient Air Quality Standards as of March 2023.

[3] Dash indicates that the county has no nonattainment areas.

3.8.2 No Action Alternative

Under the No Action Alternative, water users in the study area would continue to face water shortages under certain hydrologic conditions consistent with policy, regulation, contracts, and agreements, similar to existing conditions and drought resiliency projects would not be implemented. In response, water users could leave some crops idle, which would leave bare soils susceptible to fugitive dust emissions from windblown dusts. Water users would also continue to pump groundwater for irrigation, which releases emissions if diesel pumps are used. These actions in response to water shortages are similar to those that currently occur, therefore, there would be no change to emissions under the No Action Alternative.

3.8.3 Proposed Action

3.8.3.1 Surface Water Diversion Reduction-Related Activities

Surface water diversion reduction-related activities would not involve construction activities. Increased emissions could occur if diesel- and/or natural-gas fired engines are used for groundwater substitution. However, groundwater substitution associated with the Program would only occur in Program Years generally with smaller scale pumps that are typically electric. Cropland idling reduces use of farm equipment that reduces criteria pollutant emissions from vehicle exhaust which would be anticipated to apply to all pollutants. Air quality impacts from vehicle exhaust that would not occur during cropland idling in the study area would be similar to the No Action Alternative.

Cropland idling could result in reduced fugitive dust (PM10 and PM2.5) emissions from land preparation and harvesting activities. However, barren land resulting from idled lands could consequently result in increased windblown dust thereby increasing particulate matter emissions. It is likely that the increase in crop idling would result in a higher level of PM2.5 or dust emissions in the project area. Similar to the No Action Alternative, dust mitigation and soil retention BMPs would likely be employed. The combined effect of reduced dust emissions from the absence of land preparation and harvesting with increased dust emissions from windblown dust would likely offset one another. Therefore, it is anticipated that fugitive dust emissions occurring from cropland idling in study area would be similar to the No Action Alternative.

Crop shifting could generate small levels of increased or decreased emissions depending on the types of crops that are shifted and on the type of equipment needed to farm the crop. However, since crop shifting would only occur in Program Years, long-term changes to air quality would not be anticipated when compared to the No Action Alternative. The required reduction would be less than occurred in 2022 when water made available for diversion amounted to only 18% of contract totals.

3.8.3.2 Drought Resiliency Projects

Construction emissions would vary from day to day and by activity, timing and intensity, and wind speed and direction with potential air quality impacts from the Proposed Action would be localized in nature. Short-term air quality impacts would be associated with construction and would generally arise from dust generation (fugitive dust) and operation of construction equipment. Fugitive dust results from land clearing, grading, excavation, concrete work, and vehicle traffic on paved and unpaved roads. Fugitive dust is a source of airborne particulates, including PM10 and PM2.5. Potential construction impacts would not be expected to lead to new or worsened exceedance(s) of air quality standards if appropriate BMPs are implemented such as developing a fugitive dust control plans and ensuring exposed surfaces are wetted or otherwise stabilized or covered. Large earth-moving equipment, trucks, and other mobile sources powered by diesel or gasoline are also sources of combustion emissions, including nitrogen dioxide, carbon monoxide, volatile organic compounds, sulfur dioxide, and small amounts of air toxics. Construction equipment would meet all applicable and required emission standard requirements including idling limits and emissions and are not expected to exceed applicable thresholds. Implementation of drought resiliency project may lead to minor, short-term impacts to air quality when compared to the No Action Alternative.

3.8.4 Mitigation Measures

The following additional mitigation has been identified:

- Mitigation Measure AIR-1: Construction Truck Idling Requirements. During construction of drought resiliency projects, SRSC contractors will require construction contractors to minimize heavy-duty construction equipment idling time to 2 minutes where feasible.
- Mitigation Measure AIR-2: Dust Reduction Measures will be implemented including watering construction areas, covering hauling trucks and inactive storage areas.

3.9 Cultural Resources and Indian Sacred Sites

3.9.1 Affected Environment

The study area encompasses lands occupied by 14 distinct Native American cultural groups. Although most California tribes shared similar elements of social organization and material culture, linguistic affiliation and territorial boundaries primarily distinguish them from each other. No physical or record surveys were conducted for this EA because no site-specific actions were considered. Numerous cultural and historical resources are in the counties within the project area, as summarized in Table 37. Most of the cultural resources are located within areas that would not be affected by land use changes that could result from changes in CVP and SWP water supplies. The resources listed in Table 38 also include the sites described above near CVP and SWP facilities.

Table 3-8. Previously Recorded Cultural and Historical Resources of the Central Valley Region

County	Post-Contact Site Types	Early Native American Site Types
Butte	26 NRHP properties, 8 California Historical Landmarks, and 21 California Points of Historical Interest.	1,198 Known early Native American Site Types
Colusa	7 NRHP properties, 3 California Historical Landmarks, and 3 California Points of Historical Interest.	115 Known early Native American Site Types.
Glenn	2 NRHP properties, 2 California Historical Landmarks, and 17 California Points of Historical Interest.	373 Known early Native American Site Types.
Sacramento	90 NRHP properties, 56 California Historical Landmarks, 4 CRHR properties, 20 California Points of Historical Interest; numerous post-contact sites, such as mining features, building foundations, trash scatters, and bridges, were inundated by Folsom Reservoir; the Folsom Mining District surrounds Lake Natoma. There are over 40 post-contact sites along the Sacramento River between Sutter County boundary and Freeport; including Natomas Main Drainage Canal, Town of Freeport,	407 Known early Native American Site Types (Bureau of Reclamation 1997). There are 24 early Native American sites along the Sacramento River between Sutter County boundary and Freeport. There are 22 early Native American sites along the American River between Folsom Dam and the

County	Post-Contact Site Types	Early Native American Site Types
	Sacramento Weir, Yolo Bypass, homes and farms, and a church. There are 14 post-contact sites along the American River between Folsom Dam and the confluence with the Sacramento River.	confluence with the Sacramento River.
Shasta	26 NRHP properties, 19 California Historical Landmarks, 1 CRHR properties, 15 California Points of Historical Interest. The Anderson-Cottonwood Irrigation District Diversion Dam has been determined to be eligible for NRHP listing.	1,419 Known early Native American Site Types. Many of these sites occur along the Sacramento River near Redding and between Battle Creek and Table Mountain.
Sutter	7 NRHP properties, 2 California Historical Landmarks, and 22 California Points of Historical Interest.	62 Known early Native American Site Types.
Tehama	10 NRHP properties, 3 California Historical Landmarks, and 1 California Point of Historical Interest.	1,415 Known early Native American Site Types.

Sources: Bureau of Reclamation 1997, 2005b, 2013; California State Parks Office of Historic Preservation 2014. Notes: NRHP = National Register of Historic Places; CRHR = California Register of Historic Resources

Indian Sacred Sites are primarily identified during the process of tribal consultation typically associated with the Section 106 process. As such, once a project is identified, the lead federal agency is required to consult with tribes that have cultural affiliation.

3.9.2 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis and drought resiliency projects would not be implemented. SRSC would continue to manage cultural resources in a manner consistent with State and Federal laws.

Adverse effects to the affected environment that can occur (i.e., disturbance to cultural resources by looters, vehicles, wave action erosion, sedimentation, changing water levels, redistribution of cultural materials, etc.) could continue. Water and irrigation districts would continue to operate their systems as they do currently, moving water frequently between facilities.

3.9.3 Proposed Action

3.9.3.1 Surface Water Diversion Reduction-Related Activities

The surface water diversion reduction-related activities would occur within existing facilities and on existing agricultural fields and there would be no ground-disturbing activities, changes in land use, or construction proposed that could disturb historic properties associated with the water reduction activity component of the Proposed Action. This type of undertaking that does not have the potential to cause effects to historic properties, should such properties be present, pursuant to the Title 54 U.S.C. § 306108, commonly known as Section 106 of the National

Historic Preservation Act (NHPA) regulations codified at 36 CFR § 800.3(a)(1). As such, the surface water diversion reduction-related activities do not require further consideration under Section 106 of the NHPA. The surface water diversion reduction-related activities would also not impact Indian Sacred Sites.

3.9.3.2 Drought Resiliency Projects

Drought-resiliency projects would involve ground disturbance varying from construction of access routes to larger-scale project construction footprints. Assuming they are present, cultural resources may be impacted by ground disturbance associated with these projects which could occur from maneuvering construction equipment or from construction activities, such as compression, trampling, rutting, mixing soils, excavating by drills or heavy machinery, and restricting access.

Construction or installation of weirs or check structures and SCADA systems have the lowest potential to impact cultural resources; however, due to the need for access routes, potential power/communications connections, and minimal excavation, there remains potential for disturbance. New groundwater or deep aquifer wells, improvements to ditches and canals (including piping and lining), and automated gates installation have moderate potential to impact cultural resources. Equipment and vehicle traffic on access routes, material storage within larger staging areas, utility construction, and excavation could disturb cultural resources.

Similarly, improvements to irrigation systems, pipeline recirculation programs, on-farm reservoirs, and conjunctive use programs may include larger excavation areas, utility and irrigation line construction and decommissioning, and other project elements with potential to impact cultural resources.

Program-level activities under the Proposed Action have the potential to affect historic properties due to construction activities. However, since program-level activities are broad in scope and not fully defined, these activities will be subject to additional environmental compliance procedures in the future. Once drought resiliency projects are identified, Reclamation will evaluate the appropriate process for compliance with the Section 106 of the NHPA.

3.9.4 Mitigation Measures

The following additional mitigation has been identified:

- **Mitigation Measure CUL-1**: Conduct CHRIS Review and Desktop Evaluation for Drought- Resiliency Projects. Prior to the start of any drought-resiliency project, a qualified historian/archaeologist will request information regarding cultural resources already recorded in CHRIS to determine whether a drought-resiliency project may be located in an area where cultural resources are recorded. If through this review, a cultural resource is identified within resiliency project area or the historian/archaeologist determines through desktop review that the specific project area has potential to contain cultural resources, then implementation of MM-CUL-2 will be required.

- **Mitigation Measure CUL-2**: Conduct Pre-Construction Surveys and Establish Buffers for Drought-Resiliency Projects. If determined required by the qualified historian/archaeologist in MM-CUL-1, a site-specific pre-construction field survey will be conducted by a qualified historian/archeologist prior to the start of construction activities. The pre-construction survey will be designed to identify historic structures, archaeological sites, and potential Tribal cultural resources that may be present at the specific location of the drought-resiliency project that is to be implemented. Reports would be made available to the Office of Historic Preservation (OHP) and Native American Tribes that have requested consultation (if any), and these entities would be afforded an opportunity to comment prior to the start of construction. Any historical or archaeological resources identified during the survey would be recorded and flagged with a 30-foot buffer (or based on topography and access points to protect the find, as determined appropriate by the qualified historian/archeologist).
- **Mitigation Measure CUL-3**: Develop and Implement Applicable Monitoring and Mitigation for Drought-Resiliency Project Impacts. If the pre-construction survey conducted in MM-CUL-2 identifies any historic or archaeological resources and a Tribe(s) has requested consultation, then that Tribe(s) will be notified. If historic structures, archaeological sites, and potential Tribal cultural resources are identified and flagged, but impacts cannot be avoided or adequately minimized, then OHP and Tribes that have requested consultation (if any) will be provided a project-specific monitoring and mitigation plan.
- **Mitigation Measure CUL-4**: Develop Inadvertent Discovery Plan (IDP) to be Implemented if Prehistoric or Historical Archaeological Resources Are Encountered during Drought- Resiliency Project Construction. A qualified archaeologist will develop an IDP for the proposed project to be provided to onsite personnel involved in drought-resiliency projects that involve excavation below depths routinely disced or disturbed through routine agricultural operations. The IDP will include steps to be taken in the event that cultural resources, any artifact, or an unusual amount of bone, shell, or non-native stone are identified during construction. Work will immediately stop and activities will be relocated to another area beyond 10 meters (30 feet) of the discovery. In the case of potential human remains, the find must be reported to local law enforcement. The IDP will specify steps to notify and consult with the OHP and Tribes. If the resources are found, they would be avoided or if avoidance is not possible, mitigated in accordance with MM-CUL-3.
- **Mitigation Measure CUL-3**: Develop and Implement Applicable Monitoring and Mitigation for Drought-Resiliency Project Impacts. If the pre-construction survey conducted in MM-CUL-2 identifies any historic or archaeological resources and a Tribe(s) has requested consultation, then that Tribe(s) will be notified. If historic structures, archaeological sites, and potential Tribal cultural resources are identified and flagged, but impacts cannot be avoided or adequately minimized, then OHP and Tribes that have requested consultation (if any) will be provided a project-specific monitoring and mitigation plan.

3.10 Energy

3.10.1 Affected Environment

Due to the size of its population, California's energy consumption ranks as the second highest in the country, with an estimated total consumption of 6,882 trillion British thermal units (Btu) in 2022. Total utility-scale electric generation for California was 287,220 gigawatt-hours (GWh) in 2022, up 3.4% (9,456 GWh) from 2021. The state's energy consumption per capita, however, ranks as the fourth lowest because of its mild climate and policies related to energy efficiency (USEIA 2024). California is the seventh highest producer of energy, producing 2,152 trillion Btu in 2021. It is the nation's top producer of solar and geothermal energy and the second highest producer of biomass and hydroelectric power generation (USEIA 2024).

In 2023, California was the fourth-largest electricity producer in the nation. It is also the nation's third-largest electricity consumer and imports more electricity than any other state. In 2023, renewable resources, including hydroelectric power and small-scale solar power, supplied 54% of California's in-state electricity generation. Natural gas fueled 39% and nuclear power fueled most of the remaining 7%. Electricity demand, usage, and production in the state is projected to increase in the near future due to population growth and other factors, including climate change (California Energy Commission (CEC) 2024).

Most of the study area is served by PG&E for electricity, except for the City of Redding, which is served by Redding Electric Utility (REU), and Sacramento County, by the Sacramento Municipal Utility District. Most of the region uses natural gas for heating. Gasoline is the most used transportation fuel in California, with 97% percent of all gasoline being consumed passenger vehicles and light-duty trucks. In 2022, 13.6 billion gallons of gasoline were sold in California Diesel fuel is the second largest source of transportation fuel used in California. In 2002, 3.6 billion gallons of diesel (including off-road diesel) was sold in California (CEC 2024).

3.10.2 No Action Alternative

Under the No Action Alternative, changes in hydrologic conditions could affect the annual generation of power and energy use depending on the response to potential shortages and if groundwater substitution is used. Groundwater substitution has the most potential for increased energy impacts due to water reduction activities. These changes, however, would be the same as described in the affected environment.

3.10.3 Proposed Action

3.10.3.1 Surface Water Diversion Reduction-Related Activities

Energy intensity for water delivery in the Sacramento River geologic region has been roughly quantified by the California Public Utilities Commission (CPUC) for surface water and groundwater (CPUC 2010). Groundwater energy intensity was estimated at about 177 kilowatt hours per acre-foot. Groundwater pumping would require 29,500 MWh annually during Phase 1 Agreement Years and 5,900 MWh annually during Phase 2 Agreement Years, which, represents about 0.1% or less of the total electricity consumption in the study area and would be offset somewhat by the disuse of surface water pumping stations during these years (GCID EIR 2024). Under the hydrologic conditions associated with the Program Years, impacts to hydroelectric power generation would not be anticipated to change compared to the No Action Alternative as a result of a reduction in diversions because that water would otherwise be diverted and used by the SRSCs, and not available for power generation. Therefore, energy use and generation under the Proposed Action is anticipated to be similar to the No Action Alternative.

3.10.3.2 Drought Resiliency Projects

Construction of the drought-resiliency projects would result in the short-term consumption of energy from construction of the project components, which would vary depending on the nature of the project and construction duration. Minimal energy consumption from typical construction practices would be required. Energy would be used during construction activities in the form of diesel and gas fuel use from construction equipment. However, construction projects would be small in scope and would not represent wasteful or unnecessary consumption of energy as contractors have a financial incentive to minimize costs associated with transportation fuel and energy. Construction equipment would meet all applicable and required emission standard requirements including idling limits and emissions and are not expected to exceed applicable thresholds. Long-term energy (electricity) consumption from operations and maintenance of some drought-resiliency projects would be expected to slightly increase as compared to the No Action Alternative while others would result in efficiencies.

3.10.4 Mitigation Measures

Mitigation Measure AIR-1 has been identified as additional mitigation and is described above in Section 3.8.4.

3.11 Geology and Soils

3.11.1 Affected Environment

3.11.1.1 Geologic Setting

The Central Valley is located within the Great Valley Geomorphic Province, and is bounded by the Klamath Mountains, Cascade Range, Coast Ranges, and Sierra Nevada Geomorphic Provinces (California Geological Survey 2002).

The Sacramento Valley is in the northern portion of the Great Valley Geomorphic Province and is drained by the Sacramento River and its tributaries. Extending approximately 180 miles long and 40 to 60 miles wide, the Sacramento Valley lies between the Coast Ranges on the west and the Sierra Nevada on the east and is bounded at the north end by the Cascade Geomorphic Province near Redding and extends southeasterly to the Sacramento–San Joaquin Delta (Delta) near Stockton. The surface of the Sacramento Valley consists of recent and Pleistocene-age alluvium deposited into the bottomlands by streams draining the surrounding highlands of the Klamath Mountain Geomorphic Province to the north and the Sierra Nevada and Coast Range Geomorphic Provinces to the east and west, respectively. These stream sediments consist of heterogeneous deposits of channel gravels, riverbank sands, silt, and clay deposited on the broad floodplain that has become the Sacramento Valley (DeCourten 2008).

The area along the Sacramento River from Shasta Reservoir to downstream of Red Bluff is characterized by loosely consolidated deposits of Pliocene- and/or Pleistocene-age sandstone, shale, and gravel. Downstream of Red Bluff to the Delta, the river flows through Quaternary-age alluvium, lake, playa, and terrace deposits that are unconsolidated or poorly consolidated with outcrops of resistant, cemented alluvial units such as the Modesto and Riverbank formations (CALFED Bay-Delta Program 2000).

3.11.1.2 Seismicity

In the Sacramento Valley, the major fault zones include the Battle Creek Fault to the east of the Sacramento River, Corning Fault that extends from Red Bluff to Artois parallel to the Corning Canal, Dunnigan Hills Fault located west of I-5 near Dunnigan, Cleveland Fault located near Oroville, and Great Valley Fault system along the west side of the Sacramento Valley (Reclamation 2005).

3.11.1.3 Volcanic Potential

Active centers of volcanic activity occur in the vicinity of Mount Shasta and Lassen Peak within the Cascade Geomorphic Province north and east of the Central Valley. Lassen Peak, about 50 miles southeast of Shasta Reservoir, is a cluster of dacitic domes and vents that have formed during eruptions over the past 250,000 years. The last eruptions were relatively small and occurred between 1914 and 1917. The most recent large eruption occurred about 1,100 years ago. Large eruptions appear to occur about once every 10,000 years (U.S. Geological Survey 2000).

3.11.1.4 Slope Stability

There are two types of processes that influence slope stability in the Shasta Reservoir watershed including mass wasting (e.g., landslides) and surficial erosion on both upland areas and the bed/bank of reservoirs and riverine features. Mass wasting is dominated by deep-seated landslides and shallow debris slides. Initiation and/or reinitiation of slope movement occurs when these mass movement feature’s toes are undercut by the rise and fall of reservoir water levels during dry period and wet period flow events. Normal wave action of the reservoir also can reactivate landslides. Seiches, wave action from seismicity and landslide movement, will also undercut unstable areas. Surface erosion occurs in response to rainfall and runoff events when overland flow occurs, resulting in soil movement in rills, gullies, and sheet erosion. Particle detachment during overland flow is controlled by slope gradient and soil texture. Fine-grained soils such as fine-grained sand and silt are more susceptible to particle detachment and transport. During high-flow events, the erosion of bed and banks of riverine environments occurs for some period of time as rivers rise above base flow conditions and volume and velocity of water mobilizes alluvial material.

Land subsidence in the Sacramento occurs primarily due to aquifer-system compaction as groundwater elevations decline as a result of groundwater overdraft (i.e., groundwater withdrawals at rates greater than groundwater recharge rates) typically used for irrigation. To a lesser degree, subsidence is also caused by weathering of some types of underlying bedrock, such as limestone, decomposition of organic matter, and natural compaction of soils (Reclamation 2014). Historic subsidence of the Sacramento Valley has generally been less than ten feet (U.S. Geological Survey 2019).

Winds above a threshold velocity (13 miles per hour at one-foot above ground) blowing over erodible soils can cause erosion in three ways including saltation, suspension, and surface creep. (James et al. 2009, NRCS 2009).

Wind erosion and the release of windblown dust are influenced by soil erodibility, climatic factors, soil surface roughness, width of field, and the quantity of vegetative coverage. Soils most vulnerable to windblown erosion are coarser textured soils like sandy loams, loamy sands, and sands (NRCS 2009). Increases in erosion from wind blowing across exposed non-pasture agricultural land results in particulate matter emissions. Section 3.8, Air Quality, discusses effects of fugitive dust emissions as a result of cropland idling.

3.11.1.5 Sacramento Valley Soil Characteristics

There are three major landform types in the Sacramento Valley Region area (each with its own characteristic soils) including floodplain; basin rim/basin floor; and terraces, foothills, and mountains. Floodplain lands contain two main soil types: alluvial soils and aeolian soils (soils that have accumulated by the deposition of sand sized particles by wind action). The alluvial soils make up some of the best agricultural land in California, whereas the aeolian soils are prone to wind erosion and are deficient in plant nutrients. Basin landforms consist of poorly drained soils, such as the saline and alkali soils found in the valley trough and on the basin rims. These soils are used mainly for pasture, rice, and cotton. Terrace soils are above the valley floor and are used primarily for grazing. The upper watershed of the Sacramento Valley primarily drains foothill soils. These soils are on the hilly-to-mountainous terrain surrounding the Sacramento Valley and are formed in place through the decomposition and disintegration of the underlying parent material. Foothill soils in the northern counties in the area of analysis are primarily used for livestock grazing while mountain meadow areas are used for a mixture of grazing and growing crops (Shasta County 2004). These soils are not useful for agriculture, grazing, or timber because of their very shallow depth, steep slopes, and stony texture.

3.11.2 No Action Alternative

Under the No Action Alternative, there would be no changes to soil erosion. The No Action Alternative continues to idle land during the crop season in response to shortages under certain hydrologic conditions voluntarily, which would leave soils susceptible to erosion. Agricultural lands within the study area counties are largely composed of clays and clay loam soils, which have low erodibility. Smaller areas also consist of loams, sandy loam, and loamy sand. These soils are slightly more erodible than clays. When crop idling is necessary, management actions are typically taken to manage potential soil erosion impacts to avoid substantial loss of soils and to protect soil quality. Agricultural lands are subject to normal swelling and shrinkage during growing and harvesting cycles and structures and roads in the vicinity of the cropland are also subject to these changes.

3.11.3 Proposed Action

3.11.3.1 Surface Water Diversion Reduction-Related Activities

Cropland idling could result in temporary conversion of lands from cropland to bare fields, which could increase soil erosion. The required reduction would be less than occurred in 2022 when water made available for diversion amounted to 18% of contract totals. Rice fields are anticipated to be the majority of crop land idled under the Proposed Action as they are under the No Action Alternative. Rice is typically grown on clay soils that are less susceptible to erosion than sandy soils. Management of rice fields may reduce the potential for erosion as the residual rice straw decomposes into the soils after harvest. The fields are then flooded during the winter to aid in decomposition of the straw which allows the soil to remain wet over the winter and spring and once dried form a hard, crust like soil surface. Surface water diversion reduction-related activities could also include crops other than rice including alfalfa, tomatoes, and corn which can be grown on other soil types besides clay. The soils in the Sacramento Valley are primarily clay and clay loam with smaller portions of silt loam, loam, sandy loam, and clay loam. In general, soils that contain some percentage of clay content, such as the predominant soils in the project area, are less susceptible to erosion. Although idled rice fields are typically not conducive to soil loss from wind erosion, it is possible that idling could occur on the more erodible soil textures such as loam and silt loam which could result in soil erosion similar to the No Action Alternative.

While crop idling would result in increases of dry soil from fallow croplands under both the Proposed Action and the No Action Alternative, the study area primarily has flat topography, reducing susceptibility to slope failure or landslides and soils occurring in the study area do not include soils susceptible to seismically induced liquefaction.

Groundwater substitution could reduce groundwater levels under both the Proposed Action Alternative and the No Action Alternative, which could decrease pore-water pressure and result in a loss of structural support for clay and silt beds. This loss of structural support could result in lowering of the ground surface elevation (land subsidence). Groundwater-pumping-related land subsidence is analyzed in more detail in Section 3.4. The analysis finds that the potential for land subsidence from groundwater pumping could cause potential land subsidence similar to the No Action Alternative if groundwater levels fall below historical low water levels.

3.11.3.2 Drought Resiliency Projects

Implementation of drought resiliency projects could potentially affect soils resources at the construction locations and may result in temporary soil alteration or disturbance. Potential construction impacts would be reduced if appropriate BMPs are implemented such as developing erosion and sediment control plans. Although soils may be affected in the short-term during construction, the long-term effects permanent impact of drought resiliency projects would likely stabilize soils.

The study area has several notable faults related to the San Andreas and the Sierra Nevada fault systems. These fault systems can cause damaging levels of ground shaking and major damage to facilities and foundations not designed to resist earthquake-generated forces. Drought-resiliency projects would generally not involve foundations or facilities that could be substantially affected by fault rupture or ground shaking. The soils occurring in the study area do not include soils susceptible to seismically induced liquefaction. Some surrounding areas may be susceptible to lateral spreading; these areas are focused in the mountainous cradle. The Sacramento Valley, which is where the project area is focused, has flat topography which reduces lateral spreading potential. The study area primarily has flat topography, reducing susceptibility to slope failure or landslides. Steep slopes are present in the mountainous cradle surrounding the study area; however, there are no landslide hazard zones in the study area or in its immediate vicinity. The Proposed Action would not result in changes that would increase the potential for slope failure or landslides compared to the No Action Alternative.

3.11.4 Mitigation Measures

No Avoidance and Minimization Measures, or additional Mitigation Measures have been identified.

3.12 Greenhouse Gas Emissions

3.12.1 Affected Environment

The principal GHGs are carbon dioxide (CO2), CH4, nitrous oxide (N2O), sulfur hexafluoride (SF6), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs), in accordance with the California Health and Safety Code Section 38505(g) (DWR 2010). This EA considers only CO2, CH4, and N2O because the project has no sources of SF6, PFCs, or HFCs. Each of the principal GHGs has a long atmospheric lifetime (1 year to several thousand years). In addition, the potential heat-trapping ability of each of these gases varies substantially from one another and varies over time. For example, CH4 is 27.9 times as potent as CO2, while SF6 is 25,200 times more potent than CO2 with a 100-year time horizon (Intergovernmental Panel on Climate Change (IPCC) 2021).

For calculating emissions, the California Air Resources Board (ARB) (2023) uses a metric developed by the IPCC to account for these differences and to provide a standard basis for calculations. The metric, called the global warming potential (GWP), is used to compare the future climate impacts of emissions of various long-lived GHGs. The GWP of each GHG is indexed to the heat-trapping capability of CO2 and allows comparison of the global warming influence of each GHG relative to CO2. The GWP is used to translate emissions of each GHG to emissions of carbon dioxide equivalents, or CO2e. In this way, emissions of various GHGs can be summed, and total GHG emissions can be inventoried in common units of metric tons per year of CO2e. Most international inventories, including the United States inventory, use GWP values from the IPCC Fourth Assessment Report, per international consensus (IPCC 2007; U.S. Environmental Protection Agency 2012).

3.12.2 No Action Alternative

Under the No Action Alternative, surface water diversion reduction-related activities would be on a voluntary basis consistent with the Shasta Reservoir Framework under the 2021 LTO, and drought resiliency projects would not be implemented. In response, some crops would be idled, which would reduce vehicle exhaust from farm equipment. Farmers would also continue to pump groundwater for irrigation, which releases emissions if diesel pumps are used. These actions in response to surface water shortages would continue under the No Action Alternative.

3.12.3 Proposed Action

3.12.3.1 Surface Water Diversion Reduction-Related Activities

Crop idling has the potential to result in substantial reductions to methane (CH4) production related to rice production, under both the Proposed Action and the No Action Alternative.

Rice is typically grown in fields flooded by irrigation water. While all organic matter decomposes in soil, organic matter submerged in water undergoes anaerobic decomposition due to the lack of oxygen. The organic matter in these fields consists of soil amendments, plant residues, and root exudates. This anaerobic decomposition of organic matter in rice fields produces methane emissions. Methane production varies according to the duration of flooding, the variety or rice crop and the amount of organic matter present.

In North America, each acre of flooded rice cropland emits on average 0.65 kg CH4 per hectare per day (one hectare contains about 2.47 acres) and has an average cultivation period of 139 days per year (IPCC 2021). To provide a quantitative example of the GHG emissions reductions, idling 1,000 acres of flooded rice cropland would result in a reduction of about 36.56 metric tons (MT) of methane per year, or 994 MT of CO2e (GCID 2024). The average maximum acres to be idled for the project's Phases 1 and 2 are 83,333 acres and 16,667 acres, respectively. Additionally, this idling would result in reduced GHG emissions associated with reduced operation of irrigation equipment, farm machinery, and product transportation. Idling of non-flooded cropland would not result in any reduction in methane emissions, but reductions in GHG emissions from reduced use of farm equipment would be expected under both the Proposed Action and the No Action Alternative.

Crop shifting would not result in substantial changes in GHG emissions as there would be negligible increases or reductions depending on the changes in farm equipment associated with this component compared to the No Action Alternative.

Groundwater substitution and new groundwater or deep aquifer wells have the potential to increase GHG emissions. Groundwater pumps consume energy in the form of diesel fuel, natural gas, or, most often, electricity. Each of these energy sources has a carbon footprint, and the extent to which groundwater is used to replace surface water for irrigation would determine the extent of the impact to GHGs. There is not a clear comparison between the energy used to deliver surface water and the energy used to deliver groundwater, because both cases depend on several factors, including distance and elevation from the water source to the destination cropland. Generally, however, groundwater requires more energy to pump to the surface than surface water pumping plants use to move the same volume of water. Groundwater substitution is not anticipated to increase GHG emissions when compared to the No Action Alternative.

Conservation would have a small positive impact on GHG emissions, due to the reduced pumping activity at surface water pumping plants, resulting in lower electrical demand and associated GHG emissions.

3.12.3.2 Drought Resiliency Projects

Several drought-resiliency projects would have negligible impacts related to GHG beyond small reductions in emissions from reduced electricity use at surface water pumping plants when compared to the No Action Alternative. The project components to which this applies include piping open ditches or canals, canal lining and modernization, on-farm improvements to irrigation systems, weirs or check structures, and conjunctive use programs. Canal automation through SCADA systems, automated gates installation, and pipeline recirculation systems each would result in minor GHG emissions impacts from operations, due to the electricity required for their operation when compared to the No Action Alternative. This would be offset to an extent by the reduced pumping activity at surface water pumping plants compared to the No Action Alternative. The details of construction currently are not known in sufficient detail to estimate GHG emissions. Potential temporary increases in GHG emissions would be lessened if appropriate BMPs are implemented such as an emissions control plan and traffic management plan.

3.12.4 Mitigation Measures

Mitigation Measures AIR-1 and AIR-2 have been identified as additional mitigation and are described above in Section 3.8.4.

3.13 Noise

3.13.1 Affected Environment

Sources of ambient noise in the action area include traffic, agricultural equipment, boats, and aircraft. Some locations in the action area are within airport land use planning or influence areas and may experience ambient noise from aircraft arrivals and departures. Rail transportation corridors in the action area are a source of rail noise and vibration from freight and commuter trains. Noise levels in the study area reflect normal agricultural and transportation activity. The study area is comprised mostly of agricultural land uses, and farm equipment makes up the majority of noise-generating activity.

3.13.2 No Action Alternative

The No Action Alternative would result in no change in background noise levels in the study area, which vary between rural and urban settings. The influence of these sources of noise on ambient levels depends on the proximity to highways, rail corridors, airports, and developed areas. The No Action Alternative would have a negligible potential to generate groundborne noise.

3.13.3 Proposed Action

3.13.3.1 Surface Water Diversion Reduction-Related Activities

Surface water diversion reduction-related activities would not involve construction. In the specific case of crop idling, farm equipment usage would decrease during Agreement Years for idled crops, resulting in reduced noise impacts similar to the No Action Alternative. Use of different farming equipment and practices associated with cropland shifting and conservation may result in minor changes in noise but generally would result in similar levels of noise when compared to the No Action Alternative. Groundwater pumping would make operational noise due to the use of a pump, but generally operate around 85 dB or lower and, therefore, would not be anticipated to generate a substantial increase in noise levels compared to the No Action Alternative as groundwater pumping is already occurring in the study area.

3.13.3.2 Drought Resiliency Activities

Noise-generating activities would occur during construction of some drought-resiliency project components. These activities would temporarily increase ambient noise levels intermittently near the site of the construction activity. Construction-related noise levels would fluctuate depending on the level of work and proximity. While most of the activities would be located in parts of the study area which are not in the vicinity of any noise-sensitive human land uses, there may be limited situations in which construction may occur adjacent to a residential area. For all project-related construction, local policies and noise ordinances specific to construction activities would be followed to minimize the potential for noise related impacts.

Drought-resiliency project components could produce minor, temporary noise impacts during operation. However, there would be no substantial permanent increase in ambient noise levels when compared to the No Action Alternative.

3.13.4 Mitigation Measures

The following additional mitigation has been identified:

- **Mitigation Measure NOI-1**: Notification Requirements to Off-site Noise-sensitive Receptors for Drought-Resiliency Projects. Written notification of project activities would be provided to all off-site noise-sensitive receptors (e.g., residential land uses) located within 500 feet of drought-resiliency project locations.
- **Mitigation Measure NOI-2**: Power Equipment Use and Maintenance Requirements for Drought-Resiliency Projects. All powered heavy equipment and power tools will be used and maintained according to manufacturer specifications.
- **Mitigation Measure NOI-3**: Heavy Equipment Must Operate at Least 25 Feet from Neighboring Structures for Drought-Resiliency Projects. Drought-resiliency projects involving the use of heavy equipment (such as a large bulldozer) will be sited to occur at

least 25 feet from neighboring historical buildings and structures that are extremely susceptible to vibration damage.

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4 Cumulative Impacts

CEQ regulations define a cumulative impact as the "*effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*" (40 CFR 1508.1(i)(3)). The cumulative analysis follows applicable guidance provided by the CEQ guidance for Considering Cumulative Effects under the NEPA (CEQ 1997), Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ 2005), and the Bureau of Reclamation's (Reclamation) NEPA Handbook (Reclamation 2012).

Reclamation considers only future actions which have completed planning and any required compliance activities to be reasonably foreseeable and those that will have effects within the temporal period (2025-2045) and spatial overlap of this action. Actions similar in nature to the Proposed Action involve water supply use and management, groundwater use and management, small-scale construction, voluntary agreements, and water transfer. These actions are listed below in Table 4-1.

Drought resiliency projects are in the very early stages of planning regarding design, scope, and locations. They are being considered programmatically as part of this EA. Reclamation will evaluate whether additional environmental compliance documentation is necessary prior to specific project implementation. This EA recognizes the potential cumulative impacts that could occur with site specific project implementation. If potential for impacts is identified during specific project assessment, appropriate environmental compliance will be developed, including disclosing and evaluating potential mitigation.

Table 4-1. List of Past, Present, and Reasonably Foreseeable Future Actions (RFFA)

Project	Primary Agencies	State	Description
Del Puerto Canyon Reservoir	Del Puerto Water District and San Joaquin River Exchange Contractors Water Authority	Present	Del Puerto Water District and the Exchange Contractors would construct and operate the Del Puerto Canyon Reservoir. The project will deliver existing contracted water from the Delta- Mendota Canal into the new 80 thousand acre-feet (TAF) reservoir. The reservoir would allow water to be delivered into storage during wetter periods until it is needed in drier periods for irrigation, groundwater recharge, or wildlife beneficial uses. The reservoir would be located in Del Puerto Canyon in the Coast Range foothills west of Patterson and south of the Sacramento–San Joaquin Delta, just west of Interstate 5.

Project	Primary Agencies	State	Description
Maxwell Intertie Project	USDA and Sites Project Authority	Present	The overall purpose of the proposed Project is to increase the efficiency and reliability of water management in the western Sacramento Valley by adding to or improving existing facilities to facilitate greater flexibility in water conveyance, which would increase the drought resistance of rural communities. Rural development in California has frequently been limited by the availability and reliability of water to support the existing economic engines and the people of rural California. While rural water supplies appear to be plentiful, they are reliant on aging single-purpose water management facilities and winter storm precipitation. Water shortages during droughts and regulatory constraints on the operations of the Tehema Colusa Canal and the GCID Main Canal have decreased the reliability of the water supplies to rural agencies in the Sacramento Valley and affected Central Valley Project deliveries. Some individual TCCA member districts have independently explored potential conveyance points between the GCID canal system and individual TCCA landowners and/or individual TCCA district facilities. The proposed Project comprehensively addresses this need and facilitates the flexibility of water conveyance to improve the resiliency of participants during dry years. The Maxwell Water Intertie (MWI) pipeline would connect existing canal systems west of the Sacramento River (the GCID Main Canal and the Tehema Colusa Canal) to achieve this flexibility. The proposed project is comprised of a set of new project features or facilities that would allow for the efficient bi- directional exchange of water from two existing, large water management systems in the western portion of the Sacramento Valley of California. The project features included: A 1,200-AF capacity Terminal Regulating Reservoir (TRR) covering 130 acres with a spillway to the local irrigation ditch system and bottom drain, both of which ultimately connect to Funks Creek; TRR Pumping Plant with a 900-cubic feet per second (cfs) maximum pumping capacity, a 1-acre Electrical Switchyard adjacent to the plant, and a 3.5-mile power line; a GCID Main Canal Connection to TRR including a gated inlet control structure, short inlet channel, and concrete canal lining in the GCID Main Canal immediately upstream and downstream of the TRR connection; a 3.5-mile MWI pipeline sized for 900 cfs pumped capacity and 900 cfs gravity flow capacity, private access bridge over the GCID Main Canal for construction access and maintenance of the pipelines,

Project	Primary Agencies	State	Description
			and a 2.7-mile gravel access road that would run most of the length of the MWI pipeline alignment. The approved project included the granting of a loan from the USDA to assist in the financing of the Maxwell Water Intertie Project.
Future groundwater storage and recovery projects	N/A	Past and Present	City of Roseville (City of Roseville 2019) Mokelumne River Water & Power Authority (Mokelumne River Water & Power Authority 2015) Northeastern San Joaquin County Groundwater Banking Authority (NSJCGBA) (NSJCGBA 2011) Stockton East Water District (Stockton East Water District 2012) Madera Irrigation District (Bureau of Reclamation 2011) Kings River Conservation District (Kings River Conservation District 2012) City of Los Angeles (City of Los Angeles 2013) Los Angeles County (Los Angeles County 2013) City of San Diego (City of San Diego 2009a, 2009b) Rancho California Water District (Rancho California Water District 2011, 2012) Eastern Municipal Water District (Eastern Municipal Water District 2014a) Jurupa Community Services District (Jurupa Community Services District et al. 2010)
System Reoperation Program	DWR	Past	DWR is conducting a system reoperation study to identify potential reoperation strategies for the statewide flood protection and water supply systems. The study includes four phases. Phase 1, Plan of Study, was completed in 2011. Phase 2, Strategy Formulation and Refinements was completed in 2014. Phase 3, Preliminary Assessments of Strategies, was completed in August 2017. Phase 4, Reconnaissance Level Assessments of Strategies, is currently under development (DWR 2019a).
Contra Costa Canal Replacement Project	Contra Costa Water District (CCWD)	Present	CCWD’s Canal Replacement Project will replace the earth-lined portion of the canal with a pipeline along a portion of the 48-mile Contra Costa Canal near Oakley to reduce salinity and water quality impacts of groundwater seepage from adjacent agricultural areas, as well as to increase public safety and flood protection. As of late 2024, approximately 3.9 miles of the earth- lined portion of the Canal has been replaced with a buried pipeline (of only 700 feet of earth- lined canal remains) and the flood

Project	Primary Agencies	State	Description
			isolation structure near the fish screen has also been completed.
Alternative Intake Project	CCWD, Reclamation, and DWR	Past	The Alternative Intake Project was completed in 2010. The project located a new drinking water intake at Victoria Canal, about 2.5 miles east of CCWD's existing intake on the Old River, which allows CCWD to divert higher quality water when it is available. The new screened intake includes a 2.5-mile pipeline extension and a new pumping plant that ties into CCWD's existing conveyance system. The new intake has the same capacity and similar design as the existing Old River intake (250 cfs).
Davis-Woodland Water Supply Project	Davis, Woodland, and University of California, Davis	Past	The Davis-Woodland Water Supply Project up to 45,000 AF per year of surface water from the Sacramento River and convey it for treatment and subsequent use in Davis and Woodland and on the University of California, Davis campus. The purposes of the project are to provide a reliable water supply to meet existing and future needs, improve water quality for drinking supply purposes, and improve treated wastewater effluent quality through 2040. The Project facilities were completed in July 2016 (Woodland-Davis Clean Water Agency n.d). Project activities included construction and operation of a water intake/diversion, conveyance, and water treatment facilities. Surface water supplies would be acquired through new water rights and water rights transfers from senior water rights holders. The Project is located in the east- central portion of Yolo County, between and within the cities of Woodland and Davis, the University of California, Davis campus, and west of the Sacramento River. The new water diversion facility is constructed on the Sacramento River near the Interstate 5 crossing at the location of the existing Reclamation District 2035 diversion. The water treatment plant to treat the surface water diverted from the Sacramento River would have an ultimate capacity of up to 106 million gallons per day (mgd). Water diversions under the project was made in compliance with Standard Water Right Permit Term 91, which prohibits surface water diversions when water is being released from CVP or SWP storage reservoirs to meet in-basin entitlements, including water quality and environmental standards for protection of the Delta. Water supply needs during periods applicable to Term 91 would be satisfied by entering into water supply transfer

Project	Primary Agencies	State	Description
			agreements with senior water rights holders within the Sacramento River watershed.
Freeport Regional Water Project	Freeport Regional Water Authority and Reclamation	Past	Freeport Regional Water Authority, a Joint Powers Authority created by exercise of a joint powers agreement between the Sacramento County Water Agency (SCWA) and EBMUD, constructed a new water intake facility/pumping plant and 17-mile underground water pipeline within Sacramento County. The new water intake facility and pumping plant is located on the Sacramento River at the Freeport Bend, just upstream of Freeport and 10 miles south of Sacramento. The pumping plant diverts up to 185 mgd from the river and pump it through new pipelines to EBMUD and SCWA project facilities. Components of the facility include an in-river intake fish screen, sheet-piled in-river transition structure, electrical substation, surge control facility, compressed air system, sediment collection and settling basin system, and utilities. Construction of the intake was completed in 2010; the Vineyard Surface Water Treatment Plant was completed in 2012 (Freeport Regional Water Project 2019).
Eastern San Joaquin Integrated Conjunctive Use Program	NSJCGBA	Past	The Integrated Conjunctive Use Program is to develop approximately 140,000 to 160,000 AF per year of new surface water supply for the basin that will be used to directly and indirectly to support conjunctive use by the NSJCBGA member agencies. This amount of water would support groundwater recharge at a level consistent with the Groundwater Banking Authority's objectives for conjunctive use and the underlying groundwater basin. Within this framework, the program would implement the following categories of conjunctive use projects and actions: water conservation measures; water recycling; groundwater banking; water transfers; development of surface storage facilities; groundwater recharge; river withdrawals; and construction of pipelines and other facilities. To enable and facilitate sustainable and reliable management of San Joaquin County's water resources, NSJCGBA developed a series of Basin Management Objectives to support conjunctive use and address a variety of water resources issues, including groundwater overdraft, saline groundwater intrusion, degradation of groundwater quality, environmental quality, land subsidence, supply reliability, water demand, urban growth, recreation, agriculture, flood protection, and other issues. The purpose of the Basin Management

Project	Primary Agencies	State	Description
			Objectives is to ensure the long-term sustainability of water resources in the San Joaquin Region. A Final EIR for the program was released in February 2011 (NSJCGBA 2011).
Long-term and short-term water transfers	Reclamation and Various Parties	Past/ Present	These projects transfer water from willing buyers to willing sellers throughout the CVP service area including in-basin transfers and inter-basin transfers through the Delta. Transferred water can be for municipal, agricultural, or ecosystem enhancement purposes including use by wildlife refuges throughout the CVP service area.
Voluntary Agreements outside Reclamation's Discretion	Sacramento River Settlement Contractors, Feather River Contractors, Yuba County Water Agency, American River Parties, Mokelumne Parties, Putah Creek Parties	RFFA	The Shasta Management Plan proposes to integrate Sacramento Basin flow and non-flow measures that are part of the Voluntary Agreements (VAs) to update and1 implement the Bay- Delta Water Quality Control Plan. The VAs offer a watershed-wide approach that includes system- wide and tributary new flows, habitat restoration, and a governance and science program that would be deployed adaptively. VAs are not intended to conflict with the State Water Board's Narrative Salmon Objective of the Narrative Viability Objective. The VA's identified in this reasonably foreseeable future action will be implemented under the discretion of the primary agencies listed VAs under Reclamation's discretion are included in the 2024 Final EIS for the Long Term Operation of the CVP and SWP.
Sites Reservoir	Reclamation and Sites Project Authority	RFFA	The Sites Reservoir Project involves the construction of off-stream surface storage north of the Delta for enhanced water management flexibility in the Sacramento Valley, increased California water supply reliability, and storage and operational benefits for programs to enhance water supply reliability, both locally and Statewide, benefit Delta water quality, and improve ecosystems. Secondary objectives for the project are to: 1) allow for flexible hydropower generation to support integration of renewable energy sources, 2) develop additional recreation opportunities, and 3) provide incremental flood damage reduction opportunities (Sites Project Authority and Reclamation 2017). A Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) was released for public review on August 14, 2017. A revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (REIR/SEIS) was released for public review in November 2021. A Final Environmental Impact Report/Final Environmental Impact Statement was released in November 2023.

Project	Primary Agencies	State	Description
Delta Conveyance Project	DWR	RFFA	A Delta conveyance project that diverts water from the Sacramento River and includes a tunnel, intake structures and new pumping plants is a reasonably foreseeable project. At the time the Notice of Intent was issued for this project, California WaterFix had been approved by the State of California. DWR has stopped work on California WaterFix, but a delta conveyance project remains reasonably foreseeable given that an April 2019 Executive Order regarding how California intended to secure clean and dependable water supplies included direction to plan and modernize conveyance through the Bay-Delta with a new single tunnel project.
B.F. Sisk Dam Raise and Reservoir Expansion Project	Reclamation, DWR, and San Luis and Delta Mendota Water Authority	RFFA	Reclamation and DWR jointly manage San Luis Reservoir for the purpose of storing and reregulating CVP and SWP water from the Sacramento-San Joaquin Delta. San Luis Reservoir is an off-stream water storage facility that stores water for both projects. This project would add 10 feet to the crest of B.F. Sisk Dam in addition to the crest raise action currently being implemented under the Safety of Dams proposed action. The 10-foot embankment raise would support an increase in reservoir storage capacity of 130 TAF. The increased storage would be used to store CVP Project water, carried-over water, non-Project water, and Incremental Level 4 refuge water supplies. Increased capacity within San Luis Reservoir would only be used to help meet existing demands and would not serve any new demands in the South-of-Delta CVP and SWP service areas. The reservoir additional capacity would be filled with Delta water during excess conditions; thus, additional impacts on Delta aquatic species (e.g., juvenile salmonids and delta smelt) could result from an increase in Delta exports. The B.F. Sisk Dam Raise and Reservoir Expansion Final Supplemental EIS/EIR was released in December 2020 and the Record of Decision was published in October 2023.
Los Vaqueros Reservoir Expansion Phase	Reclamation, Contra Costa Water District (CCWD), DWR	RFFA	Los Vaqueros Reservoir is an off-stream reservoir in the Kellogg Creek watershed to the west of the Delta. The Los Vaqueros Reservoir initial construction was completed in 1997 as a 100,000 AF off-stream storage reservoir owned and operated by CCWD to improve delivered water quality and emergency storage reliability to their customers. In 2012, the Los Vaqueros Reservoir was expanded to a total storage capacity of 160,000 AF (Phase 1) to provide additional water quality and supply reliability benefits, and to adjust the timing of its Delta water diversions to accommodate the life cycles of Delta

Project	Primary Agencies	State	Description
			aquatic species, thus reducing species impact and providing a net benefit to the Delta environment. As part of the Storage Investigation Program described in the CALFED Bay Delta Program ROD, additional expansion up to 275,000 AF (Phase 2) is being evaluated by CCWD, DWR, and Reclamation. The alternatives considered in the evaluation also consider methods to convey water from Los Vaqueros Reservoir to the South Bay Aqueduct to provide water to Zone 7 Water Agency, Alameda County Water District, and Santa Clara Valley Water District. The Final EIS/R was released by Reclamation and CCWD on March 15, 2010. A supplemental EIS/R was released by Reclamation and CCWD in 2020.
Drought Plan	San Luis & Delta Mendota Water Authority, Friant Water Authority, San Joaquin River Exchange Contractors Water Authority and Reclamation	RFFA	San Luis & Delta Mendota Water Authority, Friant Water Authority, San Joaquin River Exchange Contractors Water Authority and Reclamation (collectively the Parties) have been working collaboratively on a Drought Plan to increase water supply reliability to CVP water users that rely on Sacramento–San Joaquin River Delta (Delta) exports for water service. The Drought Plan seeks for participating entities to voluntarily conserve and securely store or exchange a portion of their CVP south of Delta deliveries for subsequent use with the goal of providing at least a 5% allocation to south of Delta contractors, reducing reliance on Delta exports in the driest hydrologic conditions, and reducing the risk for a potential call on Friant Dam for EC deliveries while supporting flow and temperature goals of the San Joaquin River Restoration Program (SJRRP). The Parties are fully supportive of the SJRRP and have agreed to collaborate towards a full implementation. The Drought Plan actions are all related to enhanced management of CVP deliveries south of the Delta and is not expected to influence CVP's north of Delta operations.
Long-term Operations of the Central Valley Project and State Water Project	Reclamation and DWR	RFFA	The CVP consists of 20 dams and reservoirs that together can store nearly 12 million acre-feet (MAF) of water. Reclamation holds over 270 contracts and agreements for water supplies that depend upon CVP operations. Through operation of the CVP, Reclamation delivers water in 29 of California's 58 counties in the following approximate amounts: 5 MAF of water for farms; 600 thousand acre-feet (TAF) of water for municipal and industrial (M&I) uses; and an average of 355 TAF of Level 2 CVP water for wildlife refuges (plus additional supplies from other sources).

Project	Primary Agencies	State	Description
			Reclamation operates the CVP under water rights granted by the state of California, including those intended to protect agricultural and fish and wildlife beneficial uses in the Delta. On average, the CVP generates approximately 4.5 million megawatt hours of electricity annually. Reclamation operates the CVP in coordination with DWR's operation of the SWP, pursuant to applicable law and provisions of the Agreement Between the United States of America and the State of California for Coordinated Operation of the Central and State Water Project and its associated amendments. The mission of DWR is to manage the water resources of California, in cooperation with other agencies, to benefit the state's people and to protect, restore, and enhance the natural and human environment. DWR holds contracts with 29 public agencies in the Feather River Area, North Bay Area, South Bay Area, San Joaquin Valley, Central Coast, and Southern California for water supplies from the SWP. The SWP delivers on average 2.6 MAF of contracted water supplies annually. Two contractors from the North Bay Area receive water from the Barker Slough Pumping Plant in the Delta. DWR pumps water at the Banks Pumping Plant in the Delta for delivery to the remaining 24 public water agencies in the SWP service areas south of the Delta.

4.1 Visual

Cropland idling, cropland shifting, conservation activities, groundwater substitution, and small-scale construction projects already occur in the study area, therefore, the visual character of the No Action Alternative reflects that of the affected environment. The Proposed Action is expected to result in similar visual conditions as the No Action Alternative.

4.2 Agricultural Land Use

Past, present, and reasonably foreseeable projects may have cumulative impacts on land uses to the extent that they could affect potential changes in irrigated agricultural acreage. Water reduction activities would be temporary in nature, crop idling would affect a small percentage of the overall agricultural land in the study area, no permanent conversions of Important Farmland acres would occur. Considering the agricultural land use analysis in Section 3.3 with similar actions in Table 4-1, the Proposed Action is not likely to contribute to a cumulative impact to agricultural land use.

4.3 Hydrology and Water Quality

Past, present, and reasonably foreseeable projects may have cumulative effects on surface water resources, groundwater resources to the extent that they could change groundwater pumping, groundwater-surface water interaction, groundwater elevation, land subsidence, and groundwater quality, and surface water quality. Water reduction activities could generally change the groundwater pumping conditions; however, the change is expected to be minimal and therefore, the alternative’s contribution to cumulative changes in groundwater elevation is also expected to be minimal. Changes in pumping are considered small and may result in minimal contributions to cumulative impacts on groundwater-surface water interactions. Given the decreases in groundwater elevations and the fact that portions of these areas are known to have historic subsidence, the potential for additional subsidence exists. The location and amount of subsidence is highly dependent on the local soil conditions and historical low groundwater levels in the area. Water reduction activities and drought resiliency actions may result in short-term, temporary changes to water quality. When considered in combination with past, present and reasonably foreseeable projects, cumulative impacts are not expected on water quality.

4.4 Biological Resources

Past, present, and reasonably foreseeable projects may have cumulative effects on biological resources, to the extent that changes in vegetation, and alteration to habitat availability or quality could occur. Water reduction activities and drought resiliency project implementation could result a reduction in available habitat in rice fields and the associated reduction in the availability of habitat and food resources that wildlife species that use seasonally flooded agriculture for some portion of their lifecycle. Crop idling seasonally flooded agricultural fields under both the No Action Alternative and the Proposed Action may result in the potential for habitat fragmentation, as idling large parcels of land could impede the movement of wildlife from one area to another, inhibiting normal wildlife migration and dispersal of individuals, and potentially dissociating habitats for roosting from those for foraging. For species that migrate into the area seasonally (mainly birds), those arriving in the spring would not be impacted as they would select suitable habitat upon their arrival. For year-round residents (i.e., pond turtle, giant garter snake) the potential impacts would be greater. Past, present, and reasonably foreseeable actions projects that have or may have the potential to impact terrestrial species include water supply use and management, groundwater use and management, small-scale construction, voluntary agreements, and water transfer that when considered collectively, could contribute to a cumulative impact to biological resources.

4.5 Regional Economics

The Proposed Action and the No Action Alternative through Surface Water Diversion Reduction-Related Activities may reduce work opportunities in the study area. The Proposed Action through Drought Resilience Projects may provide short term small construction work opportunities in the study area. Cumulative impacts could vary with some generating positive improvements in agricultural revenue and employment and others generating negative effects which would be anticipated to contribute to the cumulative impacts from reasonably foreseeable projects related to agricultural-dependent economic conditions.

4.6 Environmental Justice

Past, present, and reasonably foreseeable projects may have cumulative effects on environmental justice to the extent that they could affect minority and/or low-income populations. The Proposed Action may result in impacts and/or beneficial effects on minority and/or low-income populations; however, these effects would not be disproportionately high or adverse. These impacts and/or beneficial effects may result from a reduction is water deliveries and groundwater elevation decrease and implementation of drought resiliency projects, respectively. Cumulatively, the reasonably foreseeable water supply projects are expected to benefit minority and low-income populations by improving water supply reliability and/or increasing agricultural productivity and jobs.

4.7 Air Quality

Past, present, and reasonably foreseeable projects may have cumulative effects on air quality to the extent that they could increase emissions from fossil-fueled engines for groundwater pumping and drought resiliency projects, and fugitive dust from drought resiliency projects and cropland idling. Water reduction activities and drought resiliency actions could increase or decrease airborne particles of PM10 and PM2.5 and increase fossil fuels due to groundwater pumping and implementation of drought resiliency actions under both the Proposed Action and the No Action Alternative. When combined with emissions from past, present, and reasonably foreseeable projects, a contribute to cumulative impacts on air quality could occur but are not expected to result in pollutant concentrations that would lead to new exceedances of the CAAQS or NAAQS or to worsen existing exceedances.

4.8 Cultural Resources and Indian Sacred Sites

Actions involving ground disturbance have the potential to impact cultural resources. Water reduction activities will not impact cultural resources as there are no ground-disturbing activities. The drought resiliency projects have the potential to affect historic properties due to construction activities. Reclamation will comply with the Section 106 of the NHPA including consultation on potential Indian Sacred Sites.

4.9 Energy

Past, present, and reasonably foreseeable projects may have cumulative effects on energy to the extent that they could affect energy use. Both water reduction activities and drought resiliency projects could result in minor increases in energy use and would be anticipated to be minimal. Given these minor changes in energy use, contributions to cumulative impacts from energy would be anticipated to be minimal.

4.10 Geology and Soils

Past, present, and reasonably foreseeable projects may have cumulative effects on geology and soils to the extent that they could affect soil erosion and the rate of land subsidence. Water reduction activities under both the Proposed Action and the No Action Alternative including crop idling could occur and could result in minor increases in soil erosion. Under ongoing dry conditions minimal contributions to the cumulative soil erosion condition in this region could occur. Given the decreases in groundwater elevations and the fact that portions of these areas are known to have historic subsidence, the potential for additional subsidence exists. The location and amount of subsidence is highly dependent on the local soil conditions and historical low groundwater levels in the area.

4.11 Greenhouse Gas Emissions

Past, present, and reasonably foreseeable projects may have cumulative impacts on GHG emissions to the extent that they could affect fossil-fueled equipment and groundwater pumping. Crop shifting would not result in substantial changes in GHG emissions as there would be negligible increases or reductions depending on the changes in farm equipment Groundwater substitution under both the No Action Alternative and the Proposed Action and drought resilience projects under the Proposed Action have the potential to increase GHG emissions but are expected to be minimal.

4.12 Noise

Many actions listed in Table 1 have short term impacts to noise but are not expected to reach noise thresholds in the region. While the Proposed Action may result in minor, short term impacts to noise, there would be no substantial permanent increase in ambient noise levels. Cumulative impacts under the Proposed Action and the No Action Alternative are not anticipated.

5 Consultation and Coordination

5.1 Public Involvement

Reclamation is providing the public with an opportunity to comment on the EA during the public review period. The tracking number is CGB-ED-2025-022. A notification was delivered through Reclamation's California-Great Basin Region NEPA Notification email: sha-mpr-nepanotice@usbr.gov. The document is available on Reclamation's website at: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=55409.

5.2 Agencies and Persons Consulted

Reclamation coordinated with the USFWS Bay Delta and Sacramento Offices and the SRSC Corporation in the preparation of this EA.

5.2.1 Endangered Species Act

Section 7(a)(2) of the ESA requires federal agencies to ensure that any action they authorize, fund, or carry out "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of designated critical habitat. 16 U.S.C. § 1536(a)(2). Thus, the Proposed Action is prohibited from engaging in any action that is likely to jeopardize the continued existence of an endangered or threatened species or result in destruction or adverse modification of designated critical habitat. On August 5, 2024, Reclamation transmitted a biological assessment to the USFWS for the SRSC Drought Protection Program. The USFWS issued a Biological Opinion entitled Formal Consultation *Formal Consultation on the Sacramento River Settlement Contractor's Water Reduction Program* attached in Appendix Con January 7, 2025.The Biological Opinion concluded the Proposed Action is not likely to jeopardize the continued existence of giant garter snake. The Biological Opinion contains reasonable and prudent measures and associated terms and conditions, to avoid, minimize, and mitigate the effects on giant garter snake. Reclamation and the SRSC must implement the terms and conditions provided in the Biological Opinion.

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Appendix A: Drought Resiliency Projects Technical Details

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1 Introduction

Drought-resiliency projects are expected to be implemented as part of the Drought Protection Program. This Appendix provides a description of the site preparation, excavation and regrading, pipeline recirculation installation, backfilling, demobilization, and operation anticipated to be necessary as part of the implementation of the projects.

1.1 Piping Open Ditches or Canals

Open ditches or canals are artificial waterways that are used to transport water from a water source for a variety of purposes, including agriculture uses. Open ditches or canals were typically constructed by excavating sloped, linear features or building embankments to contain and transport the water, without the use of a cover. Some of these ditches and canals are made of earth, whereas others are made of concrete with varying levels of permeability.

Piping open ditches or canals uses a series of interconnected pipes, valves, and pumps to convey water in an enclosed manner between the water source and the ultimate use. Piping offers numerous advantages for water conservation efforts. In comparison to open ditches or canals, piping allows for precise control and distribution of water, minimizing loss and ensuring optimal usage. Using pipelines instead of open ditches or canals reduces evaporation, and if maintained it can reduce leakages and seepages. Closed pipelines also protect water from external contaminants, which ensures better water quality. Compared to open channels, pipelines require less maintenance and have a longer lifespan.

To install a new pipe where an existing open ditch or canal exist, the following steps would likely be undertaken:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Existing Ditch or Canal Demolition**: If the existing ditch or canal is lined with concrete, a jackhammer or similar equipment would be used for demolition activities. Any concrete or other materials resulting from demolition activities would be disposed of at an approved landfill.
- **Excavation and Regrading**: Following site-specific demolition activities, soil would be excavated throughout the specific project site with an excavator or similar equipment. Any excess excavated soil material would either be reused on site or tested and disposed appropriately. If needed, clean soil material compatible with existing soil condition would be imported to regrade the site.

- **Pipeline Installation**: A pipeline made of high-density polyethylene (HDPE), polyvinyl chloride (PVC), or similar material would be assembled and installed on the specific project site. The pipeline may be above or below ground level and it may follow the footprint of existing open ditches or canals or be in new locations.
- **Backfilling**: Following below-ground pipeline installation, the pipeline would be covered with clean soil sourced from adjacent sites within the project area or imported. The clean fill would be compacted to ensure that the pipeline stays in place.
- **Demobilization**: Dewatering operations would be removed, and equipment would be demobilized using the same access roads used to access the site.
- **Operation**: The SRSC would continue operating the pipeline system as they would normally operate ditches or canals, with maintenance activities mainly consisting of removing tumbleweeds or other debris, burning of dead weeds and grass, repairing damage from rodents, removal of trees/shrubs that have encroached, and cleaning out sediment build-up.

1.2 Canal Lining

Although piping canals is the most efficient option in terms of water savings, it may not be available for all canals based on length or other environmental considerations. In such cases, canal lining and modernization can also provide for water savings. Canal lining is the process of reducing seepage loss of irrigation water by adding an impermeable layer to the trench.

Seepage can result in losses of irrigation water from canals, so adding lining can make irrigation systems more efficient. Existing canals can benefit even more than new structures from being lined. Although a new bare soil canal will work properly for some amount of time before it begins to erode or collapse, older canals are already well into the cycle of damage caused by erosion. There would be two ways of lining existing canals: 1) canals that are composed of bare soil can be lined with a material such as geomembrane or concrete; and 2) for canals that are already made of geomembranes or concrete, a sealant such as resin or spray-on polymer can be applied to fix cracks that are resulting in seepage. Additionally, existing canals already lined with concrete could be relined with new geomembranes or new concrete.

The following steps would likely be undertaken as part of canal lining and modernization:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Existing Canal Demolition (for Canal Lining Replacement)**: If the existing canal is lined with concrete and the objective is to replace the canal lining with new lining, a jackhammer or similar equipment would be used for demolition activities. Any previous flexible liners or spray-on polymers would be removed as much as possible before a new

liner is applied or installed. Leaving old, leaking materials in place increases the chances of problems with the new liner, especially if the old materials are uneven or lumpy. Dust control measures, including spraying water at the point where the jackhammer or similar equipment strikes, would be employed. Any concrete or other materials resulting from demolition activities would be disposed of at an approved landfill.

- **Sludge and Silt Removal (for New Canal Lining)**: Any silt, sludge, debris, and other material would be scraped from the canal. Removing these materials would ensure that the liner rests against a compacted layer of natural soil, not a loose accumulation of sludge or silt and that any resin or spray-on polymer used to fill the concrete canal lays against clean concrete.
- **Excavation and Regrading**: The canal may need to be reshaping and stabilized if erosion or damage have occurred. If applicable, soil would be excavated throughout the specific project site with an excavator or similar equipment. Any excess excavated soil material would either be reused on site or tested and disposed appropriately. If needed, clean soil material compatible with existing soil condition would be imported to regrade the site.
- **Vegetation Removal (for New Canal Lining)**: Existing dirt canals tend to establish heavy vegetation along the edges due to supplying a constant and steady source of water. Prior to installing any new liner (geomembrane, concrete, or any equivalent), or prior to applying resin, spray-on polymer or any equivalent, vegetation removal would be required.
- **Liner Installation/Application of Sealant**: Once the canal is clear of sludge and reinforced as needed, the liner would be installed. Because most canals are narrow, this step would generally involve rolling out the liner alongside the ditch and then laying it down into the channel. For concrete canal lining, the most common method would be cast-in-situ lining, which involves pouring liquid concrete into molds along the canal's sides and letting it flow to the bottom. However, other types of concrete liners could be used, including shotcrete and precast concrete. For sealant application, a spray-on polymer would be applied in the same way as spray paint. Other sealants would be applied by injecting the sealant into the cracks.
- **Demobilization**: Dewatering operations would be removed and equipment would be demobilized using the same access roads used to access the site.
- **Operation**: The SRSC would continue operating lined canals as they would normally operate existing canals, with maintenance activities mainly consisting of removing tumbleweeds or other debris, burning of dead weeds and grass (with proper fire safety precautions taken), repairing damage from rodents, removal of trees/shrubs that have encroached, and cleaning out sediment build-up. To help recirculation and reduce seepage losses, some channels, ditches, or canals may be cleared of vegetation and recompacted or reconstructed after trees and other vegetation is removed.

1.3 Canal Automation through Supervisory Control and Data Acquisition Systems

Automation plays a crucial role in the management of irrigation canal networks to improve efficiency and optimize water use. Supervisory Control and Data and Acquisition (SCADA) systems are focused on the supervision and acquisition of real-time data from a network of irrigation canals. These systems allow centralized monitoring and control of devices and sensors in the network, such as gates, valves, and flow meters. The collected data are used to visualize network status, detect anomalies, and facilitate decision-making based on real-time information. SCADA systems make it easier to detect problems early, such as leaks or device failures, and allow for a quick response for repairs (Regaber 2024). Figure 1 provides a typical example of a SCADA communications system.

All SCADA systems have the following components at a minimum: a sensor; some type of on-site apparatus that creates and electrical signal that can be transmitted; a local power supply to power the sensor and transmission unit; some type of communication system, such as hard wire, radio, satellite, or phone; a receiving unit on the other end of the communication system; and a mechanism to display the information, such as an alarm bell or computer screen (Burt and Piao 2005). As mentioned, SCADA systems may require electrical connections to power sensors and transmission units, which may require some excavation, grading, and fill if electrical lines are buried. Besides these requirements and the actual SCADA system itself, SCADA systems would not result in any other construction or operational changes.

Figure 1. Wireless SCADA System Example. Source: Aqua Systems 2000 (2024)

1.3.1 Automated Gates Installation

Some contractors would likely install automated canal gates, such as Rubicon or Langemann gates, for more efficient, reliable, and accurate canal and ditch operations and water deliveries. In some instances, automated gates may be paired with SCADA systems, which would be expected to result in additional water distribution efficiency improvements. Figure 2 shows a typical automated gate.

Figure 2. Automated Gate Example. Source: Rubicon (2024)

To install a new automated gate, the following steps would likely be undertaken:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Gate Installation**: Following dewatering activities, a new gate would be installed. Minor excavation activities may be required to install the gate and would follow requirements mentioned in other drought-resiliency projects.
- **Demobilization**: Dewatering operations would be removed, and equipment would be demobilized using the same access roads used to access the site.
- **Operation**: Maintenance activities would mainly consist of maintaining gates in operational conditions through activities such maintenance dredging/excavation for sediment accumulation behind the gates, weed control, vegetation removal, and maintenance of flow gauges and other measuring devices.

1.4 On-Farm Improvements to Irrigation Systems

This drought-resiliency project involves converting certain types of on-farm irrigation systems and methods to more efficient irrigation systems and methods. As an example, flood/row irrigation is about 50% efficient, where a sprinkler-based system can be 75% efficient. Similarly, a properly installed drip or subsurface irrigation system, which applies water directly to crop root zones using buried drip lines or drip tape can also be typically more efficient than other irrigation systems. Since drip tubing is placed in the soil between each crop row, this system only wets a small portion of the soil. Small and controlled amounts of water help avoid water logging. Another improvement to irrigation systems including installing Variable Frequency Drives (VFDs). VFDs can be used to gradually ramp an irrigation pump motor to meet actual flow and pressure demands of the system, which can result in water savings.

The steps taken to implement on-farm improvements are dependent on the existing irrigation method and the proposed method. Construction would likely occur during the non-irrigation season to minimize the amount of time fields would be out-of-service.

General construction steps for on-farm improvements could include the following:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Existing Irrigation Conveyance Equipment Removal**: This step could include deconstructing pipe systems, removing equipment from fields, or temporarily blocking existing water sources.
- **Field Preparation**: This step could include field regrading, digging trenches for below-ground pipe installation, or removing obstructions such as rocks or trees.
- **Proposed Irrigation Conveyance Installation**: This step could include installation of pipes aboveground or below ground surface, pump stations, sprinkler heads, and other equipment to convey the water from the farm delivery point to the fields.
- **Demobilization**: Dewatering operations would be removed, and equipment would be demobilized using the same access roads used to access the site.
- **Operation**: The SRSC would continue operating the irrigation system with maintenance activities mainly consisting of removing tumbleweeds or other debris, burning of dead weeds and grass, repairing pipes and sprinkler heads damage from rodents, removal of trees/shrubs that have encroached, and pump repairs.

1.4.1 Weirs or Check Structures

Weirs or check structures, are small dams that obstruct ditches, drains, or canals to collect water runoff from agricultural fields. By slowing down runoff, weirs and check structures help conserve existing water resources by adding capacity to canals and make water available for reuse. Weirs are often the size of a drainage ditch, with a channel in the center for water drainage.

To install a new weir or check structure, the following steps would likely be undertaken:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Weirs or Check Structure Construction/Installation**: First, the foundation of the weir or check structure would be installed to hold the weir or check structure weight and withstand the pressure chambers that the weir or check structure would create. Excavation and grading may be required, as would concrete work. Then, forms to pour concrete or similar material to create the weir or check structure would be installed. Concrete trucks or other construction vehicles would be used to deliver concrete wherever necessary.
- **Demobilization**: Dewatering operations would be removed, and equipment would be demobilized using the same access roads used to access the site.
- **Operations**: Maintenance activities would mainly consist of maintaining weirs or check structures in operational conditions through activities such maintenance dredging/excavation for sediment accumulation behind the weirs or check structures, weed control, and vegetation removal.

1.5 Pipeline Recirculation Programs

Pipeline recirculation programs allow water to be used as efficiently as possible by recirculating it back to fields for irrigation purposes. The system consists of ditches for collecting runoff, a flow pump and power unit (either an electric motor or a diesel engine), and a pipeline to transport water to for reapplication to a field.

To install these types of programs, the following steps would likely be undertaken:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Excavation and Regrading**: Soil would be excavated throughout the specific project site with an excavator or similar equipment to prepare the site for pipelines. Any excess excavated soil material would either be reused on site or tested and disposed appropriately. If needed, clean soil material compatible with existing soil condition would be imported to regrade the site.
- **Pipeline Recirculation Installation**: Pipelines would be placed aboveground or within the excavated area if the pipeline is buried. A flow pump and power unit would be installed.

- **Backfilling**: For below-ground pipeline installation, the pipeline would be covered with clean soil sourced from adjacent sites within the project area or imported. The clean fill would be compacted to ensure that the pipeline stays in place.
- **Demobilization**: Equipment would be demobilized using the same access roads used to access the site.
- **Operations**: The SRSC would continue operating the pipeline recirculation systems with maintenance activities mainly consisting of removing tumbleweeds or other debris, burning of dead weeds and grass, repairing pipes damage from rodents, removal of trees/shrubs that have encroached, reservoir sediment build-up removal, and pump repairs.

1.6 New Groundwater or Deep Aquifer Wells

To add to their water supply, some SRSCs would construct new groundwater wells as part of the proposed project. A maximum of 30 new wells are assumed to be constructed as part of the Proposed Action and would all comply with the minimum construction standards in California set under California Department of Water Resources (DWR) Bulletin 74 and Executive Order N-3-23, Paragraph 4.

DWR Bulletin 74 sets the minimum standards for water, monitoring, cathodic protection, and geothermal heat exchange wells, with the purpose of protecting California's groundwater quality. Coordination with the local applicable Groundwater Sustainable Agency would also occur to ensure that the well locations and related construction activities would not be inconsistent with the targets set by Groundwater Sustainability Plans under the Sustainable Groundwater Management Act and Executive Order N-3-23, Paragraph 4.

A new well consists of a bottom sump, well screen, and well casing surrounded by a gravel pack and appropriate surface and borehole seals, as depicted in Figure 3. Water enters the well through perforations or openings in the well screen and is pumped to the surface with a motor that is typically located at the surface.

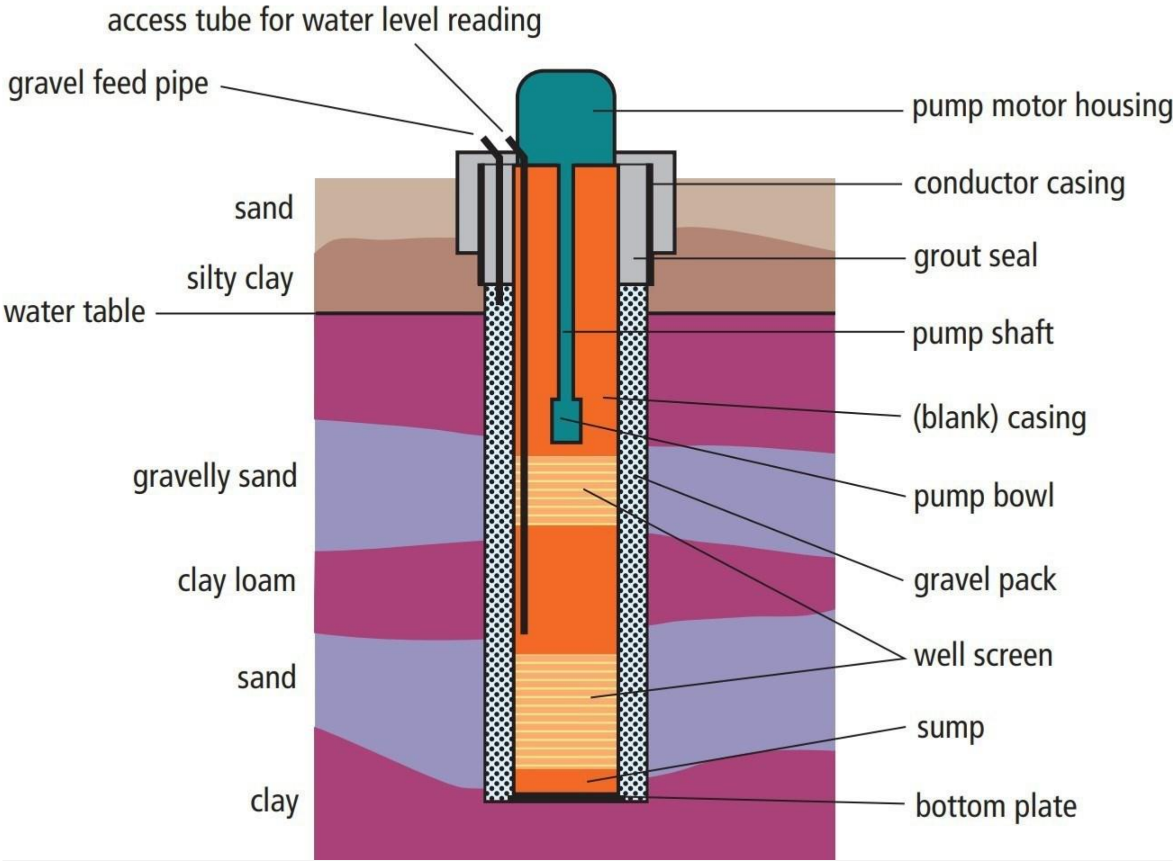

Figure 3. Well Components. Source: UC Davis (2024).

To install a new well, the following steps would likely be undertaken:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Well Drilling**: Wells are generally classified by construction method as dug/bored, driven, or drilled, as depicted in Figure 4. Dug/bored wells are holes in the ground dug by shovel or backhoe. Dug wells have a large diameter, are shallow, and are not cased continuously. Driven wells are constructed by driving pipe into the ground. Driven wells are shallow and cased continuously. Drilled wells are constructed by percussion or rotary-drilling machines. Drilled wells can be hundreds to thousands of feet deep and use continuous casing (CDWR 2024).
- **Well Casing and Well Screen Installation**: Once the well bore is drilled, the driller would install well casing and well screens as well as fill the ring around the casing with a gravel pack and the appropriate cement and bentonite seal (annular or sanitary seal) to prevent water from leaking between uncontaminated and contaminated aquifers or from the land surface into the well, as depicted in Figure 5. The purpose of installing well

screens is to keep sand and gravel from the gravel pack out of the well while providing ample water flow to enter the casing.

- **Well Development**: After the well screen, well casing, and gravel pack have been installed, the well would be developed to clean the borehole and casing of drilling fluid and to properly settle the gravel pack around the well screen. A typical method for well development is to surge or jet water or air in and out of the well screen openings. This procedure may take several days or perhaps longer, depending on the size and depth of the well. A properly developed gravel pack keeps fine sediments out of the well and provides a clean and unrestricted flow path for groundwater.
- **Aquifer Test or Pump Test**: Once the well is completed and developed, an aquifer test (or pump test) would be conducted. For an aquifer test, the well is pumped at a constant rate or with stepwise increased rates, typically for 12 hours to 7 days, while the water levels in the well are checked and recorded frequently as they decline from their standing water level to their pumping water level. Aquifer tests are used to determine the efficiency and capacity of the well and to provide information about the permeability of the aquifer.
- **Pump and Power Source Installation**: After conducting the aquifer test or pump test, the pump and power source would be installed.
- **Wellhead Protection**: Construction of the final well seal is intended to provide protection from leakage and to keep runoff from entering the wellhead.
- **Demobilization**: Equipment would be demobilized using the same access roads used to access the site.
- **Operations**: Operational activities would consist of maintenance activities including regular inspections, pump maintenance, redevelopment through airlift pumping and agitation, mechanical surging and/or jetting (same procedure as well development described in Step 4, but the goal is to remove encrusted material in the gravel pack), and chlorination.

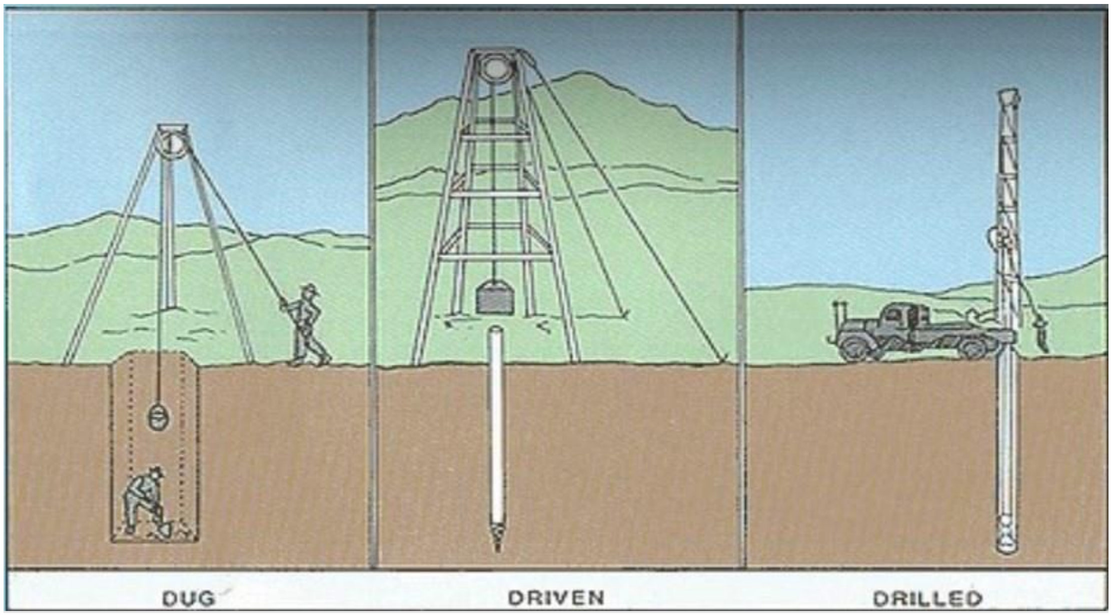

Figure 4. Well construction method. Source: CDWR (2024a)

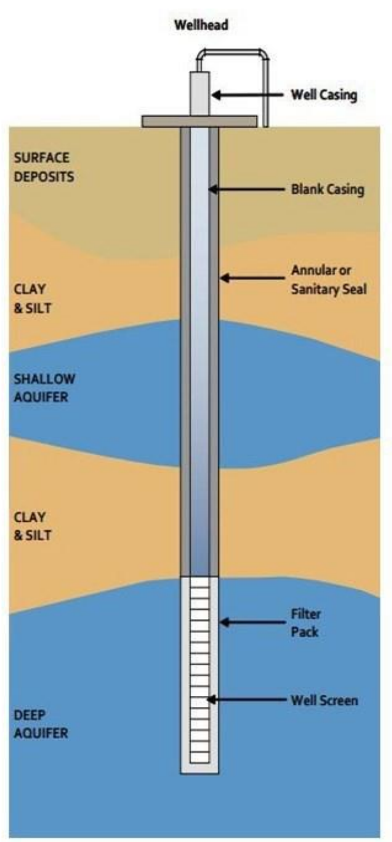

Figure 5. Typical well construction. Source: CDWR (2024a)

1.7 Conjunctive Use Program

Conjunctive management is the coordinated operation of surface water, groundwater storage and use, and conveyance facilities to meet water management objectives. Although surface water and groundwater are sometimes considered to be separate resources, they are connected by the hydrologic cycle. Conjunctive management allows surface water and groundwater to be managed in an efficient manner by taking advantage of surface water supplies when they are available and groundwater supplies when surface water is less available. For example, this could mean that surface water gets diverted by SRSCs in non-program years while groundwater is recharging, and then SRSCs and/or their landowners would pump groundwater in program years.

To implement conjunctive use programs, new conveyance systems may be constructed, and the following steps would likely be undertaken:

- **Site Preparation**: The site would be prepared for construction, including proposed access roads and staging areas, prior to completing any mobilization or construction work.
- **Excavation and Regrading**: Soil would be excavated throughout the specific project site with an excavator or similar equipment to prepare the site for pipelines, ditches, or canals. Any excess excavated soil material would either be reused on site or tested and disposed appropriately. If needed, clean soil material compatible with existing soil condition would be imported to regrade the site.
- **Conveyance System Installation**: Pipelines or irrigation ditches and canals would be installed or constructed. This step may include pouring concrete to construct new ditches or canals with concrete trucks or other construction vehicles would be used to deliver concrete wherever necessary. If no concrete is used, a roller-compacter may be used to compact soil after a ditch or canal is excavated. If a pipeline is installed, it would be placed aboveground or within the excavated area if the pipeline is buried.
- **Backfilling**: For below-ground pipeline installation, the pipeline would be covered with clean soil sourced from adjacent sites within the project area or imported. The clean fill would be compacted to ensure that the pipeline stays in place.
- **Demobilization**: Dewatering operations would be removed, and equipment would be demobilized using the same access roads used to access the site.
- **Operations**: No operational needs would be necessary as part of implementing conjunctive use programs.