## Draft Environmental Assessment/Initial Study

# 2014 San Luis & Delta Mendota Water Authority Water Transfers

## California

**U.S. Department of the Interior**
**Bureau of Reclamation**
**Sacramento, California**

**San Luis & Delta-Mendota Water Authority**
**Los Banos, California**

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# Abbreviations and Acronyms

| | |
|---|---|
| AF | Acre Foot |
| APCD | Air Pollution Control District |
| AQAP | Air Quality Attainment Plan |
| AQMD | Air Quality Management District |
| ATCM | Airborne Toxic Control Measure |
| BA | Biological Assessment |
| Banks PP | Harvey O. Banks Pumping Plant |
| Bgs | Below ground surface |
| BO | Biological Opinion |
| CAAQS | California Ambient Air Quality Standards |
| CARB | California Air Resources Board |
| CCR | California Code of Regulations |
| CDEC | California Data Exchange Center |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| Cfs | cubic feet per second |
| $CH_4$ | Methane |
| CO | Carbon Monoxide |
| COA | Coordinated Operating Agreement |
| $CO_2$ | Carbon Dioxide |
| $CO_2e$ | Carbon Dioxide Equivalent |
| CVP | Central Valley Project |
| CVPIA | Central Valley Project Improvement Act |
| dB | Decibel |
| Delta | Sacramento-San Joaquin River Delta |
| DWR | California Department of Water Resources |
| EA | Environmental Assessment |
| EDD | California Economic Development Department |
| EIR | Environmental Impact Report |
| EIS | Environmental Impact Statement |
| ESA | Endangered Species Act |
| ETAW | Evapotranspiration of Applied Water |
| FONSI | Finding of No Significant Impact |
| FE | Federal Endangered |
| FT | Federal Threatened |
| GGS | Giant Garter Snake |

| | |
|---|---|
| GHG | Greenhouse Gas |
| GIS | Geographic Information System |
| gpm | gallons per minute |
| GWP | Global Warming Potential |
| HCP | Habitat Conservation Plan |
| ID | Irrigation District |
| IPCC | Intergovernmental Panel on Climate Change |
| IS | Initial Study |
| ITAs | Indian Trust Assets |
| Jones PP | C.W. “Bill” Jones Pumping Plant |
| MCL | Maximum Contaminant Level |
| Mg/L | miligrams per liter |
| MWC | Mutual Water Company |
| $N_2O$ | Nitrous Oxide |
| NAAQS | National Ambient Air Quality Standards |
| NCCP | Natural Community Conservation Plan |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOx | Nitrogen Oxides |
| NSVPA | Northern Sacramento Valley Planning Area |
| $O_3$ | ozone |
| $PM_{10}$ | Inhalable Particulate Matter |
| $PM_{2.5}$ | Fine Particulate Matter |
| Reclamation | Bureau of Reclamation |
| SACFEM | Sacramento Valley Groundwater Model |
| SE | State Endangered |
| SIP | State Implementation Plan |
| SLDMWA | San Luis & Delta-Mendota Water Authority |
| SOx | Sulfur Oxides |
| SSC | State Species of Special Concern |
| ST | State Threatened |
| SWP | State Water Project |
| SWRCB | State Water Resources Control Board |
| TCCA | Tehama Colusa Canal Authority |
| TDS | Total Dissolved Solids |
| tpy | tons per year |
| TUC | Temporary Urgency Change |
| UCCE | University of California Cooperative Extension |

| | |
|---|---|
| USDA | United States Department of Agriculture |
| USEPA | United State Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| VOC | Volatile Organic Compounds |
| WA | Water Agency |
| WD | Water District |
| 2010-2011 WTP EA | 2010-2011 Water Transfers Program E |

# Chapter 1
# Introduction

This Environmental Assessment (EA) and Initial Study (IS) for water transfers in contract year 2014[1] was prepared by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and the San Luis & Delta-Mendota Water Authority (SLDMWA). This joint EA/IS document satisfies the requirements of the National Environmental Policy Act (NEPA) (42 USC §4231 et seq.), the Council of Environmental Quality implementing regulations (40 CFR §1500-1508), the Department of the Interior's NEPA regulations (43 CFR Part 46), the California Environmental Quality Act (CEQA), and the Governor's Office of Planning and Research regulations to implement CEQA (Sections 15000-15387 of the California Code of Regulations). Reclamation is the federal lead agency responsible for NEPA review, through the EA, of the proposed water transfers, and the SLDMWA is the state lead agency responsible for CEQA review, through the IS, of the proposed water transfers.

This EA/IS describes the potential direct, indirect, and cumulative effects of transferring water from willing sellers located upstream of the Sacramento-San Joaquin River Delta (Delta), resulting from forbearance[2] actions taken by the sellers, to the Participating Members of the SLDMWA. The sellers hold water rights on northern California waterways or contracts with the State of California (for water from the State Water Project [SWP]) or the United States (for Base Supply[3] and Central Valley Project (CVP) Water[4] ("Project Water")). This EA/IS also identifies measures that have been incorporated to minimize or avoid project-related impacts. The transfers included in this document are only those involving Project Water or Base Supply or CVP facilities. These transfers would require approval from Reclamation, which necessitates compliance with NEPA. These transfers would also require CEQA compliance for the buyers and sellers.

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[1] Water Service Contract Year is March 1, 2014 through February 28, 2015. Sacramento River Settlement Contract Year is April 1, 2014 through October 31, 2014.

[2] For purposes of this EA, the term "forbear" or "forbearance" will refer to both the Base Supply and Project Water made available under the respective Sacramento River Settlement Contract, although, it is understood the Base Supply will be forborne, while the Project Water will be transferred.

[3] Article 1(b) of the Sacramento River Settlement Contract defines Base Supply as the quantity of Surface Water established in Articles 3 and 5 which may be diverted by the Contractor from its Source of Supply each month during the period April through October of each Year without payment to the United States for such quantities diverted.

[4] Article 1(n) of the Sacramento River Settlement Contract defines Project water as all Surface Water diverted or scheduled to be diverted each month during the period April through October of each Year by the Contractor from its Source of Supply which is in excess of the Base Supply.

Other transfers not involving the SLDMWA and its Participating Members could occur during the same time period. The Tehama-Colusa Canal Authority (TCCA) is releasing a separate EA/IS to analyze transfers from a very similar list of sellers to the TCCA Member Units. These two documents reflect different potential buyers for the same water sources; that is, the sellers have only the amounts of water listed in Section 2 available for transfer, but the water could be purchased by SLDMWA or TCCA members.

## 1.1 Background

The SLDMWA and its Participating Members will experience severe water shortages in 2014 and are soliciting willing sellers to transfer water. A number of entities upstream from the Delta have expressed interest in transferring water to the Participating Members of the SLDMWA. The SLDMWA would negotiate with these sellers, on behalf of the Participating Members, to identify potential transfers and the specifics of each transfer arrangement, which, collectively, constitute the "proposed project" to be addressed under CEQA. The SLDMWA and these willing sellers are using this EA/IS to inform decision-makers and the public of the potential environmental effects of the proposed water transfers and determine whether the transfers may result in significant environmental impacts. Because of the extremely dry conditions, the environment and agricultural community are already being impacted; this EA/IS focuses on the incremental impacts beyond those already anticipated.

To facilitate the transfer of water throughout the State, Reclamation is considering whether it should approve and facilitate water transfers between willing sellers and buyers when Base Supply, Project Water, or CVP facilities are involved in the transfer. Reclamation will not take part in the transfer negotiation process, nor will Reclamation develop a "program" to connect buyers and sellers. Reclamation would focus on the approval and facilitation of individual transfers of water involving Base Supply and/or Project Water or involving CVP facilities; these transfers constitute the "proposed action" to be addressed under NEPA. Reclamation is using this EA/IS to evaluate the potential environmental effects of the proposed action and determine whether it may result in significant environmental impacts.

Transfers would occur from sellers located upstream from the Delta to buyers that receive water conveyed through the Delta. The transfer water would be conveyed, using CVP and/or SWP facilities under Joint Point of Diversion permitting, to water users experiencing water shortages in 2014, and who require supplemental water supplies to help meet anticipated demands. Reclamation would review and approve, as appropriate, proposed water transfers in accordance with the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and California Department of Water Resources [DWR] 2013), state law, the *Draft Interim Guidelines for Implementation of the Water Transfer Provisions of the Central Valley Project*

*Improvement Act (Title XXXIV of Public Law 102-575)*, or the *Addendum to DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2014).

Water supplies from the 2014 water transfers could be made available to water providers who obtain water from CVP or SWP facilities either directly or by exchange with other water providers who have access to water supplies from the CVP or SWP. Reclamation will honor CVP contract provisions in determining access to Delta pumping capacity, if necessary because capacity is less than transfer demand. DWR will likewise determine the availability of its facilities, including Delta pumping capacity, when necessary for the conveyance of transfer water.

## 1.2 Need for Proposal and Project Objectives

While the 2014 water year, which extends from October 1, 2013 through September 30, 2014, is only partially complete, the hydrologic conditions so far have been critically dry. These conditions are worsened by the dry conditions statewide in 2012 and 2013, which affected reservoir storage coming into water year 2014. For example, storage in Shasta Reservoir was about 1,794,000 acre-feet (AF) on March 3, 2014, which is 54 percent of average at this time of year and substantially less than storage on the same date in the previous year (3,620,000 AF) (California Data Exchange Center [CDEC] 2014). While it is too early in 2014 to know with certainty the final allocation, CVP and SWP water service contractors' initial allocations are 0 percent, and Sacramento River Settlement Contractors (Settlement Contractors) and refuges have been notified that they can expect 40 percent of their contract amounts rather than the anticipated 75 percent normally provided in a Critical Year[5]. Because 2014 is projected to be California's driest year on record, Governor Jerry Brown declared a drought state of emergency on January 17, 2014. The declaration calls for increased water conservation, implementation of water shortage contingency plans, accelerated funding for water supply projects, increased groundwater monitoring, and expedited processing of water transfers.

As a result of the significantly reduced allocation, the SLDMWA is in need of water for irrigation, primarily of permanent crops to prevent the long term impacts of allowing these crops to die. Reclamation's need is to approve the transfer of Base Supply or Project Water that may require the use of CVP facilities, consistent with state and federal law, the Sacramento River Settlement

[5] Article 1(f) of the Sacramento River Settlement Contract defines Critical Year as any Year in which either of the following eventualities exists: (1) The forecasted full natural inflow to Shasta Lake for the current Water Year, as such forecast is made by the United States on or before February 15 and reviewed as frequently thereafter as conditions and information warrant, is equal to or less than 3.2 million acre-feet; or (2) The total accumulated actual deficiencies below 4 million acre-feet in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the Water Year, exceed 800,000 acre-feet.

Contract, and the Interim Guidelines for Implementation of the Water Transfer Provisions of the Central Valley Project Improvement Act (Title XXXIV of Public Law 102-575).

## 1.3 Document Structure

To consider environmental impacts of the Proposed Action pursuant to both NEPA and CEQA, Chapter 3 includes the analysis of possible effects to resources using an initial study checklist adapted from the CEQA Guidelines Appendix G. Discussion of potential impacts for the No Action Alternative and Proposed Action are addressed in more detail following each checklist section. The CEQA Checklist does not incorporate all resource areas required by NEPA; Chapter 4 includes NEPA-specific components.

## 1.4 Responsible Agencies

A Responsible Agency under CEQA is "a public agency which proposes to carry out or approve a project, for which a Lead Agency is preparing or has prepared an Environmental Impact Report (EIR) or Negative Declaration" (CEQA Guidelines Section 15381). San Luis Water District (WD) is a Responsible Agency under CEQA for this environmental document. San Luis WD is part of the SLDMWA, but it is a Responsible Agency because it is proposing to approve and implement a transfer directly with potential sellers.

## 1.5 Long-Term Water Transfers

Reclamation and SLDMWA are preparing a joint Environmental Impact Statement (EIS)/EIR to analyze the effects of water transfers from water agencies in northern California to water agencies south of the Delta and in the San Francisco Bay Area. The EIS/EIR will evaluate transfers of Project Water and non-Project water supplies that require use of CVP or SWP facilities to convey the transferred water. The EIS/EIR will evaluate water transfers over a 10-year period, from 2015 through 2024. Scoping has been completed for this project and all of the scoping information is available on Reclamation's website at http://www.usbr.gov/mp/cvp/ltwt/. Transfers under that EIS/EIR would not affect 2014 water transfers, but consultation and coordination for Long-Term Water Transfers has assisted in development of this EA/IS.

# Chapter 2
# Alternatives

## 2.1 No Action

For the No Action Alternative, the SLDWMA, on behalf of its Participating Members, would not buy water from willing sellers that required Reclamation approval during contract year 2014.

Agricultural and urban water users will face shortages in the absence of water transfers. While it is too early in 2014 to know with certainty the final allocation, CVP and SWP water service contractors' initial allocations are 0 percent, and Settlement Contractors and refuges have been notified that they can expect 40 percent of their contract amounts rather than the anticipated 75 percent normally provided in a Critical Year. These users may take alternative water supply actions in response to shortages, including increased groundwater pumping, cropland idling, reduction of landscape irrigation, or water rationing. Water users may also seek to transfer water from others, which may require additional NEPA or CEQA analysis. In the absence of transfers, growers may not have enough water to meet demands, and some permanent crops could be lost.

Given the current allocation and severely dry conditions, Glenn-Colusa Irrigation District (ID) estimated that about 15 percent of rice in the service area would be idled if provided 75 percent of its contractual supply. Glenn-Colusa ID was not able to provide an estimate of land that would be idled given a 40 percent supply. Other districts indicate that they would limit supplies to each grower based on surface water supply shortages, and each grower would make a field-by-field decision of whether they should idle some of their cropland or pump groundwater to augment supplies. Cropland idling estimates are not available at this time for these districts because each grower will make independent decisions regarding idling, though it is expected many growers will be idling considerable acreage under the No Action Alternative.

## 2.2 Proposed Action/Proposed Project

The Proposed Action and Proposed Project (referred to herein as the Proposed Action) is the transfer of water in contract year 2014 to Participating Members of the SLDMWA. Reclamation has approval authority over potential transfers of Base Supply and/or Project Water, or transfers that involve the use of CVP facilities.

The Proposed Action includes potential transfers of water at times when the Delta is in balanced conditions from 18 entities north of the Delta listed in Table 2-1 and shown in Figure 2-1 to 24 entities in the San Joaquin and Santa Clara Valleys. Given the initial CVP allocation is 0 percent to CVP water service contractors, 40 percent to CVP Settlement Contractors, and 50 percent to DWR Settlement Contractors, it is highly unlikely that SLDMWA would be able to transfer enough water to meet demands. Table 2-1 shows potential upper limits for transfers under the current hydrologic conditions (with these allocations), but also shows potential upper limits if the conditions improve and allocations increase. This list represents those agencies with whom SLDMWA may negotiate the transfer of water. If hydrologic conditions drastically improve, freeing up additional water, SLDMWA may be able to negotiate additional transfers (reflected in the table under the improved conditions column). It is not possible to determine hydrologic conditions for the remainder of the year, which transfer negotiations would be successful, what combination of sellers would ultimately transfer water to SLDMWA, or how much water would ultimately be transferred to SLDMWA. For this reason, modeling and analysis assumes the higher quantities provided in Table 2-1 for improved hydrologic conditions to display the impacts that would be associated with providing higher transfer quantities to SLDMWA.

Administratively, Reclamation would evaluate each proposal individually, as it is received, to determine if it meets state law or Central Valley Project Improvement Act (CVPIA) requirements. Reclamation has followed this process in past years when approving transfers (such as the Drought Water Bank in 2009 and water transfers in 2013).

The Proposed Action is for sellers to potentially make available up to 91,313 AF under the current hydrologic condition and up to an additional 103,813 AF available if hydrologic conditions improve. Sellers could make water available for transfer through groundwater substitution, cropland idling, or crop shifting. The existing CVP and SWP facilities could be used to convey transferred water as long as existing regulatory constraints are satisfied. Water transfers conveyed through the Delta would be assumed to lose a portion of the water obtained from the Sacramento River and its tributaries to carriage losses (water required to meet water quality and flow-related objectives) in the Delta. Additional losses may be assessed for conveyance losses along the California Aqueduct, San Luis Canal, the Delta-Mendota Canal, and the San Felipe federal facilities.

Water transfers involving conveyance through the Delta would take place within the operational parameters of the Biological Opinions on the Continued Long-term Operations of the CVP/SWP (National Marine Fisheries Service [NMFS] 2009; U.S. Fish and Wildlife Service [USFWS] 2008) (NMFS and USFWS BOs) and any other operating rules in place at the time the water transfers are implemented. Because of the extremely dry conditions, Reclamation is consulting frequently with NMFS and USFWS on CVP and

SWP operations relative to the NMFS and USFWS BOs and special status fish species in the Delta. The key current operational parameters applicable to conveyance of transfer water include:

- Transfer water will be conveyed through the SWP's Harvey O. Banks Pumping Plant (Banks PP), under permits for Joint Point of Diversion, and the CVP's C.W. "Bill" Jones Pumping Plant (Jones PP) only during the transfer window that is acceptable to USFWS and NMFS, typically July through September.

- If conditions remain critically dry, water diverted from the Delta would be in compliance with existing outflow criteria and pumping restrictions imposed by the State Water Resources Control Board (SWRCB) through Reclamation and DWR's Temporary Urgency Change Petition approved by the SWRCB on January 31, 2014, as may be amended.

DWR and Reclamation would determine availability of Delta pumping capacity throughout the transfer period.

**Table 2-1. Maximum Potential Transfer by Seller (Acre Feet)**

| Water Agency | Maximum Transfer under Current Hydrologic Conditions | Maximum Transfer under Improved Conditions |
|---|---|---|
| **Sacramento River Area of Analysis** | | |
| Anderson-Cottonwood Irrigation District | 2,400 | 4,800 |
| Conaway Preservation Group | 20,340 | 26,639 |
| Eastside Mutual Water Company | 1,053 | 2,000 |
| Glenn-Colusa Irrigation District | 0 | 16,500 |
| Maxwell Irrigation District | 4,000 | 7,500 |
| Natomas Central Mutual Water Company | 0 | 30,000 |
| Pelger Mutual Water Company | 1,600 | 4,000 |
| Pleasant Grove-Verona Mutual Water Company | 7,000 | 12,000 |
| Princeton-Codora-Glenn Irrigation District | 3,000 | 3,000 |
| Provident Irrigation District | 3,000 | 3,000 |
| Reclamation District 108 | 15,000 | 27,500 |
| Reclamation District 1004 | 12,900 | 12,900 |
| River Garden Farms | 0 | 6,000 |
| Sycamore Mutual Water Company | 10,000 | 14,000 |
| Te Velde Revocable Family Trust | 1,520 | 5,387 |
| **Feather River Area of Analysis** | | |
| Garden Highway Mutual Water Company | 3,500 | 7,500 |
| Goose Club Farms and Teichert Aggregate | 6,000 | 6,000 |
| Tule Basin Farms | 0 | 6,400 |
| **Total** | **91,313** | **195,126** |

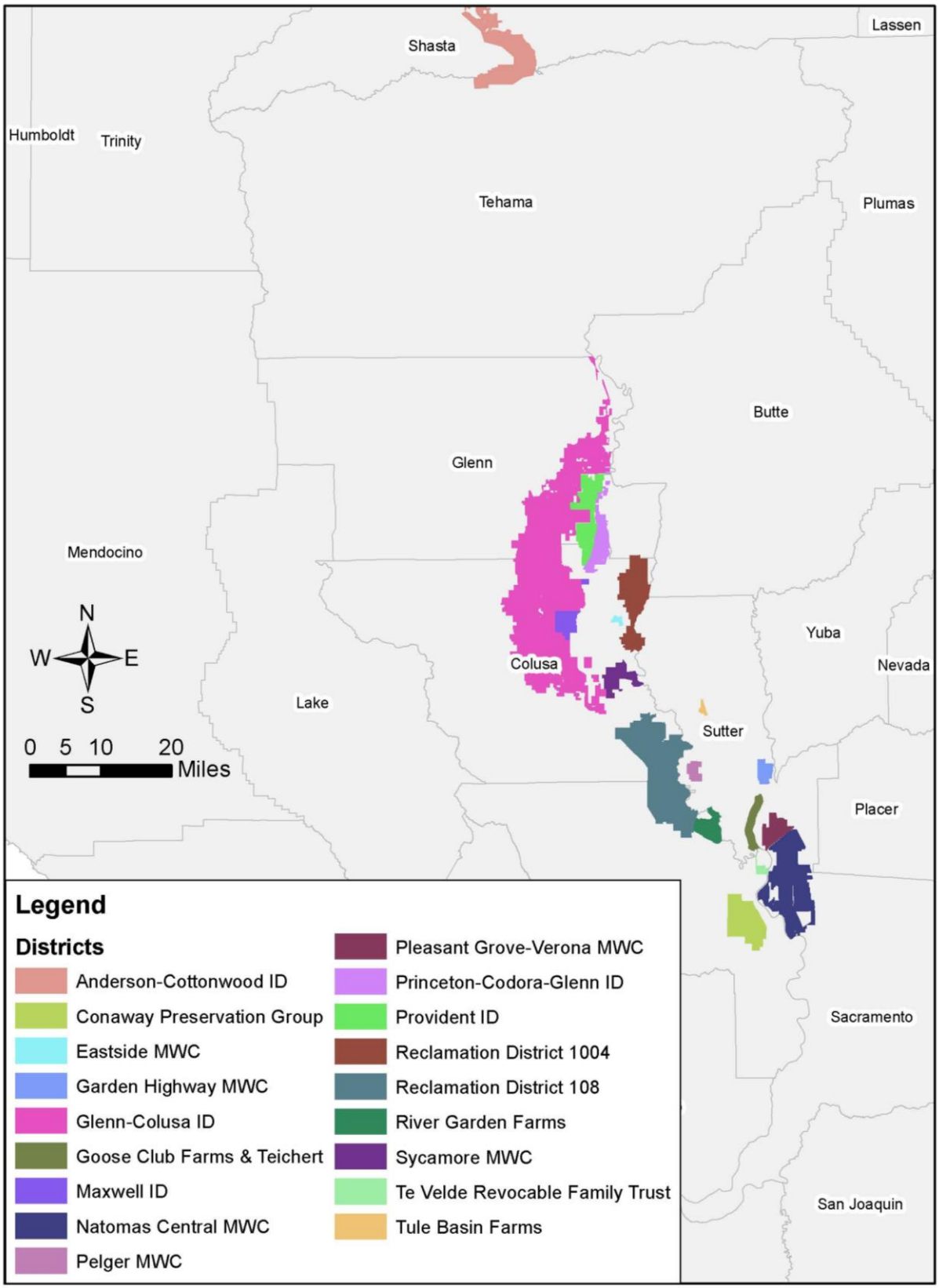


**Figure 2-1. Potential Selling Entities**

### 2.2.1 Sellers

Table 2-1 lists agencies that have expressed interest in making water available for transfer in 2014 and the maximum transfer amounts under current and potentially improved hydrologic conditions. Table 2-2 shows the methodology by which the sellers could make water available for transfer with the current CVP and SWP allocations. Because of the current hydrologic conditions, many agencies are uncertain about which transfer type would be used, and have therefore included potential upper limits for both types of transfers in Table 2-2. While the entity making water available could use one or a combination of mechanisms for making water available, or may shift the quantity made available during a particular period, the overall amount transferred would not exceed the values in Table 2-1.

Because the hydrology could change as the year moves forward, Table 2-3 shows the maximum transfer amounts for each transfer type under improved hydrologic conditions. As discussed above, these transfer quantities are assessed in this EA/IS to allow transfers to move forward if hydrologic conditions improve in the next several months. This analysis is conservative because these larger transfers would have greater potential for environmental impact than the smaller transfers under current conditions. Similar to Table 2-2, sellers have included multiple transfer types to allow flexibility, but the overall amount transferred would not exceed the values in Table 2-1.

**Table 2-2. Potential Transfer Types by Seller under Current Hydrologic Conditions (Upper Limits in Acre-Feet)**

| | April – June | | July – September | |
|---|---|---|---|---|
| Water Agency | Groundwater Substitution | Cropland Idling/Crop Shifting | Groundwater Substitution | Cropland Idling/Crop Shifting |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | | | 2,400 | |
| Conaway Preservation Group | 14,960 | 3,160 | 5,380 | 5,380 |
| Eastside Mutual Water Company | 556 | | 497 | |
| Glenn-Colusa Irrigation District | | | | |
| Maxwell Irrigation District | 2,000 | | 2,000 | |
| Natomas Central Mutual Water Company | | | | |
| Pelger Mutual Water Company | 400 | | 1,200 | |
| Pleasant Grove-Verona Mutual Water Company | 4,000 | 1,762 | 3,000 | 3,000 |
| Princeton-Codora-Glenn Irrigation District | | 1,110 | | 1,890 |
| Provident Irrigation District | | 1,110 | | 1,890 |
| Reclamation District 108 | | 5,550 | | 9,450 |
| Reclamation District 1004 | | 2,775 | 5,400 | 4,725 |
| River Garden Farms | | | | |
| Sycamore Mutual Water Company | 3,000 | 2,349 | 4,000 | 4,000 |
| Te Velde Revocable Family Trust | 1,000 | 305 | 520 | 520 |

**Table 2-2. Potential Transfer Types by Seller under Current Hydrologic Conditions (Upper Limits in Acre-Feet)**

| | April – June | | July – September | |
|---|---|---|---|---|
| **Water Agency** | **Groundwater Substitution** | **Cropland Idling/Crop Shifting** | **Groundwater Substitution** | **Cropland Idling/Crop Shifting** |
| **Feather River Area of Analysis** | | | | |
| Garden Highway Mutual Water Company | 1,500 | | 2,000 | |
| Goose Club Farms and Teichert Aggregate | | 2,220 | 2,000 | 3,780 |
| Tule Basin Farms | | | | |
| **Total[1]** | **27,416** | **20,341** | **28,397** | **34,635** |

Note:
[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. Table 2-1 reflects the total upper limit for each agency.

**Table 2-3. Potential Transfer Types by Seller under Improved Hydrologic Conditions (Upper Limits in Acre-Feet)**

| | April – June | | July – September | |
|---|---|---|---|---|
| **Water Agency** | **Groundwater Substitution** | **Cropland Idling/Crop Shifting** | **Groundwater Substitution** | **Cropland Idling/Crop Shifting** |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | 2,400 | | 2,400 | |
| Conaway Preservation Group | 16,550 | 5,925 | 10,089 | 10,089 |
| Eastside Mutual Water Company | 1,067 | | 933 | |
| Glenn-Colusa Irrigation District | | 6,105 | | 10,395 |
| Maxwell Irrigation District | 2,300 | 2,775 | 2,400 | 4,725 |
| Natomas Central Mutual Water Company | 15,000 | | 15,000 | |
| Pelger Mutual Water Company | 2,000 | 704 | 2,000 | 1,199 |
| Pleasant Grove-Verona Mutual Water Company | 7,000 | 3,330 | 5,000 | 5,670 |
| Princeton-Codora-Glenn Irrigation District | | 1,110 | | 1,890 |
| Provident Irrigation District | | 1,110 | | 1,890 |
| Reclamation District 108 | 2,775 | 7,400 | 4,725 | 12,600 |
| Reclamation District 1004 | | 2,775 | 5,400 | 4,725 |
| River Garden Farms | 3,000 | | 3,000 | |
| Sycamore Mutual Water Company | 4,000 | 3,700 | 4,000 | 6,300 |
| Te Velde Revocable Family Trust | 1,950 | 1,993 | 3,394 | 3,394 |
| **Feather River Area of Analysis** | | | | |
| Garden Highway Mutual Water Company | 3,333 | | 4,167 | |
| Goose Club Farms and Teichert Aggregate | | 2,220 | 2,000 | 3,780 |
| Tule Basin Farms | 2,880 | | 3,520 | |
| **Total[1]** | **64,255** | **51,057** | **68,028** | **66,657** |

Note:
[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. Table 2-1 reflects the total upper limit for each agency.

### 2.2.2 Buyers

Table 2-4 identifies entities that may be interested in buying transfer water. Not all of these potential buyers may end up actually purchasing water from the sellers. Purchase decisions depend on a number of factors, including, but not limited to, hydrology, water demands, availability of other supplies, and transfer costs. A major concern to potential buyers is the ability to move the purchased water through the Delta to the buyer's service area. Conveyance of the transfer water by Reclamation through the Delta is dependent on availability of capacity at the CVP or SWP pumping facilities and subject to other operational requirements. The current pumping window for transfers through Banks PP and Jones PP is July through September, but this window may shift based on real-time feedback from NMFS and USFWS. Pumping within this window can be further reduced based on specific hydrologic conditions, biological conditions, or water quality issues. Reclamation cannot guarantee that a specific quantity of transfer capacity will be available.

**Table 2-4. Potential Buyers**

| |
|---|
| Avenal State Prison |
| City of Avenal |
| City of Coalinga |
| City of Huron |
| San Luis & Delta-Mendota Water Authority Participating Members |
| Banta-Carbona Irrigation District |
| Byron Bethany Irrigation District |
| Del Puerto Water District |
| Eagle Field Water District |
| James Irrigation District |
| Laguna Water District |
| Mercy Springs Water District |
| Oro Loma Water District |
| Pacheco Water District |
| Panoche Water District |
| Patterson Irrigation District |
| Reclamation District 1606 |
| San Benito County Water District |
| San Luis Water District |
| Santa Clara Valley Water District |
| San Joaquin Valley National Cemetery |
| Tranquility Irrigation District |
| West Side Irrigation District |
| West Stanislaus Irrigation District |
| Westlands Water District |

## 2.2.3 Potential Water Transfer Methods

This EA/IS analyzes transfers from groundwater substitution and cropland idling/crop shifting, which are further described below. No other types of water transfers are covered by the evaluation in this EA/IS.

Reclamation approves transfers consistent with provisions of state and federal law that protect against injury to third parties as a result of water transfers. Several important principles include requirements that the transfer will not violate the provisions of federal or state law, will have no significant adverse effect on the ability to deliver Project Water, will be limited to water that would be consumptively used or irretrievably lost to beneficial use, will have no significant long-term adverse impact on groundwater conditions, and will not adversely affect water supplies for fish and wildlife purposes. Reclamation would not approve water transfers for which these basic principles have not been adequately addressed.

In 2014, some transfers may be accomplished through forbearance agreements rather than transfers that involve the State Water Resources Control Board. Forbearance agreements with Reclamation could be used for transfers between two CVP contractors. Under the agreements, sellers would forbear (i.e., temporarily suspend) the diversion of some of their Project Water or Base Supply, which in the absence of forbearance, would have been diverted during 2014 for use on lands within the sellers' service areas. This forbearance would be undertaken in a manner that allows Reclamation to deliver the forborne water supply as Project water to Participating Members of the SLDWMA. A forbearance agreement would not change the way that water is made available for transfer, conveyed to buyers, or used by the buyers. While the forbearance agreement would change the contractual arrangement used to deliver the water (and the necessary agency approvals for the transfer), it would not change the environmental effects of the transfer.

Additional information about water rights protection and water transfers is located at http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_transfers/docs/watertransferguide.pdf in a SWRCB staff document titled *A Guide to Water Transfers - Draft* (SWRCB 1999).

### *2.2.3.1 Groundwater Substitution*

Groundwater substitution transfers occur when sellers choose to pump groundwater in lieu of diverting surface water supplies, thereby making the surface water available for transfer. Sellers making water available through groundwater substitution actions are agricultural users. Water could be made available for transfer during the irrigation season of April through September. If there are issues related to water supply availability or conveyance capacity at the Delta, sellers could shorten the window when transfer water is available by

switching between surface water sources and groundwater pumping for irrigation.

Reclamation and DWR would convey transfer water only when capacity is available at the Jones PP and Banks PP and pumping is acceptable to NMFS and USFWS (typically July through September). CVP Water made available for transfer and pumped at the Banks PP could occur upon the SWRCB's approval of Joint Points of Diversion.

During April through June, Reclamation would attempt to retain surface water made available through groundwater substitution in upstream storage facilities until the transfer window (typically July through September) and Delta pumps have the capacity available to convey water south. In general, to retain water made available for transfer in upstream facilities, Reclamation and DWR would have to declare that the Delta is in a "balanced" condition under the terms of the Coordinated Operating Agreement (COA). Reclamation and DWR would try to facilitate the conveyance of transfer water through the pumps during the summer months based on the availability of unused capacity. The hydrologic risk of unused capacity not being available is borne by the transfer parties (in other words, Reclamation and DWR are not financially responsible if capacity is not available to convey the transferred water from the Delta).

An objective in planning a groundwater substitution transfer is to ensure that groundwater levels recover to their seasonal high levels under average hydrologic conditions. Because groundwater levels generally recover at the expense of stream flow, the wells used in a groundwater substitution transfer should be sited and pumped in such a manner that the stream flow losses resulting from pumping are primarily during the wet season, when losses to stream flow minimally affect other legal users of water. For the purposes of this EA/IS, the stream flow losses are assumed to be 12 percent of the amount pumped for transfer. The quantity of water available for transfer would be reduced by these estimated stream flow losses.

#### *2.2.3.2 Cropland Idling/Crop Shifting*

Cropland idling would make water available for transfer that would have been used for agricultural irrigation absent the transfer. Typically, the proceeds from the water transfer would pay growers to idle land that they would have otherwise placed in production. Rice has been the crop idled most frequently in previous transfer programs, and is the crop that could be idled for 2014 transfers.

The quantity of water made available for transfer through cropland idling actions would be calculated based on the evapotranspiration of applied water (ETAW). ETAW is the portion of applied surface water that is evaporated from the soil and plant surfaces and actually used by the crop. For 2014, this EA/IS only analyzes cropland idling from rice crops, which have an ETAW of 3.3 AF/acre (Reclamation and DWR 2013).

For crop shifting transfers, water is made available when farmers shift from growing a higher water use crop to a lower water use crop. The difference in ETAW values (Table 2-5) would be the amount of water that can be transferred. Transfers in 2014 could include transfers from rice to a crop with a lower water use from Table 2-5.

**Table 2-5. Estimated ETAW Values for Various Crops Suitable for Idling or Shifting Transfers**

| Crop | ETAW (acre-feet/acre) |
|---|---|
| Alfalfa[1] | 1.7 (July – Sept) |
| Bean | 1.5 |
| Corn | 1.8 |
| Cotton | 2.3 |
| Melon | 1.1 |
| Milo | 1.6 |
| Onion | 1.1 |
| Pumpkin | 1.1 |
| Rice | 3.3 |
| Sudan Grass | 3.0 |
| Sugar Beets | 2.5 |
| Sunflower | 1.4 |
| Tomato | 1.8 |
| Vine Seed/ Cucurbits | 1.1 |
| Wild Rice | 2.0 |

*Source: Reclamation and DWR 2013*

Notes:

[1] Only alfalfa grown in the Sacramento Valley floor north of the American River will be allowed for transfers. Fields must be disced on, or prior to, the start of the transfer period. Alfalfa acreage in the foothills or mountain areas is not eligible for transfer.

Water made available through cropland idling or crop shifting actions would be available at the beginning of the season (April or May) and would be available for transfer on the same pattern as would otherwise be used by the crop. (That is, in the same volume and at the same time as would have been consumptively used by the crop absent the transfer.) Transfers could be conveyed through Jones PP and Banks PP when capacity is available and pumping is acceptable to NMFS and USFWS (typically July through September). Reclamation would attempt to retain water acquired from cropland idling or crop shifting during the April-June period in upstream reservoirs until the transfer water could be released and conveyed through the Delta during July through September, with the same constraints as described for groundwater substitution.

Crop shifting would generally reduce potential environmental effects associated with cropland idling. The agencies interested in crop shifting are also interested in cropland idling, but are not sure of the distribution between the two methods. To be conservative, this EA/IS analyzes the effects as if all transfers were from crop idling because crop idling has the greater potential for effects.

For cropland idling transfers, the growers would be compensated but local economies could be adversely affected by decreased agricultural activity. To minimize socioeconomic effects on local areas where cropland idling occurs, the number of acres idled for the purpose of transferring water would be limited to 20 percent of the harvested acreage of each crop considered for idling within the selling district for the given hydrologic year. The "20 percent" figure is based on historical precedents and Water Code Section 1745.05(b) as follows:

- The agricultural industry experiences normal variation in crop acreage; therefore, agricultural economies and local public services adapt to address this variation. Historical amounts of idled land vary year-to-year by close to 20 percent, which indicates that the local economy has adjusted to similar amounts of crop idling.

- County economic measures, such as employment and personal income, fluctuate normally based on current economic conditions. Cropland idling has not generally resulted in economic impacts outside of the historical variations.

- Water Code Section 1745.05(b) requires a public hearing under some circumstances in which the amount of water from land idling exceeds 20 percent of the water that would have been applied or stored by the water supplier absent the water transfer in any given hydrologic year. Third parties would be able to attend the hearing and could argue to limit the transfer based on its economic effects.

## 2.3 Recent Environmental Documents

In 2010, Reclamation completed the 2010-2011 Water Transfer Program Environmental Assessment (2010-2011 WTP EA) (Reclamation 2010). The 2010-2011 WTP EA provided an assessment of potential impacts to Surface Water Resources, Groundwater Resources, Water Quality, Power Generation, Cultural Resources, Socioeconomics, Indian Trust Assets, Environmental Justice, Climate Change, Visual Resources, Growth Inducing Impacts, and Cumulative Effects associated with potential groundwater substitution water transfers as well as cropland idling/crop shifting water transfers. The 2010-2011 WTP EA evaluated annual groundwater substitution transfers of up to 110,409 AF from the Sacramento and American River areas and cropland idling/crop shifting transfers of up to 109,469 AF from the Sacramento River area.

On February 26, 2010, Reclamation signed a Finding of No Significant Impact (FONSI) that included Reclamation's findings in accordance with NEPA. The FONSI described the key mitigation and monitoring actions necessary to support Reclamation's decision. To address some of the most prevalent comments received during the comment period concerning potential impacts to groundwater resources, Reclamation included well reviews and monitoring and mitigation plans to be implemented under the Proposed Action to minimize

potential effects to groundwater resources. All plans were to be coordinated and implemented in conjunction with local ordinances, basin management objectives, and all other applicable regulations. The reviews and plans were to be required from sellers for review by Reclamation, and Reclamation would not approve transfers without adequate mitigation and monitoring plans. Reclamation found that the approval of proposed water transfers in support of the 2010-2011 Water Transfer Program was not a major Federal action that would significantly affect the human environment; therefore, an environmental impact statement was not required. Ultimately, however, no transfer proposals were submitted to Reclamation for approval under the 2010-2011 Water Transfer Program Proposed Action.

In 2013, Reclamation developed an EA for one-year transfers from sellers in the Sacramento River basin to SLDMWA. The EA analyzed up to 37,715 AF of groundwater substitution transfers. The 2013 Water Transfers EA included a detailed assessment of potential impacts to Surface Water Resources, Groundwater Resources, Air Quality, and Biological Resources. On June 21, 2013, Reclamation signed a FONSI with similar findings to those on the 2010-2011 WTP EA. Reclamation found that the 2013 water transfers would not significantly affect the human environment and an environmental impact statement was not required. Approximately 29,217 AF were transferred under actions and approvals addressed and cleared by this environmental document. As part of the monitoring plans required by the EA, the transferring parties have collected monitoring data starting pre-transfer. To date (through January 2014), the available monitoring data indicates that the groundwater aquifer is recovering to pre-transfer levels, as described in the EA. Final monitoring reports that describe the monitoring data will be available in May 2014.

## 2.4 Environmental Commitments

This section presents the Environmental Commitments included in the Proposed Action to reduce potential environmental impacts from water transfers in contract year 2014. These Environmental Commitments will also be included in the Biological Assessment (BA) prepared for the Proposed Action. Appendix A includes the environmental commitments of the project.

**Groundwater Substitution and Cropland Idling Transfers**

- Carriage water will be used to maintain water quality standards in the Delta.

**Groundwater Substitution Transfers**

- Well reviews and monitoring and mitigation plans will be implemented to minimize potential effects of groundwater substitution on nearby surface and groundwater water resources. Well reviews, monitoring and mitigation plans will be coordinated and implemented in conjunction with local ordinances, basin management objectives, and all other applicable regulations. DWR and Reclamation have published

draft technical information related to cropland idling and groundwater substitution transfers titled *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013), and any 2014 Water Transfer Guidelines Addendums, which are available at http://www.water.ca.gov/watertransfers/.

- In groundwater basins where sellers are in the same groundwater subbasin as protected aquatic habitats, such as giant garter snake (GGS) preserves and conservation banks, groundwater substitution will be allowed as part of the water transfer program if the seller can demonstrate that any impacts to water resources needed for special status species protection have been addressed. In these areas, sellers will be required to address these impacts as part of their mitigation plan.

**Cropland Idling Transfers**

- As part of the approval process, Reclamation will have access to the land to verify how the water transfer is being made available and to verify that the actions to protect the GGS are being implemented.

- Reclamation will provide a map(s) to USFWS in May of 2014 showing the parcels of riceland that are idled for the purpose of transferring water in 2014. These maps will be prepared to comport to Reclamation's Geographic Information System (GIS) standards.

- Water will not be purchased from a field fallowed during the two previous years (water may be purchased from the same parcel in successive years).

- The focus of GGS mitigation in districts proposing water transfers made available from fallowed rice fields will be to ensure adequate water is available for priority suitable habitat with a high likelihood of GGS occurrence.

  – The determination of priority habitat will be made through coordination with GGS experts, GIS analysis of proximity to historic tule marsh, and GIS analysis of suitable habitat. The priority habitat areas are indicated on the priority habitat map which will be maintained by USFWS. In addition, fields abutting or immediately adjacent to Federal wildlife refuges will be considered priority habitat.

  – Maintenance water in smaller drains and conveyance infrastructure support key habitat attributes such as emergent vegetation for GGS for escape cover and foraging habitat. If crop idling occurs in priority habitat areas, Reclamation will work with contractors to document that adequate water remains in drains and canals in those

priority areas. Documentation may include flow records, photo documentation, or other means of documentation agreed to by Reclamation and USFWS.

- Areas with known priority GGS populations will not be permitted to participate in cropland idling. Water sellers can request a case-by-case evaluation of whether a specific field would be precluded from participating in the water transfer program. These areas include:
  - A field abutting or immediately adjacent to Butte Creek, Colusa Drainage Canal, Gilsizer Slough, the land side of the Toe Drain along the Sutter Bypass, Willow Slough and Willow Slough Bypass in Yolo County, and
  - Lands in the Natomas Basin.
- Movement corridors include the major irrigation and drainage canals. The water seller will keep at least two feet of water in the major irrigation and drainage canals (but never more than existing conditions).

- In order to limit reduction in the amount of over-winter forage for migratory birds, including greater sandhill crane, transfers will minimize actions near known wintering areas in the Butte Sink.
- To ensure effects of cropland idling actions on western pond turtle habitat are avoided or minimized, canals will not be allowed to completely dry out.

## 2.5 Environmental Setting

The environmental setting in which implementation of the No Action Alternative or Proposed Action would occur is summarized below for resources that could be affected by water transfers. Additional details regarding relevant existing environmental conditions are provided in Chapter 3, within the analysis of potential impacts.

### 2.5.1 Aesthetics

The Central Valley of California is primarily agricultural in nature, with Interstate 5 running from north to south through the valley floor. Views in the region from most major roadways and scenic routes are of agricultural fields or urban landscapes. The mix of orchard and row crop types, fallow fields, rice, and other irrigated crops and dry fields create the visual character for most of the project area. Urban centers, such as Sacramento, Stockton, and Fresno in the

southern part of the project area, break up the farmland that dominates the views in the Central Valley, creating some major nighttime light sources near the city centers.

### 2.5.2 Air Quality

Air quality in California is regulated by the United States Environmental Protection Agency (USEPA), the California Air Resources Board (CARB), and locally by Air Pollution Control Districts (APCDs) or Air Quality Management Districts (AQMDs). The potential air quality impacts are associated with actions to make water available; therefore, the environmental effects are would be in the sellers' area. As a result, the environmental setting is focused on conditions in the sellers' area. The following air districts regulate air quality within the project study area:

- Colusa County APCD
- Feather River AQMD
- Glenn County APCD
- Sacramento Metropolitan AQMD
- Shasta County AQMD
- Yolo/Solano AQMD

In the Sacramento Valley Air Basin, ozone ($O_3$), inhalable particulate matter ($PM_{10}$), and fine particulate matter ($PM_{2.5}$) are pollutants of concern because ambient concentrations of these pollutants exceed the California Ambient Air Quality Standards (CAAQS). Additionally, ambient $O_3$ and $PM_{2.5}$ concentrations exceed the National Ambient Air Quality Standards (NAAQS), while $PM_{10}$ and carbon monoxide (CO) concentrations recently attained the NAAQS and are designated maintenance. Table 2-6 summarizes the attainment status for the counties located in the Sacramento Valley.

The Sacramento Valley Air Basin is bounded by the North Coast Ranges on the west and the Northern Sierra Nevada Mountains on the east, forming a bowl-shaped valley. The Sacramento Valley has a Mediterranean climate, which is characterized by hot dry summers and mild rainy winters.

Most of the sellers' service area supports agricultural land uses. Crop cycles, including land preparation and harvest, contribute to pollutant emissions, primarily particulate matter. Groundwater pumping with diesel and natural gas-fueled engines also emits air pollutants through exhaust. The primary pollutants emitted by diesel pumps are nitrogen oxides (NOx), volatile organic compounds (VOC), CO, $PM_{10}$, and $PM_{2.5}$; NOx and VOCs are precursors to $O_3$ formation.

**Table 2-6. State and Federal Attainment Status**

| County | Attainment Status | | | | | | |
|---|---|---|---|---|---|---|---|
| | CAAQS | | | NAAQS | | | |
| | $O_3$ | $PM_{2.5}$ | $PM_{10}$ | $O_3$ | $PM_{2.5}$ | $PM_{10}$ | CO |
| Colusa | N-T[1] | A | N | A | A | A | A |
| Glenn | N-T[1] | U | N | A | A | A | A |
| Sacramento | N | N | N | N[3] | N | M | M |
| Shasta | N | A | N | A | A | A | A |
| Sutter | N-T[1] | A | N | N[3,4] | N | A | A |
| Yolo | N-T[1] | U | N | N[3] | N | A | M |

*Source: 17 California Code of Regulations (CCR) §60200-60210; 40 Code of Federal Regulations (CFR) 81; CARB 2012; USEPA 2013*

Notes:

[1] Nonattainment/transitional areas are defined as those areas that during a single calendar year, the State standards were not exceeded more than three times at any monitoring location within the area.

[2] 8-hour $O_3$ classification = marginal

[3] 8-hour $O_3$ classification = severe

[4] The Sacramento Metro nonattainment area for Sutter County is defined as the "portion south of a line connecting the northern border of Yolo County to the southwestern tip of Yuba County and continuing along the southern Yuba County border to Placer County" (40 CFR 81.305).

Key:

A = attainment; CO = carbon monoxide; M = maintenance; N = nonattainment; N-T = nonattainment/transitional; $O_3$ = ozone; $PM_{10}$ = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; U = unclassified

### 2.5.3 Biological Resources

The project area includes the Sacramento watershed. Although the Sacramento Valley is dominated by agricultural land, remnant grassland, savannah, riparian and wetland habitats remain. In the Sacramento Valley, seasonally flooded agriculture, in particular rice fields, provide important foraging habitat for a variety of wildlife species. Rice fields also provide resting, nesting, and breeding habitat similar to natural wetlands. Irrigation ditches can contain wetland vegetation such as cattails, which provide cover habitat.

Terrestrial species potentially affected by the Proposed Action include GGS (*Thamnopphis gigas*), greater sandhill crane (*Grus canadensis tabida*), black tern (*Chlidonias niger*), and western pond turtle (*Actinemys marmorata*). The following listings apply to the above species under the Federal and California Endangered Species Acts (ESA).

- Giant Garter Snake – listed as threatened under the Federal and California ESAs
- Greater Sandhill Crane – listed as threatened under the California ESA and is fully protected under the California Fish and Game Code
- Black Tern – listed as a State Species of Concern

- Western Pond Turtle – status is under review under the Federal ESA and listed as a State Species of Concern

Table 2-7 summarizes fish species of concern in upstream rivers and tributaries of the sellers' area and the Delta region.

**Table 2-7. Fish Species of Management Concern**

| Status | Species | Location (Area of analysis) | Primary Management Consideration[1] |
|---|---|---|---|
| Listed | Winter-run Chinook Salmon | Upstream and Delta areas | FE,SE |
| | Spring-run Chinook Salmon | Upstream and Delta areas | FT,ST |
| | Central Valley Steelhead | Upstream and Delta areas | FT, Recreation |
| | Delta smelt | Delta areas | FT, SE |
| | Green sturgeon | Upstream and Delta areas | FT, Recreation |
| | Longfin smelt | Delta areas | FC, ST |
| Commercial | Fall/late-fall Chinook Salmon | Upstream and Delta areas | Commercial, Recreation |
| Recreational | Striped bass | Upstream and Delta areas | Recreation |
| | American shad | Upstream and Delta areas | Recreation |
| Ecological | Hardhead | Upstream and Delta areas | SSC, Ecological |
| | Splittail[2] | Upstream and Delta areas | SSC, Ecological |
| | White sturgeon | Upstream and Delta areas | Ecological, Recreation |

[1] FC-Federal candidate, FE-Federal endangered, FT-Federal threatened, SE-state endangered, ST-state threatened, SSC – State Species of Special Concern

[2] Under a Federal District Court ruling, the splittail rule has been remanded to USFWS. Splittail continue to be treated as a listed species.

Water transfers would not have adverse effects to biological resources in the buyers' area; therefore, they are not discussed in this document.

## 2.5.4 Geology and Soils

The Central Valley consists of mostly flat terrain associated with low gradient river valleys. There are some earthquake faults in the region but earthquakes are generally associated with coastal California, west of the Central Valley. Strong seismic shaking is not common in the Central Valley, and liquefaction and other seismic-related ground failure are not major hazards in the region. Landslides and other hazards associated with unstable soil are uncommon due to the flat terrain. Dust from agricultural activities, such as plowing, grading, and discing, is a common occurrence in the Central Valley agricultural areas, including the project area, and is a normal part of the agriculture practice in the region.

## 2.5.5 Greenhouse Gas Emissions

The greenhouse gas (GHG) analysis focuses on the following three pollutants: carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). The other two pollutant groups commonly evaluated in various GHG reporting protocols, hydrofluorocarbons and perfluorocarbons, are not expected to be emitted in large quantities as a result of the alternatives and are not discussed further in this section.

Worldwide, California is the 14th largest emitter of $CO_2$ if it were a country. On a per capita basis, California would be ranked 19th in the world (CARB 2011). Agricultural emissions represented approximately 7 percent of California's GHG emissions in 2009. Agricultural emissions represent the sum of emissions from agricultural energy use (from pumping and farm equipment), agricultural residue burning, agricultural soil management (the practice of using fertilizers, soil amendments, and irrigation to optimize crop yield), enteric fermentation (fermentation that takes place in the digestive system of animals), histosols (soils that are composed mainly of organic matter) cultivation, manure management, and rice cultivation.

## 2.5.6 Hydrology and Water Quality

### *2.5.6.1 Surface Water*

The Sacramento River flows south for 447 miles through the northern Central Valley and enters the Delta from the north. The major tributaries to the Sacramento River are the Feather, Yuba, and American rivers. Reclamation owns and operates the CVP, which has major reservoirs on the Sacramento River (Shasta Reservoir) and American River (Folsom Reservoir). DWR owns and operates the SWP, which has a major reservoir on the Feather River (Oroville Reservoir).

### *2.5.6.2 Water Quality*

While water quality in the Sacramento River system is generally good, several water bodies within the area of analysis have been identified as impaired by certain constituents of concern and appear on the most recent 303(d) list of impaired waterways under the Clean Water Act (SWRCB 2011).

On the San Joaquin River, agricultural drainage, along with wastewater treatment plant discharges, runoff from dairies, and other sources, contribute to suspended sediment and other constituents of concern in the river. The tributaries originating in the Sierras have generally good quality, but other inflow sources reduce this quality in the mainstem. The Delta receives water from the Sacramento and San Joaquin rivers; the existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon.

### *2.5.6.3 Groundwater*

**Redding Groundwater Basin**

Historically, groundwater levels have remained stable within the Redding Groundwater Basin. Even though there have been no long-term trends of declining or increasing groundwater levels, levels are affected by changes in precipitation. Seasonal groundwater fluctuations range from two to three feet in

shallow unconfined aquifers and two to five feet in semi-confined to confined aquifers in normal years (CH2M HILL 2003). These declines are usually followed by recovery to predrought levels after several successive normal or above-normal precipitation events occurred (CH2M HILL 2003).

*Land Subsidence.* Land subsidence has not been monitored in the Redding Area Groundwater Basin. However, there would be potential for subsidence in some areas of the basin if groundwater levels were substantially lowered. The groundwater basin west of the Sacramento River is composed of the Tehama Formation, which has exhibited subsidence in Yolo County.

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

**Sacramento Groundwater Basin**

The Sacramento Valley Groundwater Basin includes portions of Tehama, Glenn, Butte, Yuba, Colusa, Placer, and Yolo Counties. Groundwater accounts for less than 30 percent of the annual supply used for agricultural and urban purposes within the Sacramento Valley. Urban pumping in the Sacramento Valley increased from approximately 250,000 AF annually in 1961 to more than 800,000 AF annually in 2003 (Faunt 2009). However cumulative change in groundwater storage has been relatively constant over the long term within the Sacramento Valley. Storage tends to decrease during dry years and increase during wetter periods.

*Land Subsidence.* Historically, land subsidence occurred in the eastern portion of Yolo County and the southern portion of Colusa County, owing to groundwater extraction and geology. Due to groundwater withdrawal over several decades, as much as four feet of land subsidence has occurred east of Zamora. The area between Zamora, Knights Landing, and Woodland has been most affected (Yolo County 2009). Subsidence in this region is generally related to groundwater pumping and subsequent consolidation of loose aquifer sediments.

*Groundwater Quality.* Groundwater quality in the Sacramento Valley Groundwater Basin is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. However, there are some localized groundwater quality issues in the basin. Some of the water quality issues within the Sacramento Valley may include occurrences of saltwater intrusion or elevated levels of nitrates, naturally occurring boron, and other introduced chemicals (DWR 2003).

**San Joaquin Valley Groundwater Basin**

The San Joaquin Valley Groundwater Basin extends over the southern two-thirds of the Central Valley regional aquifer system and has an area of approximately 13,500 square miles. Extensive groundwater pumping and irrigation (with imported surface water) have modified local groundwater flow patterns and in some areas within the basin. Groundwater flow has become more rapid and complex within the basin and groundwater pumping and application of excess irrigation water has resulted in steeper hydraulic gradients as well as shortened flow paths between sources and sinks (Faunt 2009).

*Land Subsidence.* From the 1920s until the mid-1960s, the use of groundwater for irrigation of crops in the San Joaquin Valley increased rapidly, causing land subsidence throughout the west and southern portions of the valley. Land subsidence is concentrated in areas underlain by the Corcoran Clay. A 2013 United States Geologic Survey (USGS) study found that the northern portion of the Delta-Mendota Canal was stable or experienced little subsidence from 2003-2010. The southern portion of the Delta-Mendota Canal subsided as part of a large area of subsidence centered near the town of El Nido. Subsidence measurements indicated more than 20 millimeters of subsidence from 2008 to 2010 (Sneed et al 2013). Land subsidence will continue if overdraft of the underlying aquifers continues.

*Groundwater Quality*. Groundwater quality varies throughout the San Joaquin Valley Groundwater Basin. Arsenic, vanadium and boron were the trace elements that were most frequently detected at concentrations greater than the maximum contaminant level (MCL) within the basin. Aluminum, barium, lead, antimony, mercury, valadium, and fluoride were also detected at concentrations above the MCL in less than two percent of the primary aquifers (Belitz 2010, Bennett 2010, Burton 2012). Studies have shown that TDS concentrations were greater than the 450 mg/L in about two percent of the primary aquifers in the central portion of the valley and in about six percent of the primary aquifers in the northern portions of the basin (Belitz 2010, Bennett 2010, Burton 2012).

### 2.5.7 Noise

Noise is generally measured in decibels (dB), which are measured on a logarithmic scale so that each increase in 10 dB equals a doubling of loudness. The letter "A" is added to the abbreviation (dbA) to indicate an "A-weighted" scale, which filters out very low and very high frequencies that cannot be heard by the human ear.

The buyers and sellers areas are primarily agricultural; major noise sources include traffic, railroad operations, airports, industrial operations, farming operations, and fixed noise sources. Common noise sources associated with farming operations include tractors, harvesting equipment and spray equipment

(Glenn County 1993). Typical noise levels created by a range of farm equipment are presented in Table 2-8.

**Table 2-8. Typical Noise Levels Associated with Farm Equipment**

| Equipment | Distance (feet) | Sound Level (dB) |
|---|---|---|
| Diesel Wheel Tractor | | |
| - with Disc | 150 | 72-75 |
| - with Furrow | 50 | 69-79 |
| Weed Sprayer (1-cylinder) | 50 | 74-75 |
| Aero Fan 391 Speed Sprayer | 200 | 74-76 |
| Diesel Engine | 50 | 75-85 |

*Source: Brown-Buntin Associates, Inc. in Glenn County 1993*
Key: dB = decibel

A Community Noise Survey conducted in Glenn County indicated that typical noise levels in noise sensitive areas, including rural areas, are relatively quiet and fall in the range of 48 dB to 60 dB Ldn[1] (Glenn County 1993). These noise levels would be reflective of conditions in the other counties.

[1] The day-night average sound level (Ldn) is the average noise level, expressed in decibels, over a 24-hour period.

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# Chapter 3
# Environmental Impacts

The following sections use the checklist from Appendix G of the CEQA Guidelines as a template to assess potential environmental effects under both CEQA and NEPA. The discussion for each resource focuses on potential impacts; resources that would not be affected are briefly discussed.

**I. AESTHETICS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Have a substantial adverse effect on a scenic vista? | ☐ | ☐ | ☐ | ☒ |
| b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings, or other locally recognized desirable aesthetic natural feature within a city-designated scenic highway? | ☐ | ☐ | ☐ | ☒ |
| c) Substantially degrade the existing visual character or quality of the site and its surroundings? | ☐ | ☐ | ☒ | ☐ |
| d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area? | ☐ | ☐ | ☐ | ☒ |

**a, b, d) No Impact.** The No Action Alternative and Proposed Action would not affect any scenic vista, damage scenic resources, or create a new light source. The Proposed Action would not affect scenic vistas relative to rivers or reservoir because there would be no changes beyond historical or seasonal fluctuations in flows or water levels. The Proposed Action does not result in any construction or new structures that could damage scenic resources (i.e., trees, rock outcroppings, historic buildings, etc.) or produce notable sources or light or glare.

**c) Less than Significant.** Cropland idling transfers in the Proposed Action would temporarily increase the amount of idled lands in the sellers' area. The

No Action Alternative may also increase cropland idling in response to water shortages associated with the dry hydrologic conditions. Idled lands are typical features of agricultural landscapes as part of normal cultivation practices. The crop pattern resulting from the Proposed Action would likely be indistinguishable from those under normal cropping patterns. This impact would be less than significant as there would be no substantial changes or degradation to the visual character and quality of the sites or their surroundings.

**II. AGRICULTURE AND FOREST RESOURCES**:
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:

| | **Potentially Significant Impact** | **Less Than Significant with Mitigation Incorporation** | **Less Than Significant Impact** | **No Impact** |
|---|---|---|---|---|
| a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use? | ☐ | ☐ | ☐ | ☒ |
| b) Conflict with existing zoning for agricultural use, or a Williamson Act contract? | ☐ | ☐ | ☐ | ☒ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))? | ☐ | ☐ | ☐ | ☒ |
| d) Result in the loss of forest land or conversion of forest land to non-forest use? | ☐ | ☐ | ☐ | ☒ |
| e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use? | ☐ | ☐ | ☐ | ☒ |

**a, b, e) No Impact.** One-year water transfers under the Proposed Action temporarily take land out of production, but would not affect the long-term agricultural uses of the land. The No Action Alternative could also result in increased cropland idling in 2014 in response to reduced surface water allocations from the CVP and SWP. Idling cropland for a single year would be similar to fallowing a field under a normal crop rotation. Cropland idling would not affect the long-term designations of Prime Farmland or other Farmland Mapping and Monitoring Program classifications or affect Williamson Act contracts.

**c, d) No Impact.** The No Action Alternative and Proposed Action would have no impact to existing forest lands or timber, as the proposed water transfer methods do not pertain to such lands or resources.

**III. AIR QUALITY**

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Conflict with or obstruct implementation of the applicable air quality plan? | ☐ | ☐ | ☒ | ☐ |
| b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation? | ☐ | ☒ | ☐ | ☐ |
| c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non--attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)? | ☐ | ☐ | ☒ | ☐ |
| d) Expose sensitive receptors to substantial pollutant concentrations? | ☐ | ☐ | ☒ | ☐ |
| e) Create objectionable odors affecting a substantial number of people? | ☐ | ☐ | ☐ | ☒ |

### a) Less than Significant Impact

**No Action Alternative:** Under the No Action Alternative, growers may idle rice or pump groundwater to supplement reduced surface water allocations. Crop idling actions could increase fugitive dust emissions. Although there could be emission increases under the No Action Alternative, the emissions would be consistent with existing trends in air quality and would be the same as existing conditions; therefore, emissions could not impede implementation of any air quality plan.

**Proposed Action:** The air districts associated with the counties of Shasta, Tehama, Glenn, Butte, Colusa, Sutter, and Yuba comprise the Northern

Sacramento Valley Planning Area (NSVPA). The NSVPA has jointly committed to preparing and adopting an Air Quality Attainment Plan (AQAP) to achieve and maintain healthful air in these counties. The Sacramento Metropolitan AQMD and the Yolo/Solano AQMD have also adopted various air quality plans for the pollutants for which they are currently designated nonattainment. As part of these plans, several control measures were adopted by the various counties to attain and maintain air quality standards. These control measures are then promulgated in the rules and regulations at each air district; therefore, if a Proposed Action is consistent with the air districts' and State regulations, then the project is in compliance with the AQAP. The air quality impacts from with transfer actions are associated with the actions taken to reduce consumptive use and are therefore concentrated in the sellers' region. As a result, air quality impacts for the buyers are not discussed further.

The Proposed Action would use a combination of electric, diesel, and natural gas driven groundwater pumps depending on the specific water agency. All diesel-fueled engines are subject to the CARB's Airborne Toxic Control Measure (ATCM) for Stationary Ignition Engines (17 California Code of Regulations [CCR] 93115). The ATCM does not expressly prohibit the use of diesel engines for agricultural purposes; therefore, diesel engines may be used for groundwater pumping associated with groundwater substitution transfers as long as they are replaced when required by the compliance schedule.

All pumps proposed to be used by the water agencies would operate in compliance with all rules and regulations at the federal, state, and local levels; therefore, any activities associated with water transfers would be consistent with the AQAPs and the ATCM.

**b) Less than Significant with Mitigation**

**No Action Alternative:** Under the No Action Alternative, growers would leave some crops idle, which would leave bare soils susceptible to fugitive dust emissions from windblown dusts. Growers 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. There would be no change to emissions relative to existing conditions.

**Proposed Action:** To assess whether a proposed project would violate any air quality standards or contribute substantially to an existing or projected air quality violation, several of the air districts developed significance thresholds for mass daily and/or annual emission rates of criteria pollutants. Colusa, Glenn, and Shasta counties do not have published significance thresholds; therefore, the threshold used to define a "major source" in the Clean Air Act (100 tons per year) was used to evaluate significance. Table 3-1 summarizes the significance thresholds used by each air district.

**Table 3-1. CEQA Significance Thresholds**

| Air District | Operational Significance Thresholds (lbs/day) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Sacramento Metropolitan AQMD | 65 | 65 | -- | -- | -- | -- |
| Yolo-Solano AQMD | 10 tpy | 10 tpy | -- | -- | 80 | -- |
| Feather River AQMD | 25 | 25 | -- | -- | 80 | -- |

*Source: Feather River AQMD 2010; Sacramento Metropolitan AQMD 2009; Yolo-Solano AQMD 2007.*
Key:
-- = no threshold; AQMD = air quality management district; CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM10 = inhalable particulate matter; PM2.5 = fine particulate matter; SOx = sulfur oxides; tpy = tons per year; VOC = volatile organic compounds

In addition to the CEQA significance thresholds, the federal general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain de minimis amounts (40CFR 93.153). Conformity means that such federal actions must be consistent with a state implementation plan's (SIP's) purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards.

Groundwater substitution could increase air emissions in the seller area. Cropland idling transfers could reduce vehicle exhaust emissions, but increase fugitive dust emissions. Cropland idling transfers could offset some of the emissions from groundwater substitution transfers, but the quantity of water transferred under each mechanism could be much less than what is included in Table 2-3. Because cropland idling transfers may not occur up to the upper limits, they cannot be counted on to reduce impacts of groundwater substitution. Therefore, impacts were only evaluated for groundwater substitution to estimate the maximum potential emissions that could occur because of the Proposed Action.

Table 3-2 summarizes the maximum daily emissions that would be estimated to occur in each water agency subject to a daily significance threshold. Table 3-3 summarizes the annual emissions that would occur in each water agency subject to an annual significance threshold. Significance was determined for individual water agencies.

**Table 3-2. Unmitigated Daily Emissions**

| Water Agency | Peak Daily Emissions (lbs/day) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Feather River AQMD | | | | | | |
| Garden Highway Mutual Water Company | All electric engines | | | | | |
| Goose Club Farms and Teichert Aggregate | All electric engines | | | | | |
| Natomas Central Mutual Water Company | All electric engines | | | | | |
| Pelger Mutual Water Company | 22 | **277** | 60 | 18 | 3 | 3 |
| Pleasant Grove-Verona Mutual Water Company | 20 | **176** | 85 | 21 | 12 | 12 |
| Reclamation District 1004[1] | 2 | 24 | 13 | 4 | 1 | 1 |
| Tule Basin Farms | 4 | **122** | 9 | <1 | <1 | <1 |
| CEQA Significance Threshold | 25 | 25 | n/a | n/a | 80 | n/a |
| Sacramento Metropolitan AQMD | | | | | | |
| Natomas Central Mutual Water Company | All electric engines | | | | | |
| CEQA Significance Threshold | 65 | 65 | n/a | n/a | n/a | n/a |
| Yolo/Solano AQMD | | | | | | |
| Conaway Preservation Group | 9 | 91 | 68 | 18 | 8 | 8 |
| Reclamation District 108[2] | All electric engines | | | | | |
| River Garden Farms | All electric engines | | | | | |
| Te Velde Revocable Family Trust | All electric engines | | | | | |
| CEQA Significance Threshold | n/a | n/a | n/a | n/a | 80 | n/a |

Notes:
[1] Reclamation District 1004 is split into three different air districts; therefore, only emissions from Sutter County are included.
[2] Reclamation District 108 is split into two different air districts; therefore, only emissions from Yolo County are included.
Key:
AQMD = air quality management district; CEQA = California Environmental Quality Act; CO = carbon monoxide; lbs/day = pounds per day; n/a = not applicable; NOx = nitrogen oxides; PM10 = inhalable particulate matter; PM2.5 = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compound

**Table 3-3. Unmitigated Annual Emissions**

| Water Agency | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Colusa County APCD | | | | | | |
| Eastside Mutual Water Company | <1 | 2 | 2 | 1 | <1 | <1 |
| Maxwell Irrigation District | <1 | 5 | 4 | 1 | <1 | <1 |
| Reclamation District 108[2] | All electric engines | | | | | |
| Reclamation District 1004[1] | <1 | 2 | 1 | <1 | <1 | <1 |
| Sycamore Mutual Water Company | All electric engines | | | | | |
| CEQA Significance Threshold | 100 | 100 | 100 | 100 | 100 | 100 |
| Glenn County APCD | | | | | | |
| Reclamation District 1004[1] | <1 | 2 | 1 | <1 | <1 | <1 |
| CEQA Significance Threshold | 100 | 100 | 100 | 100 | 100 | 100 |
| Shasta County AQMD | | | | | | |
| Anderson-Cottonwood Irrigation District | All electric engines | | | | | |
| CEQA Significance Threshold | 100 | 100 | 100 | 100 | 100 | 100 |

**Table 3-3. Unmitigated Annual Emissions**

| Water Agency | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Yolo/Solano AQMD | | | | | | |
| Conaway Preservation Group | 1 | 6 | 4 | 1 | 1 | 1 |
| Reclamation District 108[2] | All electric engines | | | | | |
| River Garden Farms | All electric engines | | | | | |
| Te Velde Revocable Family Trust | All electric engines | | | | | |
| CEQA Significance Threshold | 10 | 10 | n/a | n/a | n/a | n/a |

Notes:
[1] Reclamation District 1004 is split into three different air districts; therefore, emissions split between Glenn and Colusa Counties.
[2] Reclamation District 108 is split into two different air districts; therefore, emissions split between Colusa and Yolo Counties.
Key:
APCD = air pollution control district; AQMD = air quality management district; CEQA = California Environmental Quality Act; CO = carbon monoxide; n/a = not applicable; NOx = nitrogen oxides; PM10 = inhalable particulate matter; PM2.5 = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compound

As shown in the tables, emissions from Pelger Mutual Water Company, Pleasant Grove-Verona Mutual Water Company, and Tule Basin Farms would exceed the daily NOx thresholds (Table 3-2).

The following mitigation measures would reduce the severity of the air quality impacts:

- AQ-1 – All diesel-fueled engines would either be replaced with an engine that would meet the applicable emission standards for model year 2013 or would be retrofit to meet the same emission standards.
- AQ-2 – Natural gas engines will be retrofit with a selective catalytic reduction device (or equivalent) that is capable of achieving a NOx control efficiency of at least 90 percent.
- AQ-3 – Any engines operating in the area of analysis that are capable of operating as either electric or natural gas engines would only operate with electricity during any groundwater transfers.
- AQ-4 – Selling agency would reduce pumping at diesel or natural gas wells to reduce emissions to below the thresholds.

Mitigated emissions are provided in Table 3-4. Implementation of these mitigation measures would reduce NOx emissions to less than significant.

**Table 3-4. Mitigated Emissions**

| Water Agency | Peak Daily Emissions (lbs/day) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Feather River AQMD | | | | | | |
| Pelger Mutual Water Company | 3 | 6 | 52 | 18 | <1 | <1 |
| Pleasant Grove-Verona Mutual Water Company | 3 | 24 | 67 | 22 | 2 | 2 |
| Tule Basin Farms | 4 | 13 | 10 | <1 | <1 | <1 |
| CEQA Significance Threshold | 25 | 25 | n/a | n/a | 80 | n/a |
| | | | | | | |

Key:
AQMD = air quality management district; CEQA = California Environmental Quality Act; CO = carbon monoxide; lbs/day = pounds per day; n/a = not applicable; NOx = nitrogen oxides; PM10 = inhalable particulate matter; PM2.5 = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compound

As discussed above, in addition to the CEQA significance thresholds, the federal general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain de minimis amounts (40 CFR 93.153). Because the CEQA-related mitigation measures are fully enforceable under Cal. Pub. Res. Code §21081.6 and would be a requirement of project implementation, mitigated emissions for the Proposed Action were compared to the general conformity de minimis thresholds.

Table 3-5 summarizes the general conformity applicability evaluation.

**Table 3-5. General Conformity Applicability Evaluation**

| | Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|
| | VOC[1] | NOx[1] | CO[2] | SOx[3] | $PM_{10}$ | $PM_{2.5}$[4] |
| Emissions[5] | 1 | 7 | 4 | 4 | <1 | 1 |
| Classification | Severe | Severe | Maintenance | $PM_{2.5}$ Precursor | Maintenance | Nonattainment |
| De Minimis Threshold | 25 | 25 | 100 | 100 | 100 | 100 |
| Exceed Threshold? | No | No | No | No | No | No |

Notes:
1 The Sacramento Metro 8-hour $O_3$ nonattainment area consists of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.
2 The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.
3 All counties are designated as attainment areas for $SO_2$; however, since $SO_2$ is a precursor to $PM_{2.5}$, its emissions must be evaluated under general conformity.
4 The 24-hour $PM_{2.5}$ nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.
5 VOC and NOx emissions are excluded from Sutter County for Garden Highway Mutual Water Company, Pelger Mutual Water Company, Reclamation District 1004, and Tule Basin Farms because they are located in areas designated as attainment for the federal 8-hour $O_3$ NAAQS.

Key:
CO = carbon monoxide; NOx = nitrogen oxides; $PM_{10}$ = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compound

Mitigated emissions would be less than the general conformity de minimis thresholds; therefore, no further action would be required under general conformity. Detailed calculations are provided in Appendix B.

**c) Less than Significant**

**No Action Alternative:** As described previously, the No Action Alternative would not change emissions relative to existing emissions. Because emissions would not increase, the No Action Alternative would not result in a cumulative impact to air quality.

**Proposed Action:** All counties affected by the Proposed Action are located in areas designated nonattainment for the $O_3$ and $PM_{10}$ CAAQS. Additionally, Sacramento County is designated nonattainment for the $PM_{2.5}$ CAAQS. Nonattainment status represents a cumulatively significant impact within the area. $O_3$ is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to $O_3$ formation include volatile organic compounds and nitrogen oxides; therefore, the significance thresholds established by the air districts for VOC and NOx are intended to maintain or attain the $O_3$ CAAQS and NAAQS. Because no single project determines the nonattainment status of a region, individual projects would only contribute to the area's designation on a cumulative basis.

Several air districts, including the Sacramento Metropolitan AQMD (2011), develop significance thresholds to determine if a project's individual emissions could result in a cumulatively considerable adverse contribution to the existing air quality conditions. Therefore, if an alternative would produce air quality impacts that are individually significant, then the alternative would also be cumulatively considerable. Conversely, if the alternative's emissions would be less than the significance thresholds, then the alternative would not be expected to result in a cumulatively considerable contribution to the existing significant cumulative impact.

The Proposed Action could exceed NOx standards (an $O_3$ precursor) in areas that are in nonattainment for $O_3$, which would be a cumulatively considerable effect. However, implementation of mitigation measures AQ-1 through AQ-4 would reduce individual impacts to less than significant and reduce the cumulative contribution. Therefore, air quality impacts would not be cumulatively considerable.

**d) Less than Significant**

**No Action Alternative and Proposed Action:** The proposed engines would either be remotely located in rural areas or would be located on existing agricultural land. The engines would not be located within one-quarter mile of a sensitive receptor. Additionally, emissions from individual engines would not

exceed any district's significance criteria. Therefore, air quality impacts would be less than significant.

**e) No Impact**

**No Action Alternative and Proposed Action:** The use of diesel engines during groundwater substitution activities may generate near-field odors that are considered a nuisance. Diesel equipment emits a distinctive odor that may be considered offensive to certain individuals. The local air districts have rules (e.g., Sacramento Metropolitan AQMD Rule 402) that prohibit emissions that could cause nuisance or annoyance to a considerable number of people. All water agencies would operate their engines in compliance with the local rules and regulations. Therefore, the proposed operation of any diesel-fueled engines would have a less than significant impact associated with the creation of objectionable odors affecting a substantial number of people.

**IV. BIOLOGICAL RESOURCES**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service? | ☐ | ☐ | ☒ | ☐ |
| b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in City or regional plans, policies, regulations or by the California Department of Fish and Wildlife or US Fish and Wildlife Service? | ☐ | ☐ | ☒ | ☐ |

**IV. BIOLOGICAL RESOURCES**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means? | ☐ | ☐ | ☒ | ☐ |
| d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? | ☐ | ☐ | ☒ | ☐ |
| e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? | ☐ | ☐ | ☐ | ☒ |
| f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? | ☐ | ☐ | ☐ | ☒ |

### a) Less than Significant Impact

**No Action Alternative:** Continued dry hydrologic conditions could affect special status fish species by reducing inflow to the Delta that could affect the ability of Reclamation and DWR to meet the operational requirements of the NMFS and USFWS BOs and D1641. CVP and SWP operations in the Delta will be managed adaptively to meet environmental and water quality standards that are put in place throughout the water year. Reclamation is consulting frequently with NMFS and USFWS on CVP and SWP operations relative to the BOs and special status fish species in the Delta. Reclamation and DWR submitted, and the SWRCB granted a temporary urgency change (TUC) petition on January 31, 2014. The SWRCB relaxed some salinity and outflow criteria in the Delta in response to extremely low storage levels, and amendments to the

TUC may be necessary as conditions warrant. Reclamation and DWR will continue to coordinate closely with the SWRCB to balance the need to provide water supplies south of the Delta, and protect water quality in the Delta.

Under No Action Alternative, growers in the sellers' area would idle rice in response to reduced water allocations. Glenn-Colusa ID estimates that approximately 15 percent of rice fields would be idled if provided a 75 percent allocation, with additional fallowing under lower allocations. Rice idling in other districts would also occur under the No Action Alternative, but estimates are unavailable at this time because those districts are managed differently than Glenn-Colusa ID. Rice idling actions could have an adverse effect to GGS that use flooded rice fields for foraging and protective cover habitat during the summer months. Rice idling would have similar adverse effects to western pond turtle.

Because of the reduced water supply due to extremely dry conditions, refuge water allocations would be reduced in 2014. A reduction in available water supply to refuges and rice growers would result in less available habitat for migratory bird species.

**Proposed Action:** Water transfers would slightly increase river flows downstream of the point of diversion relative to the No Action Alternative during the transfer period. Reclamation is consulting frequently with USFWS and NMFS on CVP and SWP operations relative to the BOs and special status fish species in the Delta. Special status fish species would not be affected by the Proposed Action beyond those impacts considered by the BOs and current consultations with NMFS and USFWS.

The Proposed Action would result in increased conveyance through the Delta during the transfer period (July through September, unless it shifts based on feedback from NMFS and USFWS). Special status fish species are generally not in the Delta during the transfer period (July-September) and effects to these fish species from transferring water during this timeframe were considered in the NMFS and USFWS BOs. Transfers would slightly increase inflow into the Delta, but would not change outflow conditions as compared to the No Action Alternative. The incremental effects of transfers on special status fish species in the Delta from water transfers would be less than significant.

The following is a discussion of effects of rice idling actions on special status wildlife species that are present in the sellers' area. Environmental Commitments have been incorporated into the Proposed Action to reduce potential impacts to special status wildlife species. The Environmental Commitments are listed in Section 2.4. Additional special status animal and plant species have the potential to occur in the project area, but would not be affected by the Proposed Action. Appendices C and D list special status animal and plant species that could be present in the project area and the reason for no effect.

Rice idling could affect special status species that use rice fields for forage, cover, nesting, breeding, or resting. Under the Proposed Action, a maximum of 32,062 acres of rice could be idled in Colusa, Glenn, Sutter and Yolo counties based on the transfer quantities in Table 2-3 and an ETAW of 3.3 acre-feet per acre. Table 3-6 shows the annual rice acreages in each county from 2002 to 2011.

**Table 3-6. Annual Harvested Rice Acreage by County in Sellers' Area**

| Year | Glenn | Colusa | Sutter | Yolo | Total |
|---|---|---|---|---|---|
| 2002 | 92,382 | 134,300 | 96,224 | 32,446 | 355,352 |
| 2003 | 87,793 | 127,350 | 93,654 | 37,303 | 346,100 |
| 2004 | 86,017 | 150,130 | 121,131 | 45,655 | 402,933 |
| 2005 | 88,876 | 136,400 | 97,801 | 34,670 | 357,747 |
| 2006 | 82,436 | 142,600 | 92,984 | 29,997 | 348,017 |
| 2007 | 82,668 | 148,550 | 108,241 | 32,660 | 372,119 |
| 2008 | 77,770 | 150,200 | 92,344 | 30,057 | 350,371 |
| 2009 | 89,483 | 152,400 | 109,766 | 36,593 | 388,242 |
| 2010 | 88,209 | 154,000 | 115,000 | 41,400 | 398,609 |
| 2011 | 84,900 | 149,000 | 112,000 | 42,500 | 388,400 |
| Average (2007-11) | 84,606 | 150,830 | 107,470 | 36,642 | 379,548 |

*Source: California Department of Food and Agriculture, California Agricultural Statistics 2003-2012*

Rice idling actions could affect the GGS that use flooded rice fields for foraging and protective cover habitat during the summer months. GGS require water during their active phase, extending from spring until fall. During the winter months, GGS are dormant and occupy burrows in upland areas. While the preferred habitat of GGS is natural wetland areas with slow moving water, GGS use rice fields and their associated water supply and tail water canals as habitat, 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 GGS.

Rice idling would affect available habitat for GGS. The GGS displaced from idled rice fields would need to find other areas to live and may face increased predation risk, competition, and reduced food supplies. This may lead to increased mortality, reduced reproductive success, and reduced condition prior to the start of the overwintering period. Rice idling transfers would be subject to the Environmental Commitments described in Section 2.4, which include numerous measures to protect GGS.

As included in the Environmental Commitments, Reclamation will coordinate with USFWS and GGS experts to identify priority suitable habitat for GGS and discourage idling in those priority areas. Implementation of Environmental Commitments will also protect movement corridors for GGS by maintaining water in irrigation ditches and canals. Some GGS would successfully relocate to find alternate forage, cover, and breeding areas.

Rice idling under the Proposed Action would have a less than significant impact on GGS because the Environmental Commitments would avoid or reduce many of the potential impacts associated with displacement of GGS. Some individual snakes would be exposed to displacement and the associated increased risk of predation, reduced food availability, increased competition, and potentially reduced fecundity. The number of individual snakes affected is expected to be small because Environmental Commitments avoid areas known to be priority habitat for GGS or where GGS populations are known to occur. The Environmental Commitment to maintain water in canals near idled fields would also protect GGS.

Migratory bird species, including the black tern, use seasonally flooded agricultural land for nesting and forage habitat during the summer rearing season. The greater sandhill crane also uses rice fields during the fall, winter, and early spring. Rice idling that reduces habitat could adversely affect these species. Migratory bird species are highly mobile and can fly to other areas of rice production or nearby wildlife refuges. To reduce impacts to the greater sandhill crane, transfers will minimize actions near known wintering areas in the Butte Sink. The proposed 2014 cropland idling transfers would reduce potential habitat for special status migratory bird species; however, given the mobility of these species and the Environmental Commitments incorporated into the Proposed Action, the impacts would be less than significant.

Ditches and drains associated with rice fields provide suitable habitat for the western pond turtle. 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. An Environmental Commitment requires drainage canals in areas where western pond turtle are known to occur not to be left completely dry. This Environmental Commitment minimizes impacts to western pond turtle. Therefore, effects to the western pond turtle of cropland idling transfers to would be less than significant.

**b, c) Less than Significant Impact**

**No Action Alternative:** Flow and elevation changes within the river and reservoirs due to the past years' dry weather conditions, lack of precipitation, and limited snow pack have resulted in existing adverse conditions for managed and unmanaged wetlands. As a result of decreased flow in rivers, there would be limited or no connection between the riparian areas and wetlands associated with these rivers. Reservoir water surface elevations continue to fall and many of the large reservoirs, such as Shasta, Folsom, and Oroville, already have water levels hundreds of feet from their bathtub ring of wetlands and riparian areas. Also, wildlife refuges, which receive the same allocation as the Sacramento River Settlement Contractors, are likely to receive a reduced supply of water due to reduced water available to the CVP and SWP. Cropland idling in response to water shortages would also reduce the amount of tail water that flows to wetlands.

**Proposed Action:** As a result of transfers, flow would increase in the Sacramento and Feather rivers downstream of the point of diversion during the transfer period (July through September). These would be minor flow increases and would not affect riparian habitat along the rivers. In April, May, and June, Reclamation and DWR may store transfer water in Shasta and Oroville reservoirs until the transfer period begins in July if conditions allow. If water is stored, river flows from the reservoirs to the seller's point of diversion would decrease in April, May, and June. The flow changes would occur from Shasta Dam downstream to the point where the water would have been diverted without transfers. The potential change in flow would be about 450 cubic feet per second (cfs), if supplies increase to allow the maximum transfers included in this document, but flow changes would be about 230 cfs if the hydrologic conditions do not improve. These estimates reflect the average change during June (the month with the greatest potential change in river flow), but instantaneous peak flows may be slightly higher. During dry conditions in 1977, flows averaged 6,560 cfs in May and 6,244 cfs in June (USGS 2014). The flow changes would be a fairly small percent of the overall river flows. The Proposed Action would result in minor effects to any riparian habitat near the rivers. Impacts would be less than significant.

Under the No Action Alternative, dry hydrologic conditions, reduced water supplies, and baseline idling would adversely impact wetlands. Rice idling transfers would reduce irrigation tail water flows to wetlands. Environmental Commitments limiting the amount of rice acres idled in historic tule marsh habitat and maintaining water in ditches would support flows to existing wetlands. The incremental effect to wetlands under the Proposed Action would be less than significant.

**d) Less than Significant Impact**

**No Action Alternative:** The lack of available water due to critically dry conditions could affect movement corridors or nursery sites for GGS and other fish and wildlife. Wildlife that is dependent on water as a means of moving from one area to another may be unable to relocate due to the parched landscape. Snakes present in areas of rice idling would have to move across dewatered habitat to find suitable areas with water. Moving across dewatered areas could expose snakes to a number of potential impacts associated with the need to relocate. These include the energetic costs associated with relocation, a reduction in food supplies associated with the decrease in habitat, increased predation, potential for increased competition in new habitats, and potentially reduced reproduction and recruitment for those individuals displaced. Dewatered areas could also affect movement of the western pond turtle that occupy drainage ditches and irrigation canals. Dewatering could require the turtle to migrate to new areas, which in turn puts them at an increased risk of predation.

**Proposed Action:** The GGS individuals and other fish and wildlife would already be affected by the dry conditions, including those areas idling rice as a consequence of the reduced water supply. For species that use irrigated rice fields and drainage ditches for habitat, such as GGS and western pond turtle, these species would need to relocate to other suitable habitat and could be exposed to a number of potential impacts associated with the need to relocate, as described above. Any additional rice acreage idled to make water available for transfer may also affect the species ability to move from one place to another. Areas idled as a consequence of the Proposed Action would be required to implement Environmental Commitments to maintain some habitat and movement corridors.

Limited data is available on how well displaced snakes can move to and assimilate into new habitats (USFWS 2010). GGS have been documented to move 0.25 to 0.5 miles per day in the course of the normal daily activities. Individuals have been documented to move up to 5 miles over the course of a few days in response to dewatering of habitat. Environmental Commitments discourage rice idling in areas of suitable habitat where GGS are likely to occur, such as areas where historic tule marsh has been converted to rice lands. If a seller chooses to idle lands within these priority habitat areas, the Environmental Commitments require that adequate water remain in the associated drains and canals. Maintenance water in smaller drains and conveyance infrastructure support key habitat attributes such as emergent vegetation which GGS utilize for escape cover and foraging habitat. Ensuring water remains in these key habitats reduces the potential impact to suitable habitat and the need for GGS individuals to relocate. Environmental Commitments would reduce potential impacts to movement corridors of GGS; therefore, impacts would be less than significant.

**e, f) Less Than Significant Impact**

**No Action Alternative:** Several adopted Habitat Conservation Plans (HCP) and Natural Community Conservation Plans (NCCP) exist within the project area, including the Natomas Basin HCP, San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, Solano Multi-Species HCP, South Sacramento HCP, and the Yuba-Sutter NCCP/HCP. These plans cover some of the potentially affected species and may have additional requirements for species conservation within their plan areas.

Increased groundwater pumping or cropland idling under the No Action Alternative would not conflict with the HCPs. However, wildlife preserves are likely to receive a reduced supply of water due to reduced water available to the CVP and SWP. Increases in groundwater pumping could also affect the water supplies needed to fulfill the water needs of the conservation banks and preserves established by some of these HCPs. For example, the Natomas Basin Habitat Conservation Plan, as implemented by the Natomas Basin Conservancy, relies on surface water supplies from Natomas Central Mutual Water Company

and groundwater in water short years. Cropland idling in response to water shortages would also reduce the amount of tail water that flows to wetlands which are part of these HCPs.

**Proposed Action:** Water transfers under the Proposed Action would have a less than significant impact on the natural communities that are covered in these plans because of the temporary nature of the transfers and the minimal changes in flows and reservoir levels associated with water transfers, as described above for Impacts b and c. The Environmental Commitments under the Proposed Action would minimize impacts to special status species that are covered in the plans. The Environmental Commitments also require sellers to address third-party impacts from groundwater substitution specifically in areas where groundwater subbasins include conservation banks or preserves for GGS. The Proposed Action would not conflict with HCP and NCCP provisions.

**V. CULTURAL RESOURCES**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Cause a substantial adverse change in the significance of a historical resource as defined in State CEQA §15064.5? | ☐ | ☐ | ☐ | ☒ |
| b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA §15064.5? | ☐ | ☐ | ☐ | ☒ |
| c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? | ☐ | ☐ | ☐ | ☒ |
| d) Disturb any human remains, including those interred outside of formal cemeteries? | ☐ | ☐ | ☐ | ☒ |

**a-d) No Action.** The water elevations of Shasta and Oroville reservoirs are at or very near historic low elevations due to dry hydrologic conditions. Under the No Action, these conditions may lead to the exposure of cultural resources that have been inundated for many years. In some cases, these water surface elevations may be historically low and the receeding water may reveal cultural resources that have been inundated since 1977.

**Proposed Action.** The decline of water surface elevations in the reservoirs utilized for water transfers would be the result of the operation of those reservoirs to fulfill downstream regulatory requirements. Reclamation and DWR will release water from the CVP and SWP reservoirs to meet the operational requirements of the NMFS and USFWS BOs and D1641. Diversions for water transfer purposes would not result in release of any additional water from Shasta or Oroville Reservoir. Operation of the reservoirs would remain unchanged when compared to the No Action Alternative. There would be no ground disturbing activities, land alteration, or construction proposed that could disturb historical, archeological, or paleontologic resources associated with the No Action Alternative or the Proposed Action. Thus, there would be no disturbance impacts to existing or potential burial sites, cemeteries, or human remains interred outside of formal cemeteries.

A Reclamation archaeologist was consulted to ensure the Proposed Action would have no adverse impact on any historic properties. It was determined that this type of activity does not have the potential to cause effects on historic properties, if present, and Reclamation has no further obligation under National Historic Preservation Act Section 106, pursuant to 36 CFR Part 800.3(a)(1).

**VI. GEOLOGY AND SOILS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: | | | | |
| i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. | ☐ | ☐ | ☐ | ☒ |
| ii) Strong seismic ground shaking? | ☐ | ☐ | ☐ | ☒ |
| iii) Seismic-related ground failure, including liquefaction? | ☐ | ☐ | ☐ | ☒ |

**VI. GEOLOGY AND SOILS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| iv) Landslides? | ☐ | ☐ | ☐ | ☒ |
| b) Result in substantial soil erosion or the loss of topsoil? | ☐ | ☐ | ☒ | ☐ |
| c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? | ☐ | ☐ | ☒ | ☐ |
| d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property? | ☐ | ☐ | ☐ | ☒ |
| e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water? | ☐ | ☐ | ☐ | ☒ |

**a) No Impact.** There are no new facilities or construction proposed for the No Action Alternative or Proposed Action, and no existing facilities fall within an Alquist-Priolo Earthquake Fault Zone, as shown in the Interim Revision of Special Publication 42 of the Division of Mines and Geology, Fault Rupture Zones in California (California Department of Conservation 2007). Therefore, the No Action Alternative and Proposed Action would not expose people or structures to impacts related to fault rupture, ground shaking, ground failure, liquefaction, or landslides.

**b) Less than Significant**

**No Action Alternative:** In 2014, surface water shortages may lead to increased cropland idling in both the seller and buyer areas. Within the seller area, the soils consist of fine particles of clay, loam, some sand, and silty clays (U.S. Department of Agriculture [USDA] 2013a). These soils are susceptible to wind

erosion but have a relatively low wind erodibility index. The Natural Resource Conservation Service (NRCS) estimated in the 2010 Natural Resources Inventory that approximately 0.68 tons of topsoil are eroded annually by wind from cultivated land, and 0.36 tons of topsoil are eroded annually from non-cultivated land (USDA 2013b).

Agricultural practices determine the amount of wind erosion to a greater extent than climate in the Sacramento Valley. Farming operations such as plowing, leveling, planting, weeding, mowing, cutting, and baling all increase wind erosion by stirring up or exposing top soil. Fallow fields experience a net reduction in wind erosion by avoiding these practices. Fine soils such as sand and silts erode at a higher rate than the clays and silty clays found in the project area. Therefore, the soils in the project area have a relatively low risk of wind erosion when left in a dry and unplanted condition.

The buyers' area similarly has soils that are primarily clay and loam (USDA 2013a). Similar to the sellers' area, these soils have a relatively low risk of wind erosion.

**Proposed Action:** Similar to the No Action Alternative, increased cropland idling in the Sacramento Valley to make water available for transfer is not likely to substantially increase wind erosion of sediments. In the buyer area, water is likely to be used on permanent crops (such as orchards and vineyards). The soils underlying these fields have a low risk of wind erosion; therefore, continued cultivation is not likely to substantially increase erosion.

**c) Less than Significant**

**No Action Alternative and Proposed Action:** The project area is underlain by clay and is located in flat terrain. No new construction or ground disturbing actions are proposed for either the No Action Alternative or the Proposed Action that could result in on- or off-site landslide, lateral spreading, liquefaction, or collapse. Groundwater substitution transfers could reduce groundwater levels, which could decrease water pressure and result in a loss of structural support for clay and silt beds. This impact is analyzed in more detail in the groundwater section of Hydrology and Water Quality. The analysis finds that the potential for land subsidence from increased groundwater pumping (under the No Action Alternative and the Proposed Action) would be small.

**d, e) No Impact.** There are no expansive soils known to exist in the project area. There are no septic tanks or alternative waste water disposal systems proposed or required for the No Action Alternative or Proposed Action. The Proposed Action does not include new construction, and thus no new waste water generation. Therefore, there would be no impact resulting from the implementation of the Proposed Action.

**VII. GREENHOUSE GAS EMISSIONS**
- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? | ☐ | ☐ | ☒ | ☐ |
| b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? | ☐ | ☐ | ☒ | ☐ |

**a, b) Less than Significant**

**No Action Alternative**: Dry conditions in 2014 may cause additional groundwater pumping and cropland idling in response to surface water shortages. Although there could be emission increases under the No Action Alternative, the emissions would be consistent with existing trends in GHG emissions and would be the same as existing conditions.

**Proposed Action**: This analysis estimated carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$) emissions that would occur from groundwater substitution transfers and cropland idling transfers using available emissions data and information on fuel type, engine size (horsepower), and annual transfer amounts included in the proposed alternatives. Existing emissions data used in the analysis includes:

- Diesel and natural gas fuel emission factors from The Climate Registry (2013a)
- Electric utility CO2 emission factors from The Climate Registry (2013b)
- "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping" (Byron Buck & Associates 2009)

Each GHG contributes to climate change differently, as expressed by its global warming potential (GWP). GHG emissions are discussed in terms of $CO_2$ equivalent ($CO_2e$) emissions, which express, for a given mixture of GHG, the amount of $CO_2$ that would have the same GWP over a specific timescale. $CO_2e$ is determined by multiplying the mass of each GHG by its GWP. This analysis uses the GWP from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (IPCC 1996) for a 100-year time period to estimate $CO_2e$. Although subsequent assessment reports have been published by the

IPCC, the international convention, as reflected in various federal, state, and voluntary reporting programs, is to use GWPs from the Second Assessment Report ($CH_4$ equal to 21 and $N_2O$ equal to 310).

The CARB uses a threshold of 25,000 metric tons $CO_2e$ per year as a threshold for including facilities in its cap-and-trade regulation (17 CCR 95800-96023). Because the goal of the regulation is to reduce GHG emissions statewide, this threshold was deemed appropriate to assess significance.

Groundwater substitution could increase GHG emissions in the seller area, while cropland idling transfers could reduce vehicle exhaust emissions. Cropland idling transfers could offset some of the emissions from groundwater substitution transfers, but the quantity of water transferred under each mechanism could be much less than what is included in Table 2-3. Therefore, impacts were evaluated for the full quantity of groundwater substitution, without regard for any potential offsets from idled land. Table 3-7 summarizes the GHG emissions associated with the Proposed Action. Detailed calculations are provided in Appendix E, Climate Change Analysis Emission Calculations.

**Table 3-7. Summary of Project GHG Emissions**

| Water Agency | Annual Emissions (metric tons $CO_2e$ per year) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Anderson-Cottonwood Irrigation District | 134 | 0.21 | 0.65 | 135 |
| Conaway Preservation Group | 1,319 | 1.59 | 4.91 | 1,325 |
| Eastside Mutual Water Company | 352 | 0.30 | 0.88 | 353 |
| Garden Highway Mutual Water Company | 230 | 0.36 | 1.12 | 232 |
| Goose Club Farms and Teichert Aggregate | 130 | 0.20 | 0.63 | 131 |
| Maxwell Irrigation District | 827 | 0.70 | 2.08 | 830 |
| Natomas Central Mutual Water Company | 620 | 0.88 | 2.76 | 624 |
| Pelger Mutual Water Company | 662 | 0.56 | 1.66 | 664 |
| Pleasant Grove-Verona Mutual Water Company | 1,000 | 0.99 | 2.98 | 1,004 |
| Reclamation District 108 | 299 | 0.46 | 1.46 | 301 |
| Reclamation District 1004 | 482 | 0.44 | 1.33 | 483 |
| River Garden Farms | 192 | 0.30 | 0.93 | 193 |
| Sycamore Mutual Water Company | 231 | 0.36 | 1.13 | 233 |
| Te Velde Revocable Family Trust | 144 | 0.22 | 0.70 | 145 |
| Tule Basin Farms | 301 | 0.23 | 0.00 | 301 |
| **Total** | **6,923** | **7.81** | **23.23** | **6,954** |

Emissions from groundwater substitution would be 6,954 metric tons $CO_2e$ per year (detailed calculations are provided in Appendix E). As a result, the Proposed Action would not conflict with any plan, policy, or regulation adopted for the purpose of reducing GHG emissions and impacts would be less than significant.

**VIII. HAZARDS AND HAZARDOUS MATERIALS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? | ☐ | ☐ | ☐ | ☒ |
| b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment? | ☐ | ☐ | ☐ | ☒ |
| c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? | ☐ | ☐ | ☐ | ☒ |
| d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? | ☐ | ☐ | ☐ | ☒ |
| e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? | ☐ | ☐ | ☐ | ☒ |
| f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area? | ☐ | ☐ | ☐ | ☒ |
| g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? | ☐ | ☐ | ☐ | ☒ |

**VIII. HAZARDS AND HAZARDOUS MATERIALS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands? | ☐ | ☐ | ☐ | ☒ |

**a-h) No Impact.** The No Action Alternative and Proposed Action would not involve the transport or use of hazardous materials, nor change in any way public exposure to hazards or hazardous materials. The No Action Alternative and Proposed Action would not occur on a hazardous materials site that would create a risk to the public or environment. The No Action Alternative and Proposed Action would not affect a public airport or private air strip. There are no new structures or buildings included in the Proposed Action; therefore, no people or structures would be exposed to wildland fires as a result of implementation.

**IX. HYDROLOGY AND WATER QUALITY**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Violate any water quality standards or waste discharge requirements? | ☐ | ☐ | ☒ | ☐ |
| b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)? | ☐ | ☐ | ☒ | ☐ |

**IX. HYDROLOGY AND WATER QUALITY**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site? | ☐ | ☐ | ☒ | ☐ |
| d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site? | ☐ | ☐ | ☐ | ☒ |
| e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff? | ☐ | ☐ | ☐ | ☒ |
| f) Otherwise substantially degrade water quality? | ☐ | ☐ | ☒ | ☐ |
| g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map? | ☐ | ☐ | ☐ | ☒ |
| h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows? | ☐ | ☐ | ☐ | ☒ |
| i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam? | ☐ | ☐ | ☐ | ☒ |
| j) Inundation by seiche, tsunami, or mudflow? | ☐ | ☐ | ☐ | ☒ |

**a) Less than Significant**

**No Action Alternative:** The No Action Alternative would not violate any waste discharge requirements as no changes to waste discharges to surface waters would occur. CVP and SWP operations in the Delta will be managed adaptively to meet water quality standards that are put in place throughout the water year. Reclamation and DWR submitted, and the SWRCB granted a TUC petition on January 31, 2014. The SWRCB relaxed some salinity and outflow criteria in the Delta in response to extremely low storage levels, and amendments to the TUC may be necessary as conditions warrant. Reclamation and DWR will continue to coordinate closely with the SWRCB to balance the need to provide water supplies south of the Delta, and protect water quality in the Delta.

**Proposed Action:** Under the Proposed Action, Reclamation and DWR would operate CVP and SWP reservoirs to convey transferred water to the buyers. This reoperation would change reservoir storage and river flows. River flows may be reduced by a small amount in April, May, and June to store transferred water until it can be conveyed through the Delta. The flow changes would occur from Shasta Dam downstream to the point where the water would have been diverted without transfers. The potential change in flow would be about 450 cfs if supplies increase to allow the maximum transfers included in this document, but flow changes would be about 230 cfs if the hydrologic conditions do not improve. These estimates show the average change during June (the month with the greatest potential change in river flow), but instantaneous peak flows may be slightly higher. During dry conditions in 1977, flows in the Sacramento River near Colusa averaged 6,560 cfs in May and 6,244 cfs in June (USGS 2014). The flow changes would be a fairly small percent of the overall river flows. Keeping water in storage in Shasta Reservoir could help conserve the cold water pool in a year where reservoir levels are so low; however, the very small change from the transfers would be a minor benefit.

**b) Less than Significant**

**No Action Alternative:** While it is too early in 2014 to know with certainty the final allocation, CVP and SWP water service contractors initial allocations are 0 percent, and Settlement Contractors and refuges have been notified that they can expect 40 percent of their contract amounts rather than the anticipated 75 percent normally provided in a Critical Year. In the Sacramento Valley, reductions in supply have historically resulted in increased groundwater pumping and decreased groundwater levels; however, the water levels have rebounded quickly after the dry period. Figures 3-1 and 3-2 show baseline groundwater trends (in addition to modeling results for the Proposed Action) at the groundwater table and in the deep aquifer, respectively, in the Sacramento Valley near Sycamore Mutual Water Company. Appendix F, Groundwater Modeling Results, contains hydrographs at additional locations throughout the valley. The groundwater basin is likely to experience groundwater level

declines similar to those that occurred during historic droughts (such as 1976-1977 and 1987-1992), caused by increased pumping to address reduced surface water supplies. In the San Joaquin Valley, reductions in supply would also lead to increased groundwater pumping, but the groundwater historically has not recovered during subsequent dry years.

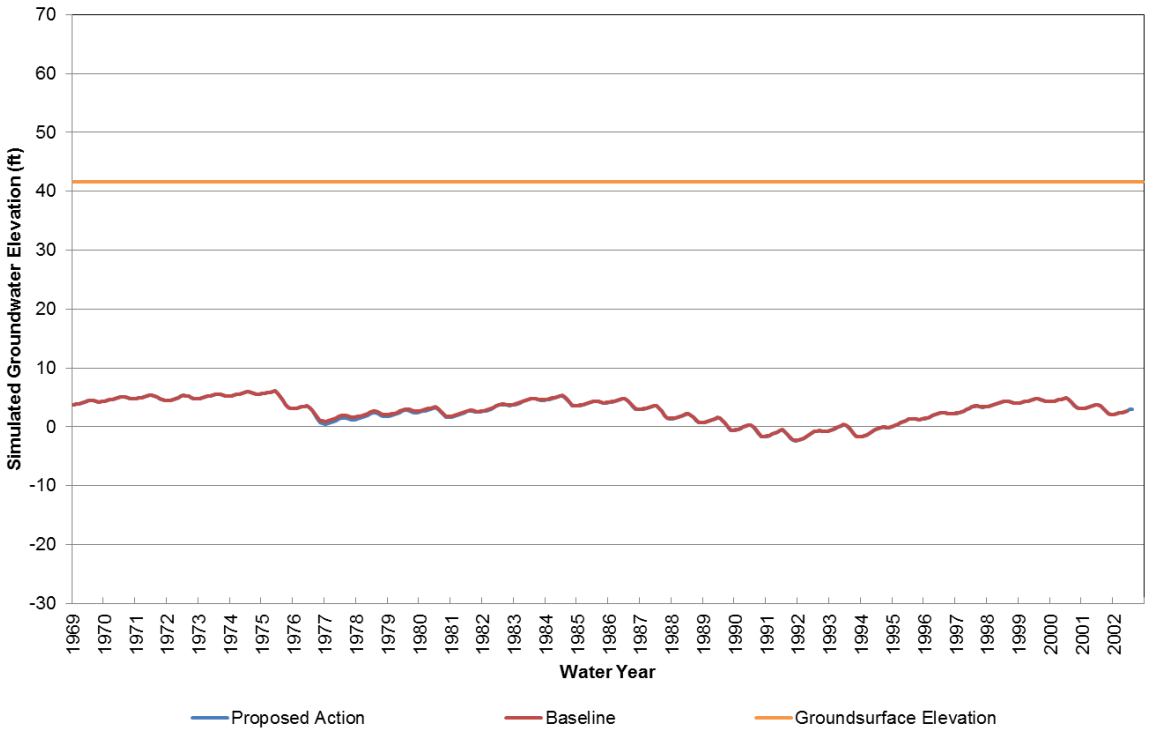


**Figure 3-1. Groundwater Levels at the Water Table due to Substitution Pumping at Location 12 (see Figure 3-3)**

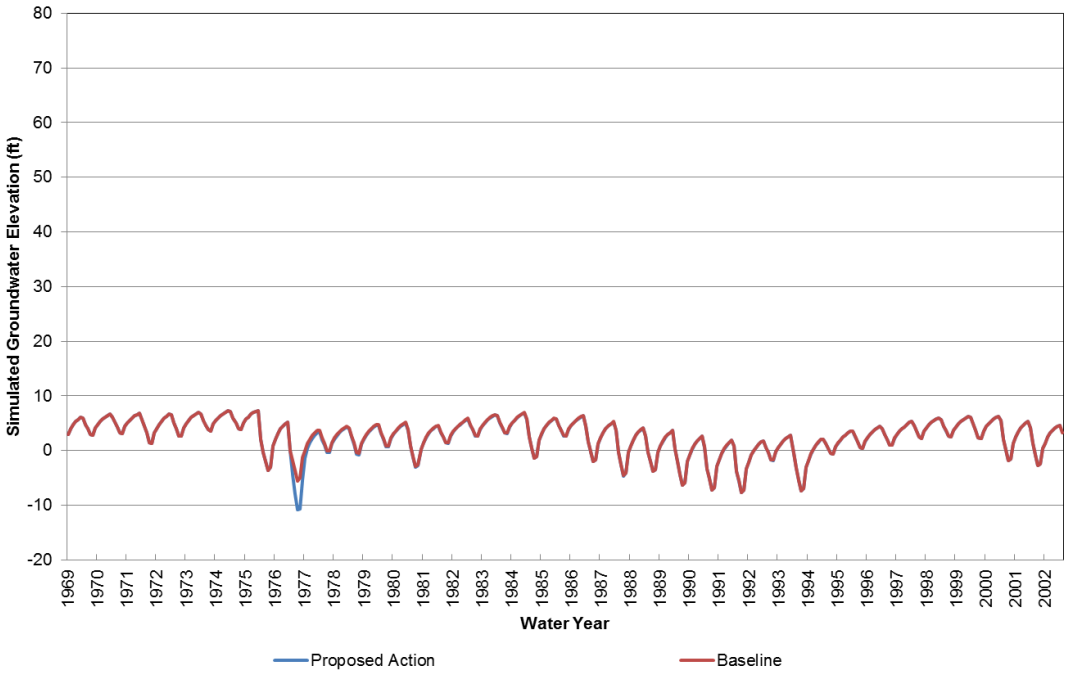


**Figure 3-2. Groundwater Levels in the Deep Aquifer due to Substitution Pumping at Location 12 (see Figure 3-4)**

**Proposed Action:** Water made available for transfer via groundwater substitution could affect groundwater hydrology. The potential effects could be short term declines in local groundwater levels, interaction with surface water, and land subsidence. Potential effects to water quality are discussed in Section (f) below.

Increased groundwater substitution pumping could result in temporary declines of groundwater levels. Groundwater substitution pumping could occur from April through September and the pumped groundwater would be used for crop irrigation. Declining groundwater levels resulting from increased groundwater substitution pumping could cause: (1) increased groundwater pumping costs due to increased pumping depth; (2) decreased yield from groundwater wells due to reduction in the saturated thickness of the aquifer; (3) decrease of the groundwater table to a level below the vegetative root zone, which could result in environmental effects; and 4) third-party impacts to neighboring wells.

**Groundwater Levels**

***Redding Groundwater Basin*.** The watersheds overlying the Redding Basin yield an average of 850,000 AF of annual runoff (CH2M Hill 2003). Much of this water is potentially available to recharge the Redding Groundwater Basin and replenish water levels that have been depressed because of groundwater pumping. Applied irrigation water (from all sources) totals approximately 270,000 AF annually in the Redding Basin area (CH2M Hill 1997). While the exact quantity of groundwater pumped annually from the Redding Groundwater

Basin is not known, it has been estimated that approximately 55,000 AF per year of water is pumped from M&I and agricultural production wells (CH2M Hill 2003). This magnitude of pumping represents approximately 6 percent of the average annual runoff.

Some of the water made available for transfer through groundwater substitution transfers would originate from the Redding Groundwater Basin in Shasta County through Anderson-Cottonwood ID. The proposed Anderson-Cottonwood ID transfer would withdraw up to 4,800 AF per year of groundwater from production wells (see Table 3-8 for details on number of wells and pumping capacity). Unlike other groundwater substitution transfers, Anderson-Cottonwood ID's proposed transfer was not simulated in the Sacramento Valley Groundwater Model (SACFEM) because the model area does not include the Redding Basin. However, Anderson-Cottonwood ID has tested operation of these wells in the past at similar production rates and has observed no substantial impacts on groundwater levels or groundwater supplies (Anderson-Cottonwood ID 2013). Based on the results of the aquifer tests, groundwater substitution transfers are unlikely to have significant effects on groundwater levels. Because of the uncertainty of how groundwater levels could change, especially during a very dry year (as 2014 appears to be), Anderson-Cottonwood ID will implement the minimization measures described below, including Monitoring and Mitigation Plans.

***Sacramento Groundwater Basin*.** Historically, groundwater levels in the basin have remained steady, declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods. DWR and other monitoring entities, as defined by Assembly Bill 1152, extensively monitor groundwater levels in the basin.

Groundwater drawdown impacts associated with groundwater pumping that would occur under the Proposed Action were evaluated using SACFEM. The effects of concurrent groundwater substitution pumping from 264 wells based on data collected from potential sellers within the Sacramento Valley have been modeled to estimate effects to groundwater resources. The modeling was completed based on initial estimates of transfers early in the season before sellers realized that they may receive reduced supplies from the CVP and SWP. The sellers have since reduced the potential amount of water available for transfer. The groundwater modeling results are therefore conservative in that the groundwater effects from pumping would be less than shown in the figures below because less water could be transferred. However, the overall groundwater level decline from both the No Action Alternative and the Proposed Action resulting from model simulations using 1977 hydrologic conditions is likely a reasonable estimate. This is because the sellers are likely to increase pumping in the No Action Alternative in response to reduced surface water deliveries.

Figures 3-3 and 3-4 show the simulated drawdown under September 1977 hydrologic conditions. During dry years, surface water resources are limited and users have historically increased groundwater pumping to address shortages. Water transfers for 2014 were simulated in SACFEM using September 1977 hydrologic conditions because this represents the driest conditions during the period of record. Simulating transfers during this period illustrates the potential to compound impacts from dry-year pumping as compared to the No Action Alternative. Water year 2014 may be drier than 1977, but data from 1977 represents the best information currently available.

Figure 3-3 presents the estimated drawdown at the water table and Figure 3-4 presents the estimated drawdown at approximately 110 feet below ground surface (bgs). Drawdown at the water table (Figure 3-3) represents the estimated decline in the water surface within the shallow, unconfined portion of the aquifer (i.e., the height of water within a shallow groundwater well). The drawdown in the deeper portion of the aquifer (Figure 3-4) represents a change in hydraulic head (i.e., water pressure) in a well that is screened in this lower portion of the aquifer.

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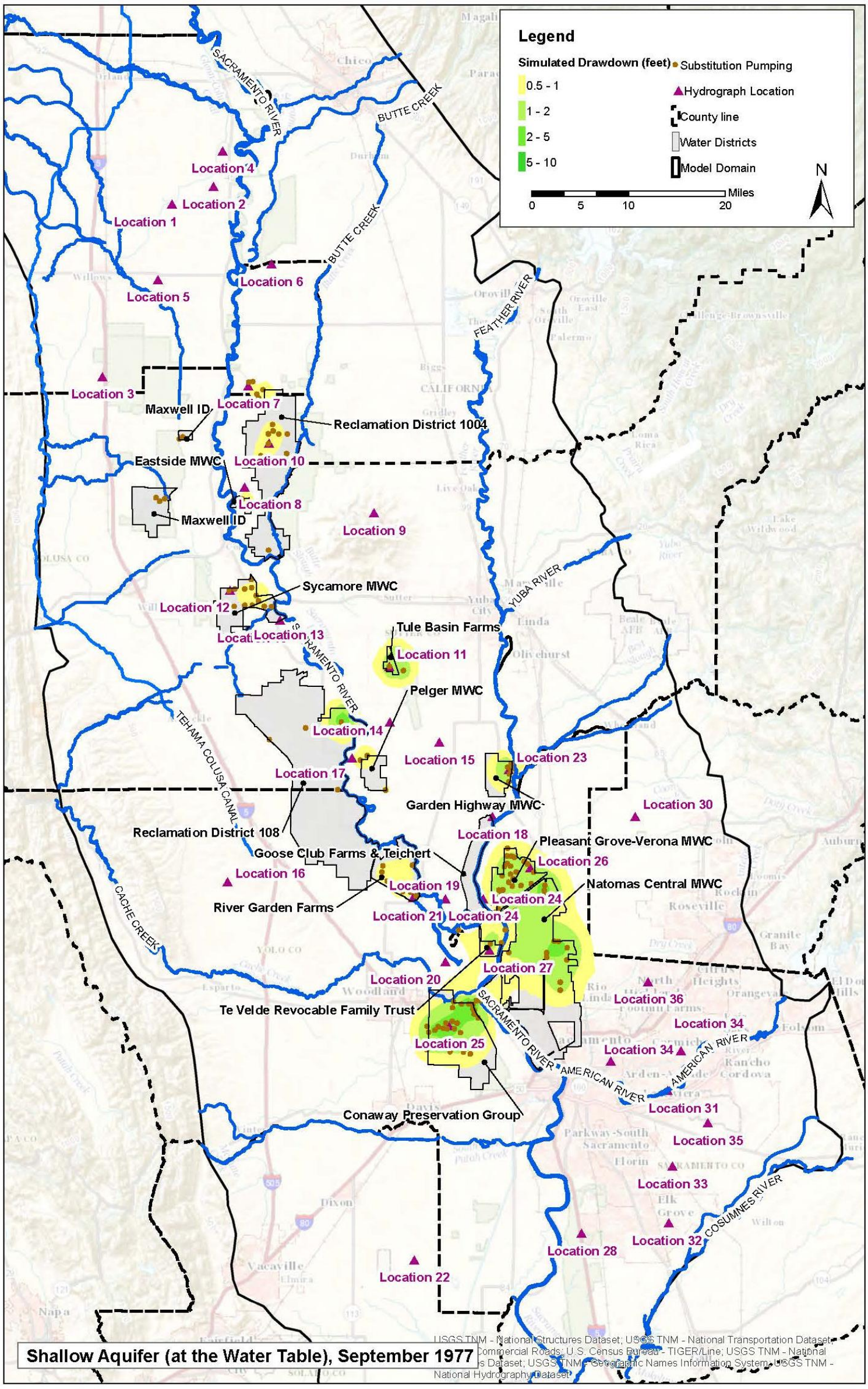


**Figure 3-3. Proposed Action Effects on Groundwater Levels at the Water Table**

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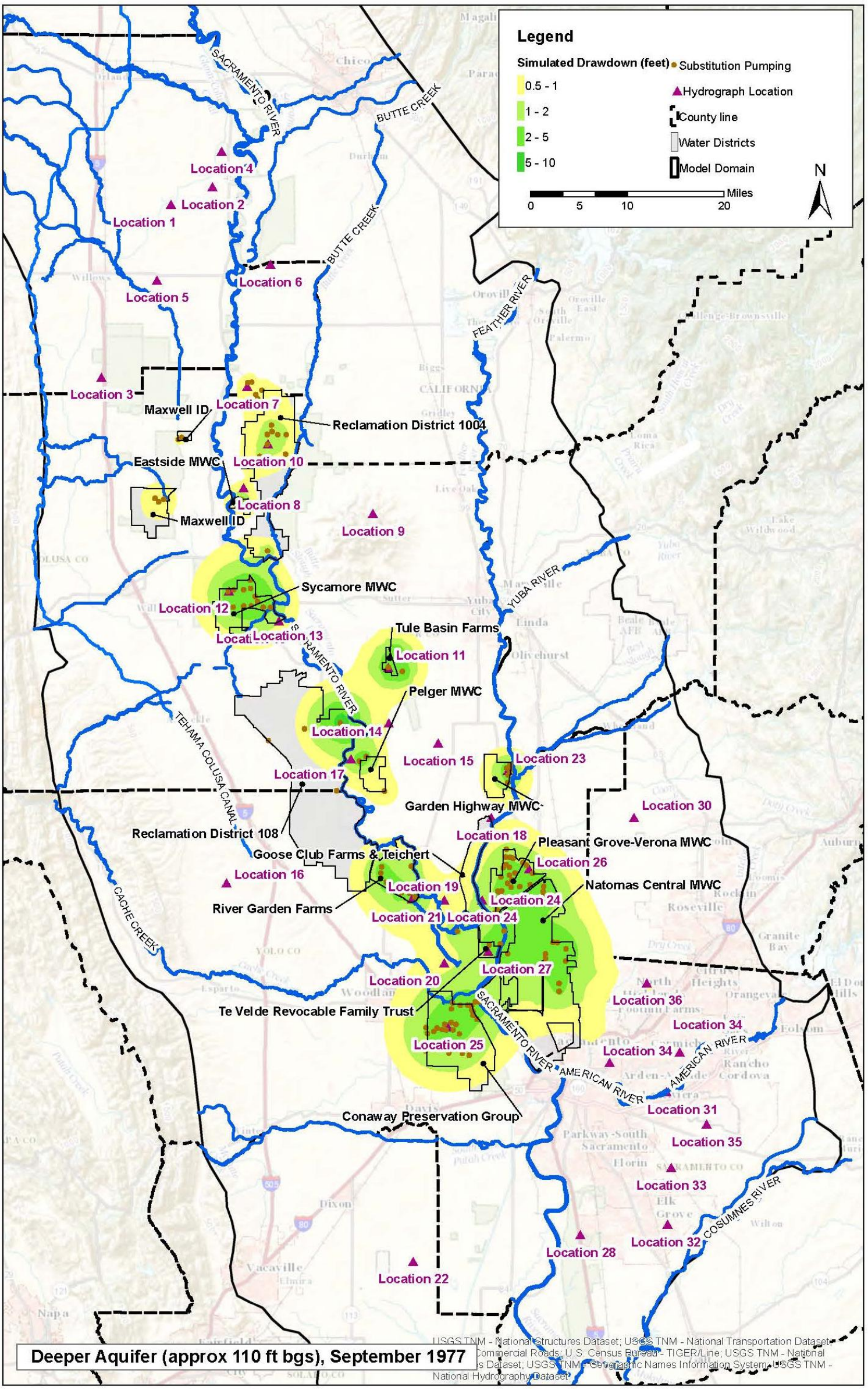


**Figure 3-4. Proposed Action Effects on Groundwater Levels in the Deep Aquifer**

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Figures 3-1 and 3-2 show simulated hydrographs for Location 12 (see Figures 3-3 and 3-4 for location). Figures 3-1 and 3-2 show that groundwater levels decline slightly more with groundwater substitution (the blue line) than under the No Action Alternative pumping conditions (the red line). The drawdown extends longer than the period of groundwater pumping, potentially over a year or two. Most areas in the model exhibit smaller drawdown changes than those shown in Figures 3-1 and 3-2. Appendix F, Groundwater Modeling Results, includes hydrographs for multiple locations.

Groundwater substitution under the Proposed Action could result in temporary drawdown that exceeds what would have occurred under the No Action Alternative. Increased groundwater pumping could also cause localized declines of groundwater levels, or cones of depression, near the wells participating in the groundwater substitution transfer. These decreased groundwater levels, however, are relatively small. Most changes in groundwater elevation are less than 5 feet and occur primarily within the localized area selling the water.

The model results correspond to monitoring information that indicates groundwater levels in the Sacramento Valley tend to decrease during the irrigation season and rebound in the wet winter months. Model results also indicate that while the groundwater levels sometimes do not return to No Action Alternative levels within one year, they recover relatively quickly (as shown in Figures 3-1 and 3-2 and the hydrographs in Appendix F). Because of the aquifer's relatively short recovery period after increased extractions, incidental recharge, and the one-year time frame of the transfer, the Proposed Action would likely have a minimal effect on long-term groundwater level trends. However, the model results may not reflect all specific local conditions throughout the Sacramento Valley. Therefore, minimization measures described below would include development of monitoring and mitigation plans to monitor and address potential groundwater level changes that could affect third parties or biological resources.

**Table 3-8. Water Transfers through Groundwater Substitution under the Proposed Action**

| Groundwater Basin | Potential Seller | Number of Wells | Pumping Rate (gpm) | Range of Screened Interval (feet) |
|---|---|---|---|---|
| Sacramento Valley | Conaway Preservation Group | 33 | 1,400- 3,500 | 70-578 |
| | Eastside Mutual Water Company | 1 | 3,800 | 150- 240 |
| | Garden Highway Mutual Water Company | 7 | 2,000 – 3,000 | 90 - 235 |
| | Goose Club Farms and Teichert Aggregate | 13 | 3,000 | 150 - 275 |
| | Maxwell Irrigation District | 5 | 3,800 | 150- 240 |
| | Pelger Mutual Water Company | 3 | 2,555 | 100- 485 |
| | Pleasant Grove-Verona Mutual Water Company | 31 | 1,500- 5,000 | 100- 260 |
| | Reclamation District 108 | 2 | 6,800 | 150- 275 |
| | Reclamation District 1004 | 16 | 1,000- 5,800 | 56- 400 |
| | River Garden Farms | 7 | 1,700- 2,990 | 170- 686 |
| | Te Velde Revocable Family Trust | 4 | 2,200- 4656 | 115-455 |
| | Sycamore Mutual Water Company | 12 | 2,500- 3,500 | 256- 906 |
| | Natomas Central Mutual Water Company | 13 | 4,200 | 150- 350 |

*Notes: gpm – gallons per minute*

### Groundwater/Surface Water Interaction

The implementation of groundwater substitution pumping can lower the groundwater table and may change the relative difference between the groundwater and surface water levels. The water pumped from a groundwater well could have two impacts that reduce the amount of surface water compared to pre-pumping conditions. The mechanisms are:

- Induced leakage. Lowering of the groundwater table causes a condition where the groundwater table is lower than the surface-water level. This condition causes leakage out of surface water bodies and could increase percolation rates on irrigated lands.

- Interception of groundwater. A well used for groundwater substitution pumping can intercept groundwater that normally might have discharged to the surface water.

Due to these depletions in streamflow, the volume of water that can be realistically transferred is not the same as the volume of groundwater pumped through a substitution action. The amount of water that can be transferred is the volume of substitution pumping less the amount of induced leakage and the amount of intercepted groundwater flow. The Proposed Action includes measures that would reduce the amount of water that the SLDMWA receives by an assumed 12 percent depletion factor to prevent any adverse impacts associated with surface water-groundwater interaction, as further described in Chapter 2. This would mitigate potential stream depletion as a result of the Proposed Action.

Reclamation and DWR have developed well acceptance criteria to further mitigate the potential for streamflow depletion based on the well's location, depth, and construction information. These criteria are in the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013).

**Land Subsidence**

Excessive groundwater extraction from unconfined and confined aquifers could lower groundwater levels and decrease water pressure. The reduction in water pressure could result in a loss of structural support for clay and silt beds. The loss of structural support could cause the compression of clay and silt beds, which could lower the ground surface elevation (land subsidence). The compression of fine-grained deposits, such as clay and silt, is largely permanent. Infrastructure damage and alteration of drainage patterns are possible consequences of land subsidence.

***Redding Groundwater Basin.*** Land subsidence has not been monitored in the Redding Groundwater Basin. However, there would be potential for subsidence in some areas of the basin if groundwater levels were substantially lowered. The groundwater basin west of the Sacramento River is composed of the Tehama Formation; this formation has exhibited subsidence in Yolo County and the similar hydrogeologic characteristics in the Redding Groundwater Basin could allow subsidence.

The potential for subsidence as a result of the Proposed Action is small if the groundwater substitution pumping is small compared to overall pumping in a region. The minimization measures described below require all groundwater substitution transfers to monitor for subsidence or provide a credible analysis why it would be unlikely. The process of real-time subsidence monitoring will measure any changes in the ground surface elevation, whether subsidence is short-term or long-term.

***Sacramento Groundwater Basin*.** Most areas of the Sacramento Valley Groundwater Basin have not experienced land subsidence that has caused impacts to the overlying land. However, portions of Colusa and Yolo counties have experienced subsidence; historically land subsidence occurred in the eastern portion of Yolo County and the southern portion of Colusa County, owing to groundwater extraction and geology. As much as four feet of land subsidence due to groundwater withdrawal has occurred east of Zamora over the last several decades. The area between Zamora, Knights Landing, and Woodland has been most affected (Yolo County 2009). Subsidence in this region is generally related to groundwater pumping and subsequent consolidation of loose aquifer sediments.

As mentioned earlier most areas of the Sacramento Valley Groundwater Basin have not experienced land subsidence that has caused impacts to the overlying land. Most of the transfers in the Proposed Action do not include groundwater substitution pumping within the areas of Yolo and Colusa counties that have had subsidence issues. Conaway Preservation Group is in eastern Yolo County near areas of historic subsidence; DWR maintains an extensometer to help monitor potential subsidence issues. A transfer in this area would need to incorporate monitoring and mitigation for subsidence as discussed in the minimization measures described below. Therefore, the effect on potential land subsidence in the Sacramento Valley would be less than significant.

**Groundwater in Buyer's Areas**

Increased surface water supplies from the water transfer could decrease groundwater pumping in the SLDMWA service area. Under the No Action Alternative, some districts and water users are pumping groundwater to meet water demands. The Proposed Action could allow users to reduce groundwater production and instead use surface water provided by the transfer. This would be a benefit to groundwater resources in the SLDMWA service area.

**Minimization Measures**

The *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) and Addendum (Reclamation and DWR 2014) provide guidance for the development of proposals for groundwater substitution water transfers. The objectives of this process are: to mitigate adverse environmental effects that occur; to minimize potential effects to other legal users of water; to provide a process for review and response to reported third party effects; and to assure that a local mitigation strategy is in place prior to the groundwater transfer. The seller will be responsible for assessing and minimizing or avoiding adverse effects resulting from the transfer within the source area of the transfer.

Each entity participating in a groundwater substitution transfer will be required to confirm that the proposed groundwater pumping will be compatible with

state and local regulations and groundwater management plans. Reclamation's transfer approval process and groundwater minimization measures set forth a framework that is designed to avoid and minimize adverse groundwater effects. Reclamation will verify that sellers adopt these minimization measures to minimize the potential for adverse effects related to groundwater extraction.

**Well Review Process** Potential sellers will be required to submit well data for Reclamation and, where appropriate, DWR review, as part of the transfer approval process. Required information is detailed in the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) and Addendum (Reclamation and DWR 2014) for groundwater substitution transfers.

For the purposes of this EA/IS, Reclamation assumes that streamflow losses due to groundwater pumping to make water available for transfer are 12 percent of the amount pumped. Sellers may submit modeling information from approved models to demonstrate that this percentage should be different. Reclamation continues to require well location and construction information to ensure that the criteria in the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) are met.

**Monitoring Program** Potential sellers will be required to complete and implement a monitoring program that must, at a minimum, include the following components:

- *Monitoring Well Network*. The monitoring program will incorporate a sufficient number of monitoring wells to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place.

- *Groundwater Pumping Measurements*. All wells pumping to replace surface water designated for transfer shall be configured with a permanent instantaneous and totalizing flow meter capable of accurately measuring well discharge rates and volumes. Flow meter readings will be recorded just prior to initiation of pumping and at designated times, but no less than monthly and as close as practical to the last day of the month, throughout the duration of the transfer.

- *Groundwater Levels*. Sellers will collect measurements of groundwater levels in both participating transfer wells and monitoring wells. Groundwater level monitoring will include measurements before, during and after transfer-related pumping. The water transfer proponent will measure groundwater levels as follows:

    - Prior to transfer: Groundwater levels will be measured monthly from March 2014 until the start of transfer.

  - Start of transfer: Groundwater levels will be measured on the same day that the transfer begins, prior to the pump being turned on.

  - During transfer: Groundwater levels will be measured weekly throughout the transfer period.

  - Post-transfer: Groundwater levels will be measured weekly for one month after the end of transfer pumping, after which groundwater levels will be measured monthly until March 2015.

- *Groundwater Quality*. For municipal sellers, the comprehensive water quality testing requirements of Title 22 should be sufficient for the water transfer monitoring program. Agricultural sellers shall measure specific conductance in samples from each participating production well. Samples shall be collected when the seller first initiates pumping, monthly during the transfer period, and at the termination of transfer pumping.

- *Land Subsidence.* Reclamation will work with the seller to develop the specifics of a mutually agreed upon subsidence monitoring effort. The extent of required land subsidence monitoring will depend on the expected susceptibility of the area to land subsidence. Areas with documented land subsidence will require more extensive monitoring than others.

- *Coordination Plan*. The monitoring program will include a plan to coordinate the collection and organization of monitoring data, and communication with the well operators and other decision makers.

- *Evaluation and Reporting*. The proposed monitoring program will describe the method of reporting monitoring data. At a minimum, sellers will provide data summary tables to Reclamation, both during and after transfer-related groundwater pumping. Post-program reporting will continue until groundwater levels recover to seasonal highs in March 2015. Water transfer proponents will provide a final summary report to Reclamation evaluating the effects of the water transfer. The final report will identify transfer-related impacts on groundwater and surface water (both during and after pumping), and the extent and significance, if any, of impacts on local groundwater users. It should include groundwater elevation contour maps for the area in which transfer operations are located, showing pre-transfer groundwater elevations, groundwater elevations at the end of the transfer, and recovered groundwater elevations in March 2015.

**Mitigation Plan** Potential sellers will also be required to complete and implement a mitigation plan. If the seller's monitoring efforts indicate that the operation of wells for groundwater substitution pumping are causing substantial adverse impacts, the seller will be responsible for mitigating any significant environmental impacts that occur. Mitigation actions could include:

- Curtailment of pumping until natural recharge corrects the issue.
- Lowering of pumping bowls in third party wells affected by transfer pumping.
- Reimbursement for significant increases in pumping costs due to the additional groundwater pumping to support the transfer.
- Other actions as appropriate.

To ensure that mitigation plans will be tailored to local conditions, the plan must include the following elements:

1. A procedure for the seller to receive reports of purported environmental or third party effects;
2. A procedure for investigating any reported effect;
3. Development of mitigation options, in cooperation with the affected third parties, for legitimate effects; and
4. Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs.

**c) Less than Significant**

**No Action Alternative**: If dry conditions persist in 2014, water users in the Sacramento and San Joaquin Valleys may idle more cropland in response to supply shortages. Under normal farming practices, growers leave fields fallow during some cropping cycles in order to make improvements such as land leveling and weed abatement or to reduce pest problems and build soils. Growers manage potential soil erosion impacts to avoid substantial loss of soils and to protect soil quality (USDA NRCS 2009). While growers would not be able to engage in management practices that result in a consumptive use of water on an idled field, they could continue such erosion control techniques as surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch (USDA NRCS 2009). Therefore, cropland idling under the No Action Alternative would not result in substantial soil erosion or sediment deposition into waterways. Impacts to water quality would be less than significant.

**Proposed Action**: The Proposed Action could include cropland idling in addition to the idling that would occur under the No Action Alternative, which has the potential to increase sediment erosion into nearby waterways. Similar to the No Action Alternative, growers would implement measures to prevent the loss of topsoil. Additionally, the rice crop cycle and the soil textures in the sellers' areas reduce the potential for wind erosion in this region. The process of rice cultivation includes incorporating the leftover rice straw into the soils after harvest through discing. Once dried, the combination of decomposed straw and clay texture soils typically produces a hard, crust-like surface. If left undisturbed, this surface texture would remain intact throughout the summer, when wind erosion would be expected to occur, until winter rains begin. This surface type would not be conducive to soil loss from wind erosion. During the winter rains, the hard, crust-like surface typically remains intact and the amount of sediment transported through winter runoff would not be expected to increase. Therefore, there would be little-to-no increase in sediment transport resulting from wind erosion or winter runoff from idled rice fields under the Proposed Action and the resultant impact would be less than significant.

**d, e, g, h, i, j) No Impact**. The Proposed Action and No Action Alternative would not involve any actions that would result in flooding or create runoff water that would exceed the capacity of existing drainage systems or provide a substantial source of polluted runoff.

**f) Less Than Significant.** Changes in groundwater levels and the potential change in groundwater flow directions could cause a change in groundwater quality through a number of mechanisms. One mechanism is the potential mobilization of areas of poorer quality water, drawn down from shallow zones, or drawn up into previously unaffected areas. Changes in groundwater gradients and flow directions could also cause (or speed) the lateral migration of poorer quality water.

**No Action Alternative:** If dry conditions in 2014 persist, surface water shortages would likely cause some water users to pump additional groundwater. The groundwater pumping could cause water quality concerns, as described above. However, the groundwater pumping would follow historic dry year trends and would not likely change groundwater quality compared to existing conditions.

**Proposed Action:**

***Redding Groundwater Basin.*** Groundwater in the Redding Basin area of analysis is typically of good quality, as evidenced by its low TDS concentrations, which range from 70 to 360 milligrams per liter (mg/L). Areas of high salinity (poor water quality), are generally found on the western basin margins, where the groundwater is derived from marine sedimentary rock. Elevated levels of iron, manganese, nitrate, and high TDS have been detected in

some areas. Localized high concentrations of boron have been detected in the southern portion of the basin (DWR Northern District 2002).

Groundwater extraction under the Proposed Action would be limited to withdrawals during the irrigation season of the 2014 contract year. Since groundwater in the Redding area is of good quality, adverse effects from the migration of reduced groundwater quality would be anticipated to be minimal.

***Sacramento Groundwater Basin.*** Groundwater quality in the Sacramento Valley Groundwater Basin is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. However, there are some localized groundwater quality issues in the basin. Arsenic was detected above the MCL in 22 percent of the primary aquifers within the Sacramento Valley. Nutrient concentration within the central Sacramento Valley region was above the MCLs in about three percent of the primary aquifers. In the southern portion of the basin, nutrients were detected above the MCLs in about one percent of the primary aquifers (Bennett 2011).

Groundwater extraction under the Proposed Action would be limited to withdrawals during the irrigation season of the 2014 contract year. Groundwater extraction under the Proposed Action would be limited to short-term withdrawals during the irrigation season and extraction near areas of reduced groundwater quality would not be expected to result in a permanent change to groundwater quality conditions. Consequently, effects from the migration of reduced groundwater quality would be less than significant.

**X. LAND USE AND PLANNING -**
Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Physically divide an established community? | ☐ | ☐ | ☐ | ☒ |
| b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect? | ☐ | ☐ | ☐ | ☒ |
| c) Conflict with any applicable habitat conservation plan or natural community conservation plan? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** The No Action Alternative and Proposed Action would not involve any construction or new structures that could divide a community or conflict with land use plans, policies, or zoning.

**c) No Impact.** The No Action Alternative and Proposed Action would not conflict with local policies protecting biological resources or habitat conservation plans.

**XI. MINERAL RESOURCES** – Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? | ☐ | ☐ | ☐ | ☒ |
| b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** The No Action Alternative and Proposed Action do not require construction or other activities that would result in the loss of availability of known mineral resources.

**XII. NOISE** - Would the project result in:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? | ☐ | ☐ | ☐ | ☒ |
| b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels? | ☐ | ☐ | ☐ | ☒ |

**XII. NOISE** - Would the project result in:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project? | ☐ | ☐ | ☐ | ☒ |
| d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project? | ☐ | ☐ | ☒ | ☐ |
| e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? | ☐ | ☐ | ☐ | ☒ |
| f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels? | ☐ | ☐ | ☐ | ☒ |

**Discussion:**

**a, b, c, e, f) No Impact.** The No Action Alternative and Proposed Action would not result in the development of any new noise-emitting devices. The Proposed Action would only rely on existing facilities and equipment. No new construction activities would be associated with the Proposed Action and no ground-disturbing actions with the potential to generate groundborne vibrations would occur. Certain wells may be located within an airport land use plan, but there would be no new permanent residents or workers near the wells that could be affected by any plane noise. For private airstrips, the Proposed Action would not expose people in the vicinity to excessive noise levels.

**d) Less Than Significant.** The No Action Alternative would not increase ambient noise levels. The Proposed Action would result in the temporary operation of existing electric, diesel, and natural gas driven wells that would result in temporary increases in noise levels. All the wells would be located in rural areas, which are generally removed from noise-sensitive receptors or in a farm setting with typical noise from agricultural operations. The wells would be

operated by a willing landowner; therefore, any localized noise levels would be approved by the landowner. Noise impacts from increased well operation would be less than significant.

**XIII. POPULATION AND HOUSING** – Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)? | ☐ | ☐ | ☐ | ☒ |
| b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere? | ☐ | ☐ | ☐ | ☒ |
| c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere? | ☐ | ☐ | ☐ | ☒ |

**a) No Impact.** The No Action Alternative and Proposed Action would not induce population growth. Water transfers would help reduce CVP water shortages, and would not increase the maximum acreage under production or require more farm workers to meet labor demands. No housing would be constructed, demolished, or replaced as a result of water transfers.

**b, c) No Impact.** The No Action Alternative and Proposed Action would include no construction, demolition, or other activities that could displace existing housing or people and necessitate the construction of replacement housing.

**XIV. PUBLIC SERVICES**

– Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Fire protection? | ☐ | ☐ | ☐ | ☒ |
| b) Police protection? | ☐ | ☐ | ☐ | ☒ |
| c) Schools? | ☐ | ☐ | ☐ | ☒ |
| d) Parks? | ☐ | ☐ | ☐ | ☒ |
| e) Other governmental facilities (including roads)? | ☐ | ☐ | ☐ | ☒ |

**a-e) No Impact.** The No Action Alternative and Proposed Action would not create any new demand for public services or require any existing public facilities to be altered. Transferred water would be transported using existing conveyance facilities and pumping stations, and would not require the use of area roads, so there would be no impact to roads or other government facilities. Water transfers would not affect the supplies available to municipalities or other jurisdictions for fire protection, parks, or school use. Therefore, there would be no impact to Public Services or Public Facilities as a result of transfers.

**XV. RECREATION –**

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated? | ☐ | ☐ | ☐ | ☒ |

**XV. RECREATION –**

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** The No Action Alternative and Proposed Action would not affect any recreation facilities or require construction or expansion of recreation facilities.

**XVI. TRANSPORTATION/TRAFFIC –**
Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Cause an Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit? | ☐ | ☐ | ☐ | ☒ |
| b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways? | ☐ | ☐ | ☐ | ☒ |
| c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks? | ☐ | ☐ | ☐ | ☒ |

**XVI. TRANSPORTATION/TRAFFIC** – Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? | ☐ | ☐ | ☐ | ☒ |
| e) Result in inadequate emergency access? | ☐ | ☐ | ☐ | ☒ |
| f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities? | ☐ | ☐ | ☐ | ☒ |

**a-g) No Impact.** The No Action Alternative and Proposed Action would not create any new demand on transportation services. The Proposed Action has no construction activities that would increase the traffic on roads in the project area. The amount of water transferred would be less than what is supplied during normal water years, and so would not create an increase in farm activity in the buyers' area that could increase traffic. There would be no impact to the level of service or air traffic patterns in the project area, nor would there be an increase to the hazard to design features, inadequate emergency access or parking capacity, or conflict with adopted policies supporting alternative transportation.

**XVII. UTILITIES AND SERVICE SYSTEMS** - Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board? | ☐ | ☐ | ☐ | ☒ |

**XVII. UTILITIES AND SERVICE SYSTEMS** - Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? | ☐ | ☐ | ☐ | ☒ |
| c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? | ☐ | ☐ | ☐ | ☒ |
| d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed? | ☐ | ☐ | ☐ | ☒ |
| e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments? | ☐ | ☐ | ☐ | ☒ |
| f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs? | ☐ | ☐ | ☐ | ☒ |
| g) Comply with federal, state, and local statutes and regulations related to solid waste? | ☐ | ☐ | ☐ | ☒ |

**a-g) No Impact.** The No Action Alternative and Proposed Action would not create any new demand on utilities or service systems. There would be no impact to utility or service systems resulting from implementing the Proposed Action. Transfers would not require the construction of new water or wastewater treatment facilities as all water transfers would be done using existing facilities. There would be no increase in demand for wastewater treatment facilities that could exceed existing capacities, and no new storm water drainage facilities would be required under the Proposed Action.

Water transfers would be done within the existing entitlements and resources, and no new water supplies for the sellers would be required. Buyers would also not require new water supplies as the transfers would provide agricultural water in lieu of the limited surface water supplies and in addition to the groundwater supplies already available in the buyers' area. Water transfers would be completed in the summer months when there is determined to be excess capacity at the Jones PP or Banks PP, therefore no new infrastructure would be required.

There would be no solid waste generated as a result of the Proposed Action, and therefore no landfill would be required. Therefore, there would be no impact to utilities or other service systems as a result of the Proposed Action.

**XVIII. MANDATORY FINDINGS OF SIGNIFICANCE –**

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? | ☐ | ☐ | ☒ | ☐ |
| b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)? | ☐ | ☐ | ☒ | ☐ |

**XVIII. MANDATORY FINDINGS OF SIGNIFICANCE –**

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly? | ☐ | ☐ | ☐ | ☒ |

**a) Less than Significant.** Water transfers would not have substantial incremental effects to habitat or species relative to the conditions would occur in response to the dry hydrologic conditions. Environmental Commitments required for 2014 transfers would reduce potential special status species impacts to less than significant. Water transfers would not degrade the quality of the environmental or eliminate examples of California history or prehistory.

**b) Less than Significant.** The cumulative analysis considers other potential water transfers that could occur in the 2014 transfer season, including non-CVP water transfers. The TCCA is releasing a separate EA/IS to analyze transfers from a similar list of sellers as included in this document. These two documents reflect different potential buyers for the same water sources; therefore, the transfer quantities identified in the two documents cannot be summed (i.e., it is the same available transfer water in both documents). The transfer quantities as identified in Table 2-1 could be purchased by either the SLDMWA Participating Members or TCCA Members Units.

Table 3-9 lists additional entities who have indicated interest in providing non-CVP water for transfer. Water transfers methods could include cropland idling and groundwater substitution (the same as described for the Proposed Action) and also stored reservoir water, which includes releases of water that would have remained in storage in non-CVP or SWP reservoirs.

There could also be in-basin transfers in the San Joaquin Valley to help manage reduced water supplies among neighboring districts. In-basin transfers to the SLDMWA Participating Members would not have cumulative effects to resources in the SLDMWA Participating Members' service areas.

**Table 3-9. Potential Additional Cumulative Sellers (Upper Limits)**

| (Acre feet) | | | |
|---|---|---|---|
| **Water Agency** | **Stored Reservoir Water** | **Groundwater Substitution** | **Cropland Idling/ Shifting** |
| Feather River Area of Analysis | | | |
| Biggs West Gridley WD | | | 32,190 |
| Butte WD | | 5,350 | 11,055 |
| Cordua ID | | 12,000 | |
| Gilsizer Slough | | 5,300 | |
| Richvale ID | | | 21,120 |
| South Sutter WD | 20,000 | | |
| Plumas MWC | | 3,500 | |
| Sutter Extension WD | | 4,000 | 11,000 |
| Western Canal WD | | | 35,442 |
| Yuba County WA | | 30,000 | 30,000 |
| American River Area of Analysis | | | |
| Placer County WA | 40,000 | | |
| Sacramento County WA | | 15,000 | |
| Delta Area of Analysis | | | |
| Reclamation District 2068 | | 1,150 | 7,500 |
| Pope Ranch | | 2,800 | 600 |
| **Total** | **60,000** | **79,100** | **148,907** |

Abbreviations:
ID: Irrigation District
MWC: Mutual Water Company
WA: Water Agency
WD: Water District

Water transfers occur in most years to move water to agencies that may be experiencing shortages. Within the last five years, Reclamation approved and facilitated transfers of 79,926 AF in 2009 (21,045 AF of cropland idling and 58,881 AF of groundwater substitution) and 31,406 AF in 2013. Reclamation participated in the monitoring efforts during and after these transfers (as specified in the environmental documents) and did not find significant environmental effects of these transfers or cumulative effects with other transfers. Additionally, non-CVP related transfers continued during this time period. In 2013, transfers from both CVP and non-CVP sources totaled 268,730 AF (DWR 2014); these transfers include transfers within basins and transfers between basins. About 249,600 AF of these transfers originated in the Sacramento Valley and were transferred to users in other areas of the Sacramento Valley, the Bay Area, the Central Valley, or southern California.

These transfers represent a small portion of the Sacramento Valley's overall supply. Applied water in the Sacramento Valley from 2001 to 2010 has ranged from a low of about 8,196,000 AF in 2005 up to 9,915,000 AF in 2004. The driest year during this period was 2007, when applied water was about 9,868,000 AF (DWR 2013). These figures include applied water from surface water, groundwater, and reuse.

The Proposed Action could have potential cumulatively considerable impacts to air quality, biological resources, and groundwater resources in the seller area. The cumulative analysis for these resources follows. The Proposed Action would not have cumulatively considerable impacts to other resources evaluated in this EA/IS.

**Air Quality**

All counties affected by the Proposed Action are located in areas designated nonattainment for the $O_3$ and $PM_{10}$ CAAQS. Additionally, Sacramento County is designated nonattainment for the $PM_{2.5}$ CAAQS. Nonattainment status represents a cumulatively significant impact within the area. $O_3$ is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to $O_3$ formation include volatile organic compounds and nitrogen oxides; therefore, the significance thresholds established by the air districts for VOC and NOx are intended to maintain or attain the $O_3$ CAAQS and NAAQS. Because no single project determines the nonattainment status of a region, individual projects would only contribute to the area's designation on a cumulative basis.

The significance thresholds developed by the air districts serve to evaluate if a proposed project could either 1) cause or contribute to a new violation of a CAAQS or NAAQS in the study area or 2) increase the frequency or severity of any existing violation of any standard in the area. Air districts recognize that air quality violations are not caused by any one project, but are a cumulative effect of multiple projects. Therefore, the air districts (including the Sacramento Metropolitan AQMD) have developed guidance that indicates a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

Implementation of mitigation measures would reduce the Proposed Action's individual impacts to less than significant. Therefore, air quality impacts would not be cumulatively considerable.

**Biological Resources**

Transfers under the cumulative condition would result in the idling of additional rice fields than those included in the Proposed Action. Most of the cumulative cropland idling transfers would occur in the Feather River area, the majority of which is in Butte and Sutter counties. There could also be some cropland idling transfers in Yuba County. Rice would be the main crop idled in these counties. RD2068 and Pope Ranch in the Delta region do not have substantial rice acreage; therefore, other crops in these districts would likely be idled for transfers.

As described in the Biological Resources section, rice fields provide habitat for GGS, western pond turtle, and migratory birds. For the GGS and western pond turtle, rice idling could result in reduced forage and cover habitat, hindered movement, and increased predation risk. For migratory birds, rice idling could reduce nesting, forage, and rearing habitat. Additional rice idled under the cumulative condition could increase these effects relative to the Proposed Action.

An additional 42,668 acres of rice could be idled under the cumulative condition, based on the cropland idling transfer quantities in Table 3-9 and an ETAW of 3.3 AF per acre for rice. Including the Proposed Action, up to 74,731 acres of rice could be idled cumulatively. The Proposed Action includes Environmental Commitments to reduce potential effects to special status species, including GGS and western pond turtle, and migratory birds. Other water transfers facilitated by Reclamation and DWR using Federal and State facilities would be required to have similar conservation measures in place to protect special status species. The Environmental Commitments would reduce potential effects to special status species of the Proposed Action under the cumulative condition, such that the Proposed Action's contribution would not be cumulatively considerable.

**Groundwater Resources**

The reduction in recharge due to the decrease in precipitation and runoff in the past years in addition to the increase in groundwater transfers would lower groundwater levels. The groundwater modeling for the Proposed Action suggests that the groundwater pumping from transfers in addition to the groundwater pumping from dry conditions would not cause significant adverse effects to groundwater levels. The additional groundwater substitution transfers in the cumulative condition are relatively small compared to overall groundwater pumping in the Sacramento Valley associated with dry year conditions and the Proposed Action; therefore, this addition to the cumulative condition is not likely to cause a significant cumulative impact.

Reclamation requires well review, monitoring, and mitigation to reduce effects to third party groundwater users for approval of transfers. Only wells that meet the requirements outlined in the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) will be allowed to participate in a transfer. Reclamation will not approve transfers if appropriate monitoring and mitigation does not occur. Monitoring and mitigation programs would reduce cumulative groundwater effects. Reclamation will verify that monitoring and mitigation are appropriately implemented and groundwater effects do not occur. Coordination of groundwater programs in the Sacramento Valley would also minimize and avoid the potential for cumulative effects to groundwater resources. DWR is involved in multiple groundwater programs in the Sacramento Valley, including monitoring programs. Reclamation will work with DWR to track program activities, collect and combine data, and assess

potential groundwater effects. Because of the required groundwater monitoring and mitigation for transfer approval and agency coordination, the Proposed Action would not result in a cumulatively considerable contribution to effects on groundwater.

**c) No Impact**. The Proposed Action would not result in environmental effects that cause substantial adverse impacts to human beings. Effects in the sellers' area would be temporary, occurring in only 2014, and do not present a substantial risk to water supplies to human beings. The Proposed Action would provide additional water to the buyers' area, which would benefit agricultural production and the regional economies in the buyers' area. There would be no long-term effects of the Proposed Action.

# Chapter 4
# Other Federal Environmental Compliance Requirements

In addition to resources analyzed in Chapter 3, Department of the Interior Regulations, Executive Orders, and Reclamation guidelines require a discussion of the following additional items when preparing environmental documentation.

## 4.1 Indian Trust Assets (ITAs)

ITAs are defined as legal interests in property held in trust by the U.S. government for Indian tribes or individuals, or property protected under U.S. law for federally recognized Indian tribes or individuals. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with a reservation or Rancheria. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S. The following ITAs overlay the boundaries of the Sacramento Valley Groundwater Basin:

- Auburn Rancheria
- Chico Rancheria
- Colusa
- Cortina
- Paskenta
- Rumsey

Groundwater substitution is the only transfer method under the Proposed Action that could affect ITAs. Auburn Rancheria, Cortina, and Rumsey lie on the border of the basin, where groundwater levels would be less affected by proposed groundwater pumping. Groundwater modeling in the Sacramento Valley Groundwater Basin shows that there would be essentially no effect to groundwater table elevations from groundwater substitution transfers near the Chico Rancheria, and Paskenta sites (see Figure 4-1). The Colusa Rancheria is close to an area of potential drawdown, but outside the area of potential effects. The changes in groundwater levels near the Colusa Rancheria would be less than one foot, which would be a minimal effect to groundwater pumping.

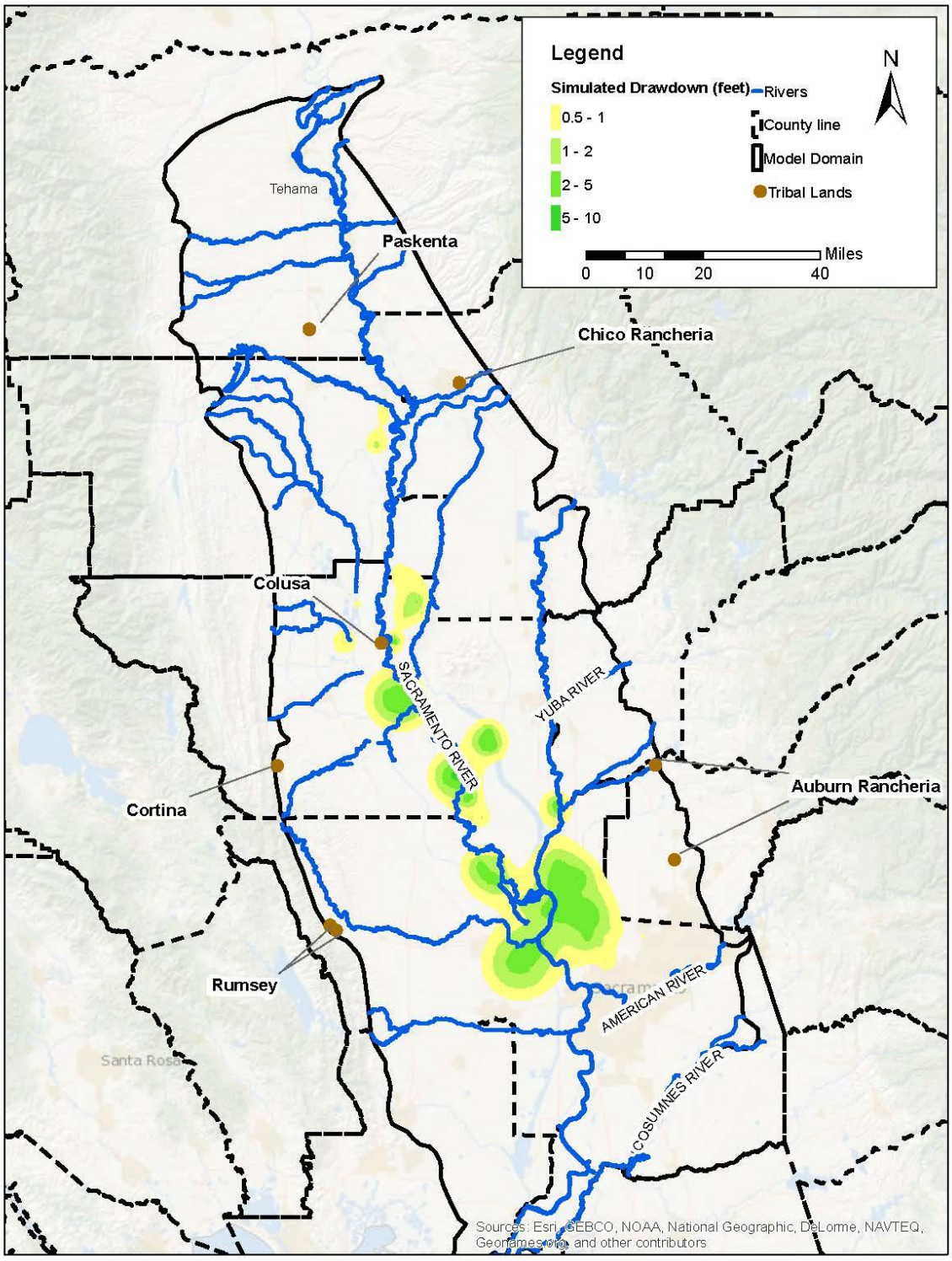


**Figure 4-1. Groundwater Effects to ITAs in the Sacramento Valley Groundwater Basin**

The Redding Rancheria falls within the Redding Groundwater Basin, which is where groundwater substitution transfers would occur by Anderson-Cottonwood ID. The groundwater evaluation concludes that there would not be significant effects to groundwater elevations in the Redding Groundwater Basin based on past pump tests and that Anderson-Cottonwood ID would implement minimization measures because of the uncertainty of changes in groundwater levels in a critical water year. As a result, there would be no effects to the Redding Rancheria.

Because groundwater substitution transfers would not affect groundwater table elevations near the ITA sites, the Proposed Action would not affect ITAs.

## 4.2 Indian Sacred Sites

As defined by Executive Order 13007: Indian Sacred Sites, a sacred site "means any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." The affected environment for the Proposed Action does not include Federal land; therefore, there is no potential for Indian Sacred Sites to be affected by the Proposed Action.

## 4.3 Socioeconomics

Agriculture is a primary industry in the counties in Colusa, Glenn, Sutter, and Yolo counties. In 2011, the combined value of agricultural production in the five counties was approximately $3.0 billion. Table 4-1 summarizes the combined regional economy in 2011 for Glenn, Colusa, Sutter, and Yolo counties. The counties were combined because many of the participating sellers' service area cross county boundaries and the regional economies are generally similar with respect to the major industries. It is important to note that Yolo County represents a significant portion of the employment, labor income, and output in the region because of its proximity to the urban Sacramento area and economic activities associated with the University of California at Davis.

**Table 4-1. Summary of 2011 Regional Economy in Glenn, Colusa, Sutter, and Yolo Counties**

| | Employment | Labor Income (million $) | Output (million $) |
|---|---|---|---|
| Agriculture | 19,806 | $9,197.1 | $24,918.9 |
| Mining | 617 | $829.1 | $2,687.7 |
| Construction | 8,461 | $35.2 | $199.9 |
| Manufacturing | 9,593 | $452.7 | $970.7 |
| Transportation, Information, Public Utilities | 11,791 | $572.5 | $4,588.5 |
| Trade | 23,761 | $532.6 | $1,661.1 |
| Service | 69,938 | $1,075.7 | $2,543.3 |
| Government | 42,919 | $2,497.2 | $8,460.2 |
| **Total** | 186,885 | $15,192.1 | $46,030.4 |

*Source: IMPLAN 2012*
[1] Employment is measured in number of jobs.
[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.
[3] Output represents the dollar value of industry production.

While the 2014 water year (which extends from October 1, 2013 through September 30, 2014) is only partially complete, the hydrologic conditions so far have been critically dry. These conditions are worsened by the dry conditions statewide in 2012 and 2013, which affected reservoir storage coming into water year 2014. For example, storage in Shasta Reservoir was 1,794,000 AF on March 3, 2014, which is 54 percent of average at this time of year and substantially less than storage on the same date in the previous year (3,620,000 AF) (CDEC 2014). The initial allocation from the SWP in January 2014 was 0 percent and similarly the initial allocation for the CVP in February 2014 was 0 percent. While it is too early in 2014 to know with certainty the final allocation, CVP and SWP water service contractors initial allocations are 0 percent, and Sacramento River Settlement Contractors and refuges have been notified that they can expect 40 percent of their contract amounts rather than the anticipated 75 percent normally provided in a Critical Year.

Facing a water shortage, growers would take actions to protect permanent crops first to protect their investments. If available, growers would likely pump groundwater to substitute reduced surface water supplies. If groundwater is not available, growers would idle field crops and use available surface water to irrigate permanent crops.

In the buyer area in the San Joaquin Valley, water shortages under the No Action Alternative may be severe enough that, even with these actions, growers may not have the available water needed to irrigate permanent crops. This could cause permanent crops to die or be permanently damaged. Damage to and loss of permanent crops would have long-term adverse effects to the regional

economy in the San Joaquin Valley. If the crop is lost, growers would lose annual revenues earned from sales and their initial investments to establish the crop. These economic effects would last beyond 2014. There may also be increased costs to remove the crops and prepare the land for subsequent planting.

Permanent crops are expensive to establish and can take several years before they begin producing. Growers would need to decide whether or not to invest new funds to reestablish the crop. If growers choose not to replant permanent crops, there would be long term effects on agricultural employment and sales to agricultural support businesses. Permanent crops are more labor intensive than field crops. Demand for farm related labor would decrease, which would increase unemployment rates in San Joaquin Valley counties. Growers would also reduce the purchase of farm- related supplies, which would decrease sales in the region.

Under the No Action Alternative, there would also be adverse economic impacts within the sellers' area as growers in the Sacramento Valley also must take actions to address water shortages. Growers with access to groundwater would likely pump groundwater to irrigate crops. Some growers would fallow field crops and use available surface water supplies to irrigate permanent crops. Glenn-Colusa ID estimates that about 15 percent of rice in the service area would be idled if provided 75 percent of its contractual supply. Cropland idling in other districts would also occur under the No Action Alternative, but estimates are unavailable at this time because other districts have not yet considered what actions they will take to address water shortages this year.

Cropland idling in the seller area under the No Action Alternative would adversely affect the regional economy. Growers would not receive revenues from crop sales and there would be a reduction in agricultural employment. Agricultural support businesses would also experience reduced sales because growers would not purchase farm-related supplies. These would be temporary adverse economic impacts in the sellers' area, caused by the lack of precipitation in 2013 and so far in 2014.

Under the Proposed Action, a maximum of 32,062 acres of rice could be idled in addition to rice acres idled as a result of the drought. Under the Proposed Action, growers selling water for transfers would be compensated for their expected losses in income that they would have received for selling a crop. As a result, growers would not experience a net loss in income and would presumably receive more revenue than if the crop were produced, which would be an economic benefit to participating growers.

Adverse regional economic effects would occur to businesses and individuals who support farming activities, such as farm workers, fertilizer and chemical dealers, wholesale and agricultural service providers, truck transport, and others involved in crop production and processing. These businesses and individuals

would not receive compensation from the water transfer. Cropland idling would result in direct effects to employment, labor income and output. This analysis quantifies effects to employment to represent the magnitude of potential economic effects of the proposed cropland idling. There would be similar relative effects to labor income and output to the regional economy.

Rice production provides approximately 3 farm jobs per 1,000 acres (University of California Cooperative Extension 2007, IMPLAN 2013). Based on the maximum acreages proposed for idling as a result of the Proposed Action, the direct effects of rice idling would be approximately 96 jobs lost in Colusa, Glenn, Sutter, and Yolo counties. These job losses would largely occur in the agricultural sector.

There would also be secondary regional economic impacts as a result of increased idling. Secondary effects occur because of the linkages among industries and include effects to employment, income, and output of support industries and as a result of reduced household spending. Secondary effects are often measured by economic multipliers. The employment multiplier for the "other crop farming" sector (which includes rice) in Colusa, Glenn, Sutter, and Yolo region is 2.87 (IMPLAN 2012), meaning that for every 1 job lost in the other crop farming sector, an additional 1.87 jobs would be lost in the regional economy.

Based on the estimated direct effects and employment multipliers, the total economic effect to employment of the proposed rice idling actions would be a loss of 276 jobs in Colusa, Glenn, Sutter, and Yolo counties. These job losses would be less than 1 percent of the total employment in both regions. At the regional level, this effect would not be substantial. Further, the Proposed Action would last for one year and growers could put the land back into agricultural production in the subsequent year if water supplies increase. Therefore, economic effects from cropland idling would be a temporary effect.

Effects may be more adverse in local communities. Rural communities have a much smaller economic base, and any changes to economic levels would be more adverse relative to a large regional economy. Reclamation and participating buyers and sellers will limit cropland idling as a result of the Proposed Action to less than 20 percent of the acreage of a particular crop in a district to reduce the potential for economic effects. Water Code Section 1745.05(b) requires a public hearing under some circumstances in which the amount of water from land idling exceeds 20 percent of the water that would have been applied or stored by the water supplier absent the water transfer in any given hydrologic year. Third parties would be able to attend the hearing and could argue to limit the transfer based on its economic effects.

In the buyer area, water transfers under the Proposed Action would provide water for irrigation that would help maintain crop production. Even with transfers, growers would continue to face water shortages and take actions to address reduce supplies. Transfer water would be used to irrigate permanent crops to keep them alive through the dry year and support long-term production. Permanent crops are typically more labor intensive and have higher value than field crops. Continued irrigation of permanent crops through the 2014 irrigation season would support farm labor and provide revenue to the region through 2014 and in the long-term. Transfer water would help local farm economies in the San Joaquin Valley by providing employment and wages to farm laborers. Transfers would protect growers' investments in permanent crops and farm income. Transfers would provide long-term economic benefits by keeping permanent crops alive through the 2014 dry conditions. If permanent crops do not survive through 2014, there would be substantial long-term adverse economic effects to the buyer area by reducing employment and income in subsequent years. The Proposed Action would benefit the regional economy in the buyer area.

## 4.4 Environmental Justice

The 1994 Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires all Federal agencies to conduct "programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under, such programs, policies, and activities, because of their race, color, or national origin." Cropland idling could affect farm labor employment by temporarily reducing the amount of agricultural land in production or the number of farm workers needed to work existing land. Table 4-2 shows 2012 demographics and income in the counties where cropland idling could occur. In 2012, Colusa County had a Hispanic population greater than 50 percent. All counties had a lower median household income and higher unemployment rate relative to the state; and, Glenn, Sutter, and Yolo counties had a higher poverty rate than the state. These statistics indicate a potential for environmental justice effects in the seller area.

**Table 4-2. 2012 Demographics and Income in Transferring Counties**

| | | CA | Colusa | Glenn | Sutter | Yolo |
|---|---|---|---|---|---|---|
| **Population** | | 38,041,430 | 21,411 | 27,992 | 95,022 | 204,118 |
| **Ethnicity[1] (%)** | Hispanic or Latino | 38.2 | 56.6 | 38.7 | 29.3 | 31.0 |
| **Race[2] (%)** | White | 73.7 | 91.8 | 90.2 | 74.7 | 76.2 |
| | African American | 6.6 | 1.2 | 1.1 | 2.4 | 3.0 |
| | American Indian | 1.7 | 2.6 | 3.0 | 2.3 | 1.8 |
| | Asian | 13.9 | 1.7 | 2.9 | 16.1 | 13.6 |
| | Pacific Islander | 0.5 | 0.6 | 0.2 | 0.4 | 0.6 |
| | Multirace | 3.6 | 2.2 | 2.7 | 4.1 | 4.8 |
| **Poverty Rate (2008-2012)[3] (%)** | | 15.3 | 15.2 | 19.5 | 17.0 | 18.7 |
| **Unemployment Rate[4] (%)** | | 10.5 | 20.0 | 14.7 | 17.6 | 11.5 |
| **Median Household Income (2008-2012)** | | $61,400 | $52,165 | $42,641 | $50,510 | $57,260 |

*Source: California Employment Development Department (EDD) 2013, U.S. Census Bureau 2013.*

Notes:

[1] The U.S. Census Bureau classifies Hispanic or Latino as an ethnicity, and surveys for this percentage across all races; therefore, the actual percentage of persons of only Hispanic or Latino origin could be smaller than the stated percentage (U.S. Census Bureau 2013).

[2] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic (U.S. Census Bureau 2013).

[3] The U.S. Census Bureau classifies families and persons as *below poverty* "if their total family income or unrelated individual income was less than the poverty threshold" as defined for all parts of the country by the federal government (U.S. Census Bureau 2013).

[4] Civilian labor force is defined as all civilians 16 years or older employed or looking for work, and not in institutions. Data for unemployment rates were collected from EDD and are 2012 Annual Average (EDD 2013).

[5] Household income is defined by the U.S. Census Bureau as "the sum of money income received in the calendar year by all household members 15 years old and over" (U.S. Census Bureau 2013).

Table 4-3 shows 2003-2012 total farm employment in the counties that could idle cropland. Farm employment would be the most directly affected by cropland idling transfers.

**Table 4-3. Farm Employment, 2003-2012**

| | Colusa, Glenn, Sutter and Yolo Counties | Annual Percent Change |
|---|---|---|
| **2003** | 11,480 | -- |
| **2004** | 11,330 | -1% |
| **2005** | 11,390 | 1% |
| **2006** | 11,390 | 0% |
| **2007** | 12,080 | 6% |
| **2008** | 12,310 | 2% |
| **2009** | 12,580 | 2% |
| **2010** | 12,950 | 3% |
| **2011** | 13,270 | 2% |
| **2012** | 13,440 | 1% |

*Source: EDD 2012*

Economic effects in the buyers' and sellers' areas as a result of the reduced supplies in this critical hydrologic year under the No Action Alternative are described in Section 4.3. These effects would also be relevant for environmental justice issues. In the buyers' area in the San Joaquin Valley, reduced water supplies could cause long-term damage to or loss of permanent crops, which would reduce farm worker employment for the long-term. This could result in a disproportionate impact to low income and minority workers under the No Action Alternative. In the sellers' area, field crops would likely be idled in response to water shortages and to shift available surface water supplies to irrigate permanent crops. There would be some losses in employment of low income and minority workers on field crops, but employment needs for labor-intensive permanent crops would remain unchanged. Effects in the sellers' area would be temporary.

Under the Proposed Action, cropland idling transfers could disproportionately and adversely affect minority and low-income farm workers by reducing agricultural production. A maximum of 32,062 acres of rice could be idled in Glenn, Colusa, Sutter, and Yolo counties. Based on the maximum idling acreage under the Proposed Action, approximately 96 farm workers jobs would be lost in the region (0.7 percent of total 2012 farm employment) due to rice idling. This magnitude of job losses is within historic annual fluctuations in farm worker employment. Annual changes in farm worker employment from 2002 to 2012 were 1 percent or greater in all but 1 year (EDD 2012). All farm worker effects would be temporary and only occur during the 2014 crop season. Cropland idling under the Proposed Action would not result in an adverse and disproportionately high effect to farm employment.

Water transfers under the Proposed Action would provide water to growers in the buyers' area. Increased water supply would mostly be used to irrigate permanent crops that face water shortages under the No Action Alternative. This would provide employment for the labor intensive, permanent crops, which would provide farm employment for low income and minority workers. This would be a beneficial effect to environmental justice populations.

## 4.5 Consultation and Coordination

### 4.5.1 2014 Stakeholder Involvement

Reclamation and SLDMWA continue to coordinate with interested sellers to implement water transfers in 2014. Reclamation and SLDMWA also coordinate frequently with DWR on water transfers and use of SWP facilities. Tables 2-1 and 2-2 are the result of coordination among agencies.

### 4.5.2 Resource Agency Involvement

Reclamation and SLDMWA have been coordinating efforts with USFWS. Reclamation has also met with California Department of Fish and Wildlife and solicited their input on the environmental commitments. Reclamation will submit a Biological Assessment for USFWS review under Section 7 of the Federal ESA.

### 4.5.3 Public Comments

Reclamation and SLDMWA are releasing this EA/IS for a 20 day public review period, beginning on March 12, 2014. Reclamation and SLDMWA invite the public to submit comments during this period.

# Chapter 5
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# Appendix A

# Environmental Commitments and Minimization Measures

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# Appendix A
# Environmental Commitments and Minimization Measures

This appendix includes the environmental commitments and minimization measures for 2014 water transfers. Chapter 2 of the EA/IS includes the environmental commitments and Chapter 3 of the EA/IS includes an evaluation of environmental effects and associated minimization measures.

## A.1 Environmental Commitments

**Groundwater Substitution and Cropland Idling Transfers**

- Carriage water will be used to maintain water quality standards in the Delta.

**Groundwater Substitution Transfers**

- Well reviews and monitoring and mitigation plans will be implemented to minimize potential effects of groundwater substitution on nearby surface and groundwater water resources. Well reviews, monitoring and mitigation plans will be coordinated and implemented in conjunction with local ordinances, basin management objectives, and all other applicable regulations. DWR and Reclamation have published draft technical information related to cropland idling and groundwater substitution transfers titled *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013), and any 2014 Water Transfer Guidelines Addendums, which are available at http://www.water.ca.gov/watertransfers/.

- In groundwater basins where sellers are in the same groundwater subbasin as protected aquatic habitats, such as giant garter snake (GGS) preserves and conservation banks, groundwater substitution will be allowed as part of the water transfer program if the seller can demonstrate that any impacts to water resources needed for special status species protection have been addressed. In these areas, sellers will be required to address these impacts as part of their mitigation plan.

**Cropland Idling Transfers**

- As part of the approval process, Reclamation will have access to the land to verify how the water transfer is being made available and to verify that the actions to protect the GGS are being implemented.

- Reclamation will provide a map(s) to USFWS in May of 2014 showing the parcels of riceland that are idled for the purpose of transferring water in 2014. These maps will be prepared to comport to Reclamation's Geographic Information System (GIS) standards.

- Water will not be purchased from a field fallowed during the two previous years (water may be purchased from the same parcel in successive years).

- The focus of GGS mitigation in districts proposing water transfers made available from fallowed rice fields will be to ensure adequate water is available for priority suitable habitat with a high likelihood of GGS occurrence.

  – The determination of priority habitat will be made through coordination with GGS experts, GIS analysis of proximity to historic tule marsh, and GIS analysis of suitable habitat. The priority habitat areas are indicated on the priority habitat map which will be maintained by USFWS. In addition, fields abutting or immediately adjacent to Federal wildlife refuges will be considered priority habitat.

  – Maintenance water in smaller drains and conveyance infrastructure support key habitat attributes such as emergent vegetation for GGS for escape cover and foraging habitat. If crop idling occurs in priority habitat areas, Reclamation will work with contractors to document that adequate water remains in drains and canals in those priority areas. Documentation may include flow records, photo documentation, or other means of documentation agreed to by Reclamation and USFWS.

  – Areas with known priority GGS populations will not be permitted to participate in cropland idling. Water sellers can request a case-by-case evaluation of whether a specific field would be precluded from participating in the water transfer program. These areas include:

    o A field abutting or immediately adjacent to Butte Creek, Colusa Drainage Canal, Gilsizer Slough, the land side of the Toe Drain along the Sutter Bypass, Willow Slough and Willow Slough Bypass in Yolo County, and

    - Lands in the Natomas Basin.

  – Movement corridors include the major irrigation and drainage canals. The water seller will keep at least two feet of water in the major irrigation and drainage canals (but never more than existing conditions).

- In order to limit reduction in the amount of over-winter forage for migratory birds, including greater sandhill crane, transfers will minimize actions near known wintering areas in the Butte Sink.

- To ensure effects of cropland idling actions on western pond turtle habitat are avoided or minimized, canals will not be allowed to completely dry out.

## A.2 Minimization Measures

### Groundwater

The *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) and Addendum (Reclamation and DWR 2014) provide guidance for the development of proposals for groundwater substitution water transfers. The objectives of this process are: to mitigate adverse environmental effects that occur; to minimize potential effects to other legal users of water; to provide a process for review and response to reported third party effects; and to assure that a local mitigation strategy is in place prior to the groundwater transfer. The seller will be responsible for assessing and minimizing or avoiding adverse effects resulting from the transfer within the source area of the transfer.

Each entity participating in a groundwater substitution transfer will be required to confirm that the proposed groundwater pumping will be compatible with state and local regulations and groundwater management plans. Reclamation's transfer approval process and groundwater minimization measures set forth a framework that is designed to avoid and minimize adverse groundwater effects. Reclamation will verify that sellers adopt these minimization measures to minimize the potential for adverse effects related to groundwater extraction.

**Well Review Process** Potential sellers will be required to submit well data for Reclamation and, where appropriate, DWR review, as part of the transfer approval process. Required information is detailed in the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) and Addendum (Reclamation and DWR 2014) for groundwater substitution transfers.

For the purposes of this EA/IS, Reclamation assumes that streamflow losses due to groundwater pumping to make water available for transfer are 12 percent of the amount pumped. Sellers may submit modeling information from approved models to demonstrate that this percentage should be different. Reclamation continues to require well location and construction information to ensure that the criteria in the *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) are met.

**Monitoring Program** Potential sellers will be required to complete and implement a monitoring program that must, at a minimum, include the following components:

- *Monitoring Well Network*. The monitoring program will incorporate a sufficient number of monitoring wells to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place.

- *Groundwater Pumping Measurements*. All wells pumping to replace surface water designated for transfer shall be configured with a permanent instantaneous and totalizing flow meter capable of accurately measuring well discharge rates and volumes. Flow meter readings will be recorded just prior to initiation of pumping and at designated times, but no less than monthly and as close as practical to the last day of the month, throughout the duration of the transfer.

- *Groundwater Levels*. Sellers will collect measurements of groundwater levels in both participating transfer wells and monitoring wells. Groundwater level monitoring will include measurements before, during and after transfer-related pumping. The water transfer proponent will measure groundwater levels as follows:

    - Prior to transfer: Groundwater levels will be measured monthly from March 2014 until the start of transfer.

    - Start of transfer: Groundwater levels will be measured on the same day that the transfer begins, prior to the pump being turned on.

    - During transfer: Groundwater levels will be measured weekly throughout the transfer period.

    - Post-transfer: Groundwater levels will be measured weekly for one month after the end of transfer pumping, after which groundwater levels will be measured monthly until March 2015.

- *Groundwater Quality*. For municipal sellers, the comprehensive water quality testing requirements of Title 22 should be sufficient for the water transfer monitoring program. Agricultural sellers shall measure specific conductance in samples from each participating production well. Samples shall be collected when the seller first initiates pumping, monthly during the transfer period, and at the termination of transfer pumping.

- *Land Subsidence.* Reclamation will work with the seller to develop the specifics of a mutually agreed upon subsidence monitoring effort. The extent of required land subsidence monitoring will depend on the expected susceptibility of the area to land subsidence. Areas with documented land subsidence will require more extensive monitoring than others.

- *Coordination Plan*. The monitoring program will include a plan to coordinate the collection and organization of monitoring data, and communication with the well operators and other decision makers.

- *Evaluation and Reporting.* The proposed monitoring program will describe the method of reporting monitoring data. At a minimum, sellers will provide data summary tables to Reclamation, both during and after transfer-related groundwater pumping. Post-program reporting will continue until groundwater levels recover to seasonal highs in March 2015. Water transfer proponents will provide a final summary report to Reclamation evaluating the effects of the water transfer. The final report will identify transfer-related impacts on groundwater and surface water (both during and after pumping), and the extent and significance, if any, of impacts on local groundwater users. It should include groundwater elevation contour maps for the area in which transfer operations are located, showing pre-transfer groundwater elevations, groundwater elevations at the end of the transfer, and recovered groundwater elevations in March 2015.

**Mitigation Plan** Potential sellers will also be required to complete and implement a mitigation plan. If the seller's monitoring efforts indicate that the operation of wells for groundwater substitution pumping are causing substantial adverse impacts, the seller will be responsible for mitigating any significant environmental impacts that occur. Mitigation actions could include:

- Curtailment of pumping until natural recharge corrects the issue.

- Lowering of pumping bowls in third party wells affected by transfer pumping.

- Reimbursement for significant increases in pumping costs due to the additional groundwater pumping to support the transfer.

- Other actions as appropriate.

To ensure that mitigation plans will be tailored to local conditions, the plan must include the following elements:

1. A procedure for the seller to receive reports of purported environmental or third party effects;

2. A procedure for investigating any reported effect;

3. Development of mitigation options, in cooperation with the affected third parties, for legitimate effects; and

4. Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs.

## Air Quality

Emissions from Pelger Mutual Water Company, Pleasant Grove-Verona Mutual Water Company, and Tule Basin Farms would exceed the daily NOx thresholds.

The following mitigation measures would reduce the severity of the air quality impacts:

- AQ-1 – All diesel-fueled engines would either be replaced with an engine that would meet the applicable emission standards for model year 2013 or would be retrofit to meet the same emission standards.

- AQ-2 – Natural gas engines will be retrofit with a selective catalytic reduction device (or equivalent) that is capable of achieving a NOx control efficiency of at least 90 percent.

- AQ-3 – Any engines operating in the area of analysis that are capable of operating as either electric or natural gas engines would only operate with electricity during any groundwater transfers.

- AQ-4 – Selling agency would reduce pumping at diesel or natural gas wells to reduce emissions to below the thresholds.

# Appendix B

# Air Quality Emission Calculations

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**Table 1. General Conformity Applicability Evaluation (Unmitigated Emissions)**

| County/ Nonattainment Area | Emissions (tons per year) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | VOC | | NOx | | CO | SOx | PM10 | PM2.5 | |
| | Sacramento Metro[1] | Butte County | Sacramento Metro[1] | Butte County | Sacramento Area[2] | Sacramento[3,4] | Sacramento Co. | Sacramento[4] | Butte County |
| Butte | n/a | (0.1) | n/a | (0.3) | n/a | n/a | n/a | n/a | (3.7) |
| Colusa | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Glenn | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sacramento | 0 | n/a | 0 | n/a | 0 | 0 | 0 | 0 | n/a |
| Shasta | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sutter[5] | 1 | n/a | 11 | n/a | n/a | 3 | n/a | 1 | n/a |
| Yolo | 1 | n/a | 6 | n/a | 4 | 1 | n/a | 1 | n/a |
| Total | 2 | (0.1) | 17 | (0.3) | 4 | 4 | 0 | 1 | (3.7) |
| Classification | Severe-15 | | | | Maintenance | PM2.5 Precursor | Maintenance | Nonattainment | |
| De Minimis Threshold (tpy) | 25 | | | | 100 | 100 | 100 | 100 | |
| Exceed? | No | No | No | No | No | No | No | No | No |

Note:

[1]The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the

[2]The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability

[3]All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

[4]The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis

[5]VOC and NOx emissions are excluded from Sutter County for Cranmore Farms, Garden Highway Mutual Water Company, Gilsizer Slough Ranch, Pleasant Grove-Verona Mutual Water

**Table 2. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)**

| Water Agency | County | VOC | NOx |
|---|---|---|---|
| Biggs-West Gridley Water District | Sutter | n/a | n/a |
| Garden Highway Mutual Water Company | Sutter | Electric | Electric |
| Pelger Mutual Water Company | Sutter | 1.3 | 16 |
| Reclamation District 1004 | Sutter | 0.1 | 2 |
| Tule Basin Farms | Sutter | 0.2 | 8 |
| Total | | 1.6 | 25 |

## Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

**Table 3. Daily VOC Emissions**

| Water Agency | Daily VOC Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 8.52 | 8.52 |
| Eastside Mutual Water Company | 1.70 | | | | | | 1.70 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 3.68 | | | | | | 3.68 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 22.49 | | 22.49 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 19.98 | | 19.98 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 1.58 | 1.58 | | | 1.58 | | 4.74 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 3.52 | | 3.52 |
| **Total** | **6.96** | **1.58** | **0.00** | **0.00** | **44.05** | **8.52** | **61.11** |

**Table 4. Daily NOx Emissions**

| Water Agency | Daily NOx Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 91.12 | 91.12 |
| Eastside Mutual Water Company | 32.26 | | | | | | 32.26 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 69.90 | | | | | | 69.90 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 277.32 | | 277.32 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 175.80 | | 175.80 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 23.57 | 23.57 | | | 23.57 | | 70.70 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 121.68 | | 121.68 |
| **Total** | **125.73** | **23.57** | **0.00** | **0.00** | **598.37** | **91.12** | **838.79** |

## Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

**Table 5. Daily CO Emissions**

| Water Agency | Daily CO Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 68.00 | 68.00 |
| Eastside Mutual Water Company | 29.71 | | | | | | 29.71 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 64.38 | | | | | | 64.38 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 59.76 | | 59.76 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 85.25 | | 85.25 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 13.22 | 13.22 | | | 13.22 | | 39.65 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 9.45 | | 9.45 |
| **Total** | **107.31** | **13.22** | **0.00** | **0.00** | **167.68** | **68.00** | **356.22** |

**Table 6. Daily SOx Emissions**

| Water Agency | Daily SOx Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 17.78 | 17.78 |
| Eastside Mutual Water Company | 10.58 | | | | | | 10.58 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 22.92 | | | | | | 22.92 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 18.34 | | 18.34 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 20.57 | | 20.57 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 3.99 | 3.99 | | | 3.99 | | 11.97 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.02 | | 0.02 |
| **Total** | **37.49** | **3.99** | **0.000** | **0.00** | **42.92** | **17.78** | **102.18** |

**Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)**

**Table 7. Daily PM10 Emissions**

| Water Agency | Daily PM10 Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 7.98 | 7.98 |
| Eastside Mutual Water Company | 1.70 | | | | | | 1.70 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 3.68 | | | | | | 3.68 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 2.96 | | 2.96 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 11.93 | | 11.93 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.83 | 0.83 | | | 0.83 | | 2.49 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **6.21** | **0.83** | **0.0000** | **0.00** | **15.72** | **7.98** | **30.73** |

**Table 8. Daily PM2.5 Emissions**

| Water Agency | Daily PM2.5 Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 7.98 | 7.98 |
| Eastside Mutual Water Company | 1.70 | | | | | | 1.70 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 3.68 | | | | | | 3.68 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 2.89 | | 2.89 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 11.90 | | 11.90 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.83 | 0.83 | | | 0.83 | | 2.48 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **6.20** | **0.83** | **0.0000** | **0.00** | **15.61** | **7.98** | **30.62** |

## Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

**Table 9. Annual VOC Emissions**

| Water Agency | Annual VOC Emissions (tons/yr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 0.55 | 0.55 |
| Eastside Mutual Water Company | 0.10 | | | | | | 0.10 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 0.24 | | | | | | 0.24 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 1.26 | | 1.26 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.29 | | 1.29 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.10 | 0.10 | | | 0.10 | | 0.31 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.23 | | 0.23 |
| **Total** | **0.44** | **0.10** | **0.00** | **0.00** | **2.65** | **0.55** | **3.74** |

**Table 10. Annual NOx Emissions**

| Water Agency | Annual NOx Emissions (tons/yr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 5.89 | 5.89 |
| Eastside Mutual Water Company | 1.92 | | | | | | 1.92 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 4.51 | | | | | | 4.51 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 15.50 | | 15.50 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 11.35 | | 11.35 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 1.52 | 1.52 | | | 1.52 | | 4.57 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 7.86 | | 7.86 |
| **Total** | **7.96** | **1.52** | **0.00** | **0.00** | **36.23** | **5.89** | **51.60** |

**Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)**

**Table 11. Annual CO Emissions**

| Water Agency | Annual CO Emissions (tons/yr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 4.39 | 4.39 |
| Eastside Mutual Water Company | 1.77 | | | | | | 1.77 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 4.16 | | | | | | 4.16 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 3.34 | | 3.34 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 5.51 | | 5.51 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.85 | 0.85 | | | 0.85 | | 2.56 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.61 | | 0.61 |
| **Total** | **6.78** | **0.85** | **0.00** | **0.00** | **10.31** | **4.39** | **22.34** |

**Table 12. Annual SOx Emissions**

| Water Agency | Annual SOx Emissions (tons/yr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 1.15 | 1.15 |
| Eastside Mutual Water Company | 0.63 | | | | | | 0.63 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 1.48 | | | | | | 1.48 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 1.03 | | 1.03 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.33 | | 1.33 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.26 | 0.26 | | | 0.26 | | 0.77 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **2.37** | **0.26** | **0.000** | **0.00** | **2.61** | **1.15** | **6.39** |

## Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

**Table 13. Annual PM10 Emissions**

| Water Agency | Annual PM10 Emissions (tons/yr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 0.52 | 0.52 |
| Eastside Mutual Water Company | 0.10 | | | | | | 0.10 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 0.24 | | | | | | 0.24 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.17 | | 0.17 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.77 | | 0.77 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.05 | 0.05 | | | 0.05 | | 0.16 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **0.39** | **0.05** | **0.0000** | **0.00** | **0.99** | **0.52** | **1.95** |

**Table 14. Annual PM2.5 Emissions**

| Water Agency | Annual PM2.5 Emissions (tons/yr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 0.52 | 0.52 |
| Eastside Mutual Water Company | 0.10 | | | | | | 0.10 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 0.24 | | | | | | 0.24 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.16 | | 0.16 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.77 | | 0.77 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.05 | 0.05 | | | 0.05 | | 0.16 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **0.39** | **0.05** | **0.0000** | **0.00** | **0.98** | **0.52** | **1.94** |

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | |
|---|---|---|
| Agency | Anderson-Cottonwood Irrigation District | |
| Transfer Volume | 4,800 | acre feet/year |
| Location | Shasta | County |

**Table 15. Anderson-Cottonwood Irrigation District Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Power Rating (hp) | Emission Tier | Pump Rate (AF) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| | Barney Street | Electric | 200 | n/a | 4,350 | 5,500 | 83% | 3,996 | 3,946 |
| | Crowley Gulch | Electric | 50 | n/a | 875 | 1,000 | 17% | 804 | 4,365 |
| | | | | | | **Total** | **100%** | **4,800** | **8,311** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Conversion Factors

| | | |
|---|---|---|
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | | | |
|---|---|---|---|---|---|
| Agency | Conaway Preservation Group | | Federal Attainment Status | | Peak Month |
| Transfer Volume | 26,639 acre feet/year | PM10 | A | *Engines subject to ATCM.* | 6,393 AF/month |
| Location | Yolo County | PM2.5 | N | | 46,669 gallons/minute |
| | | O3 | N | | 53% peak pump rate |

**Table 16. Conaway Preservation Group Criteria Pollutant Emissions**

| | | | | | | | | | | | | | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operation (hours/day) | Operation (hours/year) | Fuel Consumption (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Conaway PG6W-3 | 6W-3 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG5W-3 | 5W-3 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG7W-4 | 7W-4 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG12W-5 | 12W-5 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG1W-3 | 1W-3 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG12W-1 | 12W-1 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG7W-2 | 7W-2 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG13W-3 | 13W-3 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG7W-5 | 7W-5 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG32NW-2 | 32NW-2 | Electric | TBD | 114 | n/a | 3,500 | 4% | 255 | 1,062 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG33NW-4 | 33NW-4 | Electric | | 100 | n/a | 3,400 | 4% | 248 | 1,032 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PGOW-2 | OW-2 | Electric | | 100 | n/a | 3,400 | 4% | 248 | 1,032 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PGOW-3 | OW-3 | Electric | | 125 | n/a | 3,400 | 4% | 248 | 1,032 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG32NW-1 | 32NW-1 | Electric | | 100 | n/a | 3,300 | 4% | 240 | 1,001 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG6-2 | 6-2 | Electric | | 100 | n/a | 2,700 | 3% | 197 | 819 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PGOW-1 | OW-1 | Electric | | 100 | n/a | 2,600 | 3% | 189 | 789 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG20-1 | 20-1 | Electric | | 100 | n/a | 2,500 | 3% | 182 | 759 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG21W-1 | 21W-1 | Electric | | 100 | n/a | 2,500 | 3% | 182 | 759 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG31W-1 | 31W-1 | Electric | | 100 | n/a | 2,300 | 3% | 167 | 698 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG33NW-1 | 33NW-1 | Electric | | 100 | n/a | 2,300 | 3% | 167 | 698 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG8-1 | 8-1 | Diesel | 2007 | 170 | T3 | 2,300 | 3% | 167 | 698 | 13 | 1,648 | 15,715 | 0.1 | 2.8 | 3.7 | 0.93 | 0.22 | 0.22 | 0.71 | 13.56 | 17.84 | 4.45 | 1.07 | 1.07 | 0.05 | 0.88 | 1.15 | 0.29 | 0.07 | 0.07 |
| Conaway PG33NW-2 | 33NW-2 | Electric | | 100 | n/a | 2,200 | 3% | 160 | 667 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG33NW-8 | 33NW-8 | Electric | | 100 | n/a | 2,200 | 3% | 160 | 667 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG33NW-3 | 33NW-3 | Electric | | 100 | n/a | 2,100 | 2% | 153 | 637 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG33NW-6 | 33NW-6 | Electric | | 100 | n/a | 2,100 | 2% | 153 | 637 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PGOW-5 | OW-5 | Electric | | 125 | n/a | 2,000 | 2% | 146 | 607 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG33NW-5 | 33NW-5 | Electric | | 100 | n/a | 1,800 | 2% | 131 | 546 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG7W-1 | 7W-1 | Electric | | 100 | n/a | 1,800 | 2% | 131 | 546 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG17W-3 | 17W-3 | Diesel | 2005 | 170 | T2 | 1,700 | 2% | 124 | 516 | 13 | 1,648 | 15,715 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.18 | 22.37 | 17.84 | 4.45 | 1.07 | 1.07 | 0.08 | 1.44 | 1.15 | 0.29 | 0.07 | 0.07 |
| Conaway PGOW-4 | OW-4 | Electric | | 100 | n/a | 1,700 | 2% | 124 | 516 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| Conaway PG16W-2 | 16W-2 | Diesel | 2005 | 170 | T2 | 1,600 | 2% | 117 | 485 | 13 | 1,648 | 15,715 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.18 | 22.37 | 17.84 | 4.45 | 1.07 | 1.07 | 0.08 | 1.44 | 1.15 | 0.29 | 0.07 | 0.07 |
| Conaway PG8-2 | 8-2 | Diesel | 2002 | 170 | T1 | 1,500 | 2% | 109 | 455 | 13 | 1,648 | 15,715 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 5.45 | 32.82 | 14.49 | 4.45 | 4.77 | 4.77 | 0.35 | 2.12 | 0.94 | 0.29 | 0.31 | 0.31 |
| Conaway PG33NW-7 | 33NW-7 | Electric | | 100 | n/a | 1,400 | 2% | 102 | 425 | 13 | 1,648 | n/a | | | | | | | | | | | | | | | | | | |
| | | | | | **Total** | **87,800** | **100%** | **6,393** | **26,639** | **421** | **54,376** | **62,859** | | | | | | | **8.52** | **91.12** | **68.00** | **17.78** | **7.98** | **7.98** | **0.55** | **5.89** | **4.39** | **1.15** | **0.52** | **0.52** |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Average HP from all pumps |
| | Emission factor based on NMHC+NOx emission standard |
| | Emission factor from AP-42 |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | | |
|---|---|---|---|---|---|
| Agency | Eastside Mutual Water Company | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 2,000 acre feet/year | PM10 | A | *Engines not subject to ATCM if remotely-located.* | 480 AF/month |
| Location | Colusa County | PM2.5 | A | | 3,504 gallons/minute |
| | | O3 | A | | 92% peak pump rate |

**Table 17. Eastside Mutual Water Company Criteria Pollutant Emissions**

| | | | | | | | | | | | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Fuel Consumption (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Eastside MWC7631T | 7631T | Diesel | 2006 | 215 | T3 | 3,800 | 100% | 2,000 | 2,858 | 34,476 | 0.1 | 2.8 | 2.6 | 0.9 | 0.15 | 0.15 | 1.70 | 32.26 | 29.71 | 10.58 | 1.70 | 1.70 | 0.10 | 1.92 | 1.77 | 0.63 | 0.10 | 0.10 |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Emission factor based on NMHC+NOx emission standard |
| | Emission factor from AP-42 |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | | |
|---|---|---|---|---|---|
| Agency | Garden Highway Mutual Water Company | | Federal Attainment Status | | |
| Transfer Volume | 7,500 | acre feet/year | PM10 | A | *Engines subject to ATCM.* |
| Location | Sutter | County | PM2.5 | N | |
| | | | O3 | N | |

### Table 18. Garden Highway Mutual Water Company Criteria Pollutant Emissions

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| Garden Highway MWC23 | 23 | Electric | | 110 | n/a | 2,000 | 11% | 829 | 2,250 |
| Garden Highway MWC17 | 17 | Electric | | 110 | n/a | 2,900 | 16% | 1,202 | 2,250 |
| Garden Highway MWC4 | 4 | Electric | | 110 | n/a | 2,100 | 12% | 870 | 2,250 |
| Garden Highway MWC19 | 19 | Electric | | 110 | n/a | 2,600 | 14% | 1,077 | 2,250 |
| Garden Highway MWC24 | 24 | Electric | | 110 | n/a | 3,000 | 17% | 1,243 | 2,250 |
| Garden Highway MWC25 | 25 | Electric | | 110 | n/a | 3,000 | 17% | 1,243 | 2,250 |
| Garden Highway MWC 22 | 22 | Electric | | 110 | n/a | 2,500 | 14% | 1,036 | 2,250 |
| | | | | | | **Total** | **100%** | **7,500** | **15,752** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Legend

Horsepower estimated based on average size engine for fuel type in study area

Conversion Factors

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Goose Club Farms and Teichert Aggregate | Federal Attainment Status | |
| Transfer Volume | 2,000 acre feet/year | PM10 A | *Engines subject to ATCM.* |
| Location | Sutter County | PM2.5 N | |
| | | O3 N | |

**Table 19. Goose Club Farms and Teichert Aggregate Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| Goose Club1 | 1 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club2 | 2 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club3 | 3 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club4 | 4 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club5 | 5 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club6 | 6 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club7 | 7 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club8 | 8 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club9 | 9 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club10 | 10 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club11 | 11 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club12 | 12 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| Goose Club13 | 13 | Electric | TBD | 125 | n/a | 3,000 | 17% | 333 | 603 |
| | | | | | | **Total** | **100%** | **2,000** | **3,621** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Conversion Factors

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | | |
|---|---|---|---|---|---|
| Agency | Maxwell Irrigation District | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 4,700 acre feet/year | PM10 | A | *Engines not subject to ATCM if remotely-located.* | 1,128 AF/month |
| Location | Colusa County | PM2.5 | A | | 8,234 gallons/minute |
| | | O3 | A | | 43% peak pump rate |

### Table 20. Maxwell Irrigation District Criteria Pollutant Emissions

| | | | | | | Pump Rate | | Transfer Volume | | Operation | | Fuel Consumption | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | (gpm) | (% of Total) | (AF/month) | (AF/year) | (hours/day) | (hours/year) | (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| MID1 | MID1 | Diesel | 2006 | 215 | T3 | 3,800 | 20% | 226 | 940 | 10 | 1,343 | 16,204 | 0.1 | 2.8 | 2.6 | 0.9 | 0.15 | 0.15 | 0.74 | 13.98 | 12.88 | 4.58 | 0.74 | 0.74 | 0.05 | 0.90 | 0.83 | 0.30 | 0.05 | 0.05 |
| MID2 | MID2 | Diesel | 2006 | 215 | T3 | 3,800 | 20% | 226 | 940 | 10 | 1,343 | 16,204 | 0.1 | 2.8 | 2.6 | 0.9 | 0.15 | 0.15 | 0.74 | 13.98 | 12.88 | 4.58 | 0.74 | 0.74 | 0.05 | 0.90 | 0.83 | 0.30 | 0.05 | 0.05 |
| MID3 | MID3 | Diesel | 2006 | 215 | T3 | 3,800 | 20% | 226 | 940 | 10 | 1,343 | 16,204 | 0.1 | 2.8 | 2.6 | 0.9 | 0.15 | 0.15 | 0.74 | 13.98 | 12.88 | 4.58 | 0.74 | 0.74 | 0.05 | 0.90 | 0.83 | 0.30 | 0.05 | 0.05 |
| MID4 | MID4 | Diesel | 2006 | 215 | T3 | 3,800 | 20% | 226 | 940 | 10 | 1,343 | 16,204 | 0.1 | 2.8 | 2.6 | 0.9 | 0.15 | 0.15 | 0.74 | 13.98 | 12.88 | 4.58 | 0.74 | 0.74 | 0.05 | 0.90 | 0.83 | 0.30 | 0.05 | 0.05 |
| MID5 | MID5 | Diesel | 2006 | 215 | T3 | 3,800 | 20% | 226 | 940 | 10 | 1,343 | 16,204 | 0.1 | 2.8 | 2.6 | 0.9 | 0.15 | 0.15 | 0.74 | 13.98 | 12.88 | 4.58 | 0.74 | 0.74 | 0.05 | 0.90 | 0.83 | 0.30 | 0.05 | 0.05 |
| | | | | | **Total** | **19,000** | **100%** | **1,128** | **4,700** | **52** | **6,717** | **81,020** | | | | | | | **3.68** | **69.90** | **64.38** | **22.92** | **3.68** | **3.68** | **0.24** | **4.51** | **4.16** | **1.48** | **0.24** | **0.24** |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Engine information assumed to be equivalent to Eastside MWC because it is the adjacent water district. |
| | Emission factor based on NMHC+NOx emission standard |
| | Emission factor from AP-42 |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | | |
|---|---|---|---|---|---|
| Agency | Natomas Central Mutual Water Company | | Federal Attainment Status | | |
| Transfer Volume | 30,000 | acre feet/year | PM10 | M | *Engines subject to ATCM.* |
| Location | Sacramento | County | PM2.5 | N | |
| | Sutter | County | O3 | N | |

**Table 21. Natomas Central Mutual Water Company Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 2 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 3 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 4 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 5 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 6 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 7 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 8 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 9 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 10 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 11 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 12 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | 13 | Electric | | 110 | n/a | 4,200 | 8% | 2,308 | 2,984 |
| | | | | | | **Total** | **100%** | **30,000** | **38,792** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Legend

Horsepower estimated based on average size engine for fuel type in study area

Conversion Factors

| | | |
|---|---|---|
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | | | |
|---|---|---|---|---|---|
| Agency | Pelger Mutual Water Company | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 4,000 acre feet/year | PM10 | A | *Engines subject to ATCM.* | 960 AF/month |
| Location | Sutter County | PM2.5 | N | | 7,008 gallons/minute |
| | | O3 | N | | 50% peak pump rate |

**Table 22. Pelger Mutual Water Company Criteria Pollutant Emissions**

| | | | | | | | | | | | | | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operation (hours/day) | Operation (hours/year) | Fuel Consumption (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Pelger MWC Well 3 Klein | Well 3 Klein | Diesel | | 250 | T0 | 4,700 | 33% | 320 | 1,333 | 12 | 1,541 | 21,608 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 7.50 | 92.44 | 19.92 | 6.11 | 0.99 | 0.96 | 0.42 | 5.17 | 1.11 | 0.34 | 0.06 | 0.05 |
| Pelger MWC Well 1 Tucker | Well 1 Tucker | Diesel | | 250 | T0 | 4,700 | 33% | 320 | 1,333 | 12 | 1,541 | 21,608 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 7.50 | 92.44 | 19.92 | 6.11 | 0.99 | 0.96 | 0.42 | 5.17 | 1.11 | 0.34 | 0.06 | 0.05 |
| Pelger MWC Well 2 Flopet | Well 2 Flopet | Diesel | | 250 | T0 | 4,700 | 33% | 320 | 1,333 | 12 | 1,541 | 21,608 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 7.50 | 92.44 | 19.92 | 6.11 | 0.99 | 0.96 | 0.42 | 5.17 | 1.11 | 0.34 | 0.06 | 0.05 |
| | | | | | **Total** | **14,100** | **100%** | **960** | **4,000** | **36** | **4,622** | | | | | | | | **22.49** | **277.32** | **59.76** | **18.34** | **2.96** | **2.89** | **1.26** | **15.50** | **3.34** | **1.03** | **0.17** | **0.16** |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Pump rate based on Well Development & Test Report (October 13, 1993); maximum test pump rate. |
| | Fuel type assumed to be diesel (worst-case emissions) |
| | Engines assumed to be Tier 0 (noncertified) because model year not known (worst-case emissions). |
| | Emission factor from AP-42 |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Agency | Pleasant Grove-Verona Mutual Water Company | Maximum Pump Rate | 2,880 AF/month | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 12,000 acre feet/year | | 21,023 gallons/minute | PM10 | A | *Engines subject to ATCM.* | 2,880 AF/month |
| Location | Sutter County | | | PM2.5 | N | | 21,023 gallons/minute |
| | | | | O3 | N | | 28% peak pump rate |

**Table 23. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions**

| | | | | | | | | | | | | Fuel | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power Rating | Emission | Pump Rate | | Transfer Volume | | Operation | | Consumption | | | | | | | | | | | | | | | | | | |
| Description | Well | Fuel Type | Model Year | (hp) | Tier | (gpm) | (% of Total) | (AF/month) | (AF/project) | (hours/day) | (hours/year) | (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| PGVMWC Well #1 | Well #1 | Electric | | 30 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #2 | Well #2 | Electric | | 250 | n/a | 5,000 | 7% | 189 | 788 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Monster Pump | Monster Pump | Electric | | 60 | n/a | 3,100 | 4% | 117 | 489 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #12&17 | Well #12&17 | Electric | | 50 | n/a | 1,500 | 2% | 57 | 237 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #11 | Well #11 | Diesel | 2004 | 250 | T2 | 4,200 | 6% | 159 | 662 | 7 | 856 | 12,011 | 0.2 | 4.7 | 2.6 | 0.93 | 0.15 | 0.15 | 0.90 | 17.10 | 9.54 | 3.40 | 0.55 | 0.55 | 0.06 | 1.10 | 0.62 | 0.22 | 0.04 | 0.04 |
| PGVMWC Well #13&15 | Well #13&15 | Electric | | 240 | n/a | 4,800 | 6% | 182 | 757 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #16 | Well #16 | Electric | | 240 | n/a | 1,700 | 2% | 64 | 268 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Willey #1 | Willey #1 | Diesel | 2000 | 168 | T1 | 3,000 | 4% | 114 | 473 | 7 | 856 | 8,071 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 2.80 | 16.86 | 7.44 | 2.28 | 2.45 | 2.45 | 0.18 | 1.09 | 0.48 | 0.15 | 0.16 | 0.16 |
| PGVMWC Willey #2 | Willey #2 | Electric | | 159 | n/a | 3,000 | 4% | 114 | 473 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Willey #3 | Willey #3 | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Willey #4 | Willey #4 | Diesel | 1974 | 150 | T0 | 3,000 | 4% | 114 | 473 | 7 | 856 | 7,207 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.50 | 30.83 | 6.64 | 2.04 | 0.48 | 0.47 | 0.16 | 1.99 | 0.43 | 0.13 | 0.03 | 0.03 |
| PGVMWC Well #30 | Well #30 | Diesel | 2000 | 100 | T1 | 1,500 | 2% | 57 | 237 | 7 | 856 | 4,804 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 1.67 | 10.04 | 4.43 | 1.36 | 1.46 | 1.46 | 0.11 | 0.65 | 0.29 | 0.09 | 0.09 | 0.09 |
| PGVMWC Well #31 | Well #31 | Electric | | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #32 | Well #32 | Electric | | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #33 | Well #33 | Electric | | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas Sand Field Well | Nicholas Sand Field Well | Diesel | 2002 | 62 | T1 | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 1.04 | 6.23 | 2.75 | 0.84 | 0.91 | 0.91 | 0.07 | 0.40 | 0.18 | 0.05 | 0.06 | 0.06 |
| PGVMWC Nicholas Filipino Camp #2 | Nicholas Filipino Camp #2 | Electric | | 40 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas Filipino Camp South | Nicholas Filipino Camp South | Diesel | 2002 | 62 | T1 | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 1.04 | 6.23 | 2.75 | 0.84 | 0.91 | 0.91 | 0.07 | 0.40 | 0.18 | 0.05 | 0.06 | 0.06 |
| PGVMWC Nicholas Johnston Field Well #2 | Nicholas Johnston Field Well #2 | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas Johnston Well | Nicholas Johnston Well | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas 72-Acre Field South | Nicholas 72-Acre Field South | Diesel | 2002 | 62 | T1 | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 1.04 | 6.23 | 2.75 | 0.84 | 0.91 | 0.91 | 0.07 | 0.40 | 0.18 | 0.05 | 0.06 | 0.06 |
| PGVMWC Nicholas 72-Acre Field North | Nicholas 72-Acre Field North | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas BBC Well | Nicholas BBC Well | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Kelly 190 Field Well #2 | Kelly 190 Field Well #2 | Electric | | 30 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Kelly Windmill Field Well #2 | Kelly Windmill Field Well #2 | Diesel | 2002 | 62 | T1 | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 1.04 | 6.23 | 2.75 | 0.84 | 0.91 | 0.91 | 0.07 | 0.40 | 0.18 | 0.05 | 0.06 | 0.06 |
| PGVMWC Kelly Windmill North Field Well | Kelly Windmill North Field Well | Diesel | 2002 | 62 | T1 | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 1.1 | 6.9 | 3.0 | 0.93 | 1.00 | 1.00 | 1.04 | 6.23 | 2.75 | 0.84 | 0.91 | 0.91 | 0.07 | 0.40 | 0.18 | 0.05 | 0.06 | 0.06 |
| PGVMWC Kelly 306 Well | Kelly 306 Well | Electric | | 111 | n/a | 2,600 | 3% | 98 | 410 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Scheidel & Osterli #16 | Scheidel & Osterli #16 | Diesel | 1997 | 234 | T1 | 3,400 | 4% | 129 | 536 | 7 | 856 | 11,242 | 1.0 | 6.9 | 8.5 | 0.93 | 0.40 | 0.40 | 3.32 | 23.48 | 29.10 | 3.18 | 1.38 | 1.38 | 0.21 | 1.52 | 1.88 | 0.21 | 0.09 | 0.09 |
| PGVMWC Scheidel & Osterli #17 | Scheidel & Osterli #17 | Diesel | 1999 | 101 | T0 | 1,500 | 2% | 57 | 237 | 7 | 856 | 4,852 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 1.68 | 20.76 | 4.47 | 1.37 | 0.32 | 0.32 | 0.11 | 1.34 | 0.29 | 0.09 | 0.02 | 0.02 |
| PGVMWC Scheidel & Osterli #18A | Scheidel & Osterli #18A | Diesel | 1999 | 101 | T0 | 1,800 | 2% | 68 | 284 | 7 | 856 | 4,852 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 1.68 | 20.76 | 4.47 | 1.37 | 0.32 | 0.32 | 0.11 | 1.34 | 0.29 | 0.09 | 0.02 | 0.02 |
| PGVMWC River Ranch #19 | River Ranch #19 | Diesel | 2008 | 99 | T3 | 2,500 | 3% | 95 | 394 | 7 | 856 | 4,756 | 0.2 | 3.3 | 3.7 | 0.93 | 0.30 | 0.30 | 0.25 | 4.82 | 5.40 | 1.35 | 0.43 | 0.43 | 0.02 | 0.31 | 0.35 | 0.09 | 0.03 | 0.03 |
| | | | | | Total | 76,100 | 100% | 2,880 | 12,000 | 206 | 26,548 | 72,714 | | | | | | | 19.98 | 175.80 | 85.25 | 20.57 | 11.93 | 11.90 | 1.29 | 11.35 | 5.51 | 1.33 | 0.77 | 0.77 |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Average HP estimated from pump rates |
| | HP interpolated from other pumps |
| | Emission factor from AP-42 |
| | Emission factor based on NMHC+NOx emission standard |

Conversion Factors

| | | | |
|---|---|---|---|
| 1 lb = | 453.6 | g | |
| 1 ton = | 2,000 | lbs | |
| 1 kW = | 1.34 | hp | |
| 1 day = | 24 | hours | |
| 1 hour = | 60 | minutes | |
| 1 month = | 31 | days | (peak occurs in July and August) |
| 1 acre-foot = | 325,851 | gallons | |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | |
|---|---|---|
| Agency | Reclamation District 108 | |
| Transfer Volume | 7,500 | acre feet/year |
| Location | Colusa | County |
| | Yolo | County |

Federal Attainment Status

| | | |
|---|---|---|
| PM10 | A | *Engines not subject to ATCM if remotely-located.* |
| PM2.5 | A | |
| O3 | A | |

**Table 24. Reclamation District 108 Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| RD-108 Well 1 | Well 1 | Electric | | 100 | n/a | 3,300 | 18% | 1,367 | 2,250 |
| RD-108 Well 5 | Well 5 | Electric | | 150 | n/a | 1,500 | 8% | 622 | 2,250 |
| RD-108 Well 6 | Well 6 | Electric | | 250 | n/a | 5,700 | 31% | 2,362 | 2,250 |
| RD-108 Well 7 | Well 7 | Electric | | 250 | n/a | 3,800 | 21% | 1,575 | 2,250 |
| RD-108 Well 8 | Well 8 | Electric | | 250 | n/a | 3,800 | 21% | 1,575 | 2,250 |
| | | | | | **Total** | **18,100** | **100%** | **7,500** | **11,252** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Agency | Reclamation District 1004 | | | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 5,400 | acre feet/year | | PM10 | A | *Engines not subject to ATCM if remotely-located.* | 1,296 AF/month |
| Location | Colusa | County | | PM2.5 | A | | 9,460 gallons/minute |
| | Glenn | County | | O3 | A | | 17% peak pump rate |
| | Sutter | County | | | | | |

**Table 25. Reclamation District 1004 Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/day) | Transfer Volume (AF/year) | Operation (hours/day) | Operation (hours/year) | Fuel Consumption (gal/yr) | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (lbs/day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RD-1004Behring Ranch Club House No. 496461 | Behring Ranch Club House No. 496461 | Electric | | 202 | n/a | 3,400 | 6% | 79 | 330 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Behring Ranch Nursery Well No. 17N1W10H1 | Behring Ranch Nursery Well No. 17N1W10H1 | Diesel | TBD | 40 | T0 | 1,000 | 2% | 23 | 97 | 4 | 527 | 1,184 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.22 | 0.41 | 5.06 | 1.09 | 0.33 | 0.08 | 0.08 | 0.03 | 0.33 | 0.07 | 0.02 | 0.01 | 0.01 |
| RD-1004Gardener No. 498178 | Gardener No. 498178 | Diesel | 2009 | 215 | T3 | 3,500 | 6% | 82 | 340 | 4 | 527 | 6,362 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.29 | 5.49 | 5.06 | 1.80 | 0.29 | 0.29 | 0.02 | 0.35 | 0.33 | 0.12 | 0.02 | 0.02 |
| RD-1004Drumheller Well #7 | Drumheller Well #7 | Diesel | TBD | 162 | T0 | 4,000 | 7% | 93 | 388 | 4 | 527 | 4,794 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 1.66 | 20.51 | 4.42 | 1.36 | 0.32 | 0.31 | 0.11 | 1.32 | 0.29 | 0.09 | 0.02 | 0.02 |
| RD-1004Myers Well #2 No. 340884 | Myers Well #2 No. 340884 | Electric | 1982 | 100 | n/a | 4,100 | 7% | 96 | 398 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Stonewell #6 No. 11334 | Stonewell #6 No. 11334 | Electric | 2006 | 40 | n/a | 1,800 | 3% | 42 | 175 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Myers Well #1 No. 3457 | Myers Well #1 No. 3457 | Electric | 2006 | 40 | n/a | 2,200 | 4% | 51 | 214 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Hall Well No. 369428 | Hall Well No. 369428 | Electric | 2011 | 125 | n/a | 4,500 | 8% | 105 | 437 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Hall Well No. X | Hall Well No. X | Electric | TBD | 148 | n/a | 4,500 | 8% | 105 | 437 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Gardener No. 374672 | Gardener No. 374672 | Diesel | 2008 | 215 | T3 | 3,500 | 6% | 82 | 340 | 4 | 527 | 6,362 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.29 | 5.49 | 5.06 | 1.80 | 0.29 | 0.29 | 0.02 | 0.35 | 0.33 | 0.12 | 0.02 | 0.02 |
| RD-1004Behring Ranch West Well No. 97863 | Behring Ranch West Well No. 97863 | Electric | | 53 | n/a | 2,300 | 4% | 54 | 223 | 4 | 527 | n/a | | | | | | | | | | | | | | | | | | |
| RD-1004Behring Ranch 10 Field Well No. 496441 | Behring Ranch 10 Field Well No. 496441 | Diesel | 2008 | 225 | T3 | 5,800 | 10% | 135 | 563 | 4 | 527 | 6,658 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.30 | 5.74 | 5.29 | 1.88 | 0.30 | 0.30 | 0.02 | 0.37 | 0.34 | 0.12 | 0.02 | 0.02 |
| RD-1004Behring Ranch Pearl 20094 | Behring Ranch Pearl 20094 | Diesel | TBD | 80 | T0 | 2,500 | 4% | 58 | 243 | 4 | 527 | 2,367 | 1.1 | 14.1 | 3.0 | 0.93 | 0.30 | 0.29 | 0.82 | 10.13 | 2.18 | 0.67 | 0.22 | 0.21 | 0.05 | 0.65 | 0.14 | 0.04 | 0.01 | 0.01 |
| RD-1004Sikes & Parachini #2 No. 374682 | Sikes & Parachini #2 No. 374682 | Diesel | 2008 | 150 | T3 | 4,000 | 7% | 93 | 388 | 4 | 527 | 4,439 | 0.1 | 2.8 | 3.7 | 0.93 | 0.22 | 0.22 | 0.20 | 3.83 | 5.04 | 1.26 | 0.30 | 0.30 | 0.01 | 0.25 | 0.33 | 0.08 | 0.02 | 0.02 |
| RD-1004Sikes & Parachini #1 No. 93124 | Sikes & Parachini #1 No. 93124 | Diesel | 2006 | 173 | T2 | 4,000 | 7% | 93 | 388 | 4 | 527 | 5,119 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.38 | 7.29 | 5.81 | 1.45 | 0.35 | 0.35 | 0.02 | 0.47 | 0.38 | 0.09 | 0.02 | 0.02 |
| RD-1004Rancho Valeta No. 726883 | Rancho Valeta No. 726883 | Diesel | 2004 | 170 | T2 | 4,500 | 8% | 105 | 437 | 4 | 527 | 5,030 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.38 | 7.16 | 5.71 | 1.42 | 0.34 | 0.34 | 0.02 | 0.46 | 0.37 | 0.09 | 0.02 | 0.02 |
| | | | | | **Total** | **55,600** | **100%** | **1,296** | **5,400** | **65** | **8,439** | **42,315** | | | | | | | **4.74** | **70.70** | **39.65** | **11.97** | **2.49** | **2.48** | **0.31** | **4.57** | **2.56** | **0.77** | **0.16** | **0.16** |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Average HP estimated from pump rates |
| | HP interpolated from other pumps |
| | Power rating equal to pump with closest equivalent pump rate |
| | Engines assumed to be Tier 0 (noncertified) because model year not known (worst-case emissions). |
| | Emission factor based on NMHC+NOx emission standard |
| | Emission factor from AP-42 |

Conversion Factors

| | | | |
|---|---|---|---|
| 1 lb = | 453.6 | g | |
| 1 ton = | 2,000 | lbs | |
| 1 kW = | 1.34 | hp | |
| 1 day = | 24 | hours | |
| 1 month = | 31 | days | (peak occurs in July and August) |
| 1 hour = | 60 | minutes | |
| 1 acre-foot = | 325,851 | gallons | |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | |
|---|---|---|---|
| Agency | River Garden Farms | | |
| Transfer Volume | 6,000 | acre feet/year | |
| Location | Yolo | County | |

Federal Attainment Status

| | | |
|---|---|---|
| PM10 | A | *Engines subject to ATCM.* |
| PM2.5 | N | |
| O3 | N | |

**Table 26. River Garden Farms Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| RG Field 65 PW | Field 65 PW | Electric | 2008 | 110 | n/a | 2,500 | 14% | 862 | 1,873 |
| RG Field 71 PW | Field 71 PW | Electric | 2001 | 110 | n/a | 1,700 | 10% | 586 | 1,873 |
| RG Field 98 PW | Field 98 PW | Electric | 1963 | 110 | T0 | 2,900 | 17% | 1,000 | 1,873 |
| RG Field 104 PW | Field 104 PW | Electric | 2008 | 110 | n/a | 2,500 | 14% | 862 | 1,873 |
| RG Field 104-09 PW | Field 104-09 PW | Electric | 2009 | 110 | n/a | 2,990 | 17% | 1,031 | 1,873 |
| RG Field 91-09 PW | Field 91-09 PW | Electric | 2009 | 110 | n/a | 2,840 | 16% | 980 | 1,873 |
| RG Field 117 PW | Field 117 PW | Electric | 2009 | 110 | n/a | 1,965 | 11% | 678 | 1,873 |
| | | | | | **Total** | **17,395** | **100%** | **6,000** | **13,113** |

Legend

Horsepower estimated based on average size engine for fuel type in study area

Conversion Factors

| | | | |
|---|---|---|---|
| 1 lb = | 453.6 | g | |
| 1 ton = | 2,000 | lbs | |
| 1 kW = | 1.34 | hp | |
| 1 day = | 24 | hours | |
| 1 month = | 31 | days | (peak occurs in July and August) |
| 1 hour = | 60 | minutes | |
| 1 acre-foot = | 325,851 | gallons | |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency Sycamore Mutual Water Company
Transfer Volume 8,000 acre feet/year
Location Colusa County

**Table 27. Sycamore Mutual Water Company Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| Sycamore Family Trust11 | 11 | Electric | | 100 | n/a | 2,500 | 7% | 571 | 1,241 |
| Sycamore Family Trust15 | 15 | Electric | | 75 | n/a | 2,500 | 7% | 571 | 1,241 |
| Sycamore Family Trust14 | 14 | Electric | | 100 | n/a | 2,500 | 7% | 571 | 1,241 |
| Sycamore Family Trust17 | 17 | Electric | | 125 | n/a | 3,500 | 10% | 800 | 1,241 |
| Sycamore Family Trust1 | 1 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust2 | 2 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust3 | 3 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust4 | 4 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust5 | 5 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust6 | 6 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust7 | 7 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| Sycamore Family Trust8 | 8 | Electric | | 125 | n/a | 3,000 | 9% | 686 | 1,241 |
| | | | | | | **Total** | **100%** | **8,000** | **14,896** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Conversion Factors

1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | |
|---|---|---|
| Agency | Te Velde Revocable Family Trust | |
| Transfer Volume | 5,344 | acre feet/year |
| Location | Yolo | County |

### Table 28. Te Velde Revocable Family Trust Criteria Pollutant Emissions

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) |
|---|---|---|---|---|---|---|---|---|---|
| Sacramento River Ranch123448 | 123448 | elec | | 127 | n/a | 4656 | 35% | 1,856 | 2,165 |
| Sacramento River Ranch123447 | 123447 | elec | | 104 | n/a | 2200 | 16% | 877 | 2,165 |
| Sacramento River Ranch33839 | 33839 | elec | | 143 | n/a | 2833 | 21% | 1,129 | 2,165 |
| Sacramento River Ranch33838 | 33838 | elec | | 125 | n/a | 3715 | 28% | 1,481 | 2,165 |
| | | | | | | **Total** | **100%** | **5,344** | **8,661** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Conversion Factors

| | | |
|---|---|---|
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Agency | Tule Basin Farms | | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 6,400 | acre feet/year | PM10 | A | *Engines subject to ATCM.* | 1,536 AF/month |
| Location | Sutter | County | PM2.5 | N | | 11,212 gallons/minute |
| | | | O3 | N | | 93% peak pump rate |

**Table 29. Tule Basin Farms Criteria Pollutant Emissions**

| | | | | | | | | | | | | | Emission Factors (lb/MMBtu) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operation (hours/day) | Operation (hours/year) | Fuel Consumption (MMBtu/hr) | Fuel Consumption (MMBtu/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Tule Basin Farms1 | 1 | Electric | | 125 | n/a | 3,750 | 31% | 480 | 2,000 | 22 | 2,896 | n/a | n/a | | | | | | | | | | | | | | | | | | |
| Tule Basin Farms2 | 2 | Natural Gas | 1985 | 190 | n/a | 3,750 | 31% | 480 | 2,000 | 22 | 2,896 | 1.33 | 3,852 | 0.118 | 4.08 | 0.317 | 0.00059 | 0.0000771 | 0.0000771 | 3.52 | 121.68 | 9.45 | 0.02 | 0.00 | 0.00 | 0.23 | 7.86 | 0.61 | 0.00 | 0.00 | 0.00 |
| Tule Basin Farms3 | 3 | Electric | | 125 | n/a | 4,500 | 38% | 576 | 2,400 | 22 | 2,896 | n/a | n/a | | | | | | | | | | | | | | | | | | |
| | | | | | **Total** | **12,000** | **100%** | **1,536** | **6,400** | **67** | **8,689** | **1.33** | **3,852** | | | | | | | **3.52** | **121.68** | **9.45** | **0.02** | **0.00** | **0.00** | **0.23** | **7.86** | **0.61** | **0.00** | **0.00** | **0.00** |

Conversion Factors

| | | | |
|---|---|---|---|
| 1 MMBtu = | 1,000,000 | Btu | |
| 1 ton = | 2,000 | pounds | |
| 1 day = | 24 | hours | |
| 1 hour = | 60 | minutes | |
| 1 month = | 31 | days | (peak occurs in July and August) |
| 1 acre-foot = | 325,851 | gallons | |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

| | | | |
|---|---|---|---|
| Estimated BSFC = | 7000 | Btu/bhp-hr | (Estimated from Waukesha engine specifications) |
| Higher Heating Value | 1,020 | Btu/scf | (AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines) |

## CARB Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines

**Table 30**
**Summary of the Emission Standards for New Stationary Diesel-Fueled CI Engines > 50 BHP used in Agricultural Operations**

| Horsepower Range | Diesel PM [1] (g/bhp-hr) | HC (g/bhp-hr) | NOx (g/bhp-hr) | NMHC+NOx (g/bhp-hr) | CO (g/bhp-hr) |
|---|---|---|---|---|---|
| 50<HP<100 | 0.3 | | | | |
| 100<=HP<175 | 0.22 | | | | |
| 175<=HP | 0.15 | | | | |

*Source: See Section 93115.8(a)*

Notes:

[1] Less than or equal to the emission standard OR Off-Road CI Engine Certification Standard for an off-road engine of the maximum rated power, whichever is more stringent.

[2] Off-Road CI Engine Certification Standard for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard, or Tier 1 standards.

[3] Prior to January 1, 2008, these limits shall not apply to engines sold from one agricultural operation to another and funded under State or federal incentive.

**Table 31**
**Emission Standards for Noncertified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations**

| Horsepower (HP) Range | Compliance Date [1] | PM (g/bhp-hr) | HC [2,3] (g/bhp-hr) | NOx [2,3] (g/bhp-hr) | NMHC+NOx [2,3] (g/bhp-hr) | CO [2,3] (g/bhp-hr) |
|---|---|---|---|---|---|---|
| 50<HP<75 | 2011 | 0.3 | | | | |
| 75<=HP<100 | 2011 | 0.3 | | | | |
| 100<=HP<175 | 2010 | 0.22 | | | | |
| 175<=HP<=750 | 2010 | 0.15 | | | | |
| 750<HP | 2014 | 0.075 | | | | |

*Source: See Sections 93115.8(b) (2) and (4)*

Note:

[1] Compliance date on or after December 31

[2] Engine Certification Standards for off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in Title 13.

**Table 32**
**Emission Standards Tier 1- and Tier 2-Certified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations**

| Horsepower Range (hp) | Compliance Date | PM (g/bhp-hr) | HC [2,3] (g/bhp-hr) | NOx [2,3] (g/bhp-hr) | NMHC+NOx [2,3] (g/bhp-hr) | CO [2,3] (g/bhp-hr) |
|---|---|---|---|---|---|---|
| 50<HP<75 | 2015 | 0.02 | | | | |
| 75<=HP<175 | 2015 | 0.01 | | | | |
| 175<=hp<=750 | 2014 | 0.01 | | | | |
| 750<HP | 2014 | 0.075 | | | | |

*Source: See Sections 93115.8(b)(3) and (4)*

Notes:

[1] Compliance date on or after December 31 or 12 years after the date of initial installation, whichever is later.

[2] Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in agricultural operation shall not exceed Tier 1 standards in Tier 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

**Table 33**
**Tier 1, Tier 2, and Tier 3 Exhaust Emission Standards**

| Maximum Rated Power | Tier | Model Year | (g/kW-hr) | | | | | (g/hp-hr) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NOx | HC | NMHC+NOx | CO | PM | NOx | HC | NMHC+NOx | CO | PM |
| kW<8 | T1 | 2000-2004 | - | - | 10.5 | 8.0 | 1 | - | - | 7.8 | 6.0 | 0.7 |
| *hp <11* | T2 | 2005 -2007 | - | - | 7.5 | 8.0 | 0.8 | - | - | 5.6 | 6.0 | 0.6 |
| 8≤kW<19 | T1 | 2000-2004 | - | - | 9.5 | 6.6 | 0.8 | - | - | 7.1 | 4.9 | 0.6 |
| *11<=hp<25* | T2 | 2005 -2007 | - | - | 7.5 | 6.6 | 0.8 | - | - | 5.6 | 4.9 | 0.6 |
| 19≤kW<37 | T1 | 2000-2003 | - | - | 9.5 | 5.5 | 0.8 | - | - | 7.1 | 4.1 | 0.6 |
| *25<=hp<50* | T2 | 2004 -2007 | - | - | 7.5 | 5.5 | 0.6 | - | - | 5.6 | 4.1 | 0.4 |
| 37≤kW<56 | T1 | 2000-2003 | 9.2 | - | - | - | - | 6.9 | - | - | - | - |
| *50<=hp<75* | T2 | 2004-2007 | - | - | 7.5 | 5.0 | 0.4 | - | - | 5.6 | 3.7 | 0.3 |
| | T3 | 2008 -2011 | - | - | 4.7 | 5.0 | 0.4 | - | - | 3.5 | 3.7 | 0.3 |
| 56≤kW<75 | T1 | 2000-2003 | 9.2 | - | - | - | - | 6.9 | - | - | - | - |
| *75<=hp<100* | T2 | 2004-2007 | - | - | 7.5 | 5.0 | 0.4 | - | - | 5.6 | 3.7 | 0.3 |
| | T3 | 2008-2011 | - | - | 4.7 | 5.0 | 0.4 | - | - | 3.5 | 3.7 | 0.3 |
| 75≤kW<130 | T1 | 2000-2002 | 9.2 | - | - | - | - | 6.9 | - | - | - | - |
| *100<=hp<175* | T2 | 2003-2006 | - | - | 6.6 | 5.0 | 0.3 | - | - | 4.9 | 3.7 | 0.2 |
| | T3 | 2007 -2011 | - | - | 4.0 | 5.0 | 0.3 | - | - | 3.0 | 3.7 | 0.2 |
| 130≤kW<225 | T1 | 1996-2002 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *175<=hp<300* | T2 | 2003-2005 | - | - | 6.6 | 3.5 | 0.2 | - | - | 4.9 | 2.6 | 0.1 |
| | T3 | 2006 -2010 | - | - | 4.0 | 3.5 | 0.2 | - | - | 3.0 | 2.6 | 0.1 |
| 225≤kW<450 | T1 | 1996-2000 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *300<=hp<600* | T2 | 2001-2005 | - | - | 6.4 | 3.5 | 0.2 | - | - | 4.8 | 2.6 | 0.1 |
| | T3 | 2006 -2010 | - | - | 4.0 | 3.5 | 0.2 | - | - | 3.0 | 2.6 | 0.1 |
| 450≤kW≤560 | T1 | 1996-2001 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *600<=hp<750* | T2 | 2002-2005 | - | - | 6.4 | 3.5 | 0.2 | - | - | 4.8 | 2.6 | 0.1 |
| | T3 | 2006 -2010 | - | - | 4.0 | 3.5 | 0.2 | - | - | 3.0 | 2.6 | 0.1 |
| kW>560 | T1 | 2000-2005 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *hp>750* | T2 | 2006 -2010 | - | - | 6.4 | 3.5 | 0.2 | - | - | 4.8 | 2.6 | 0.1 |

*Source: Title 13, California Code of Regulations, Division 3, Chapter 9, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."*

NOx and NMHC fraction - Table B-26

| | |
|---|---|
| NOx | 95% |
| NMHC | 5% |

http://www.arb.ca.gov/msprog/moyer/guidelines/cmp_guidelines_part4.pdf

PM Size Fractions

| | |
|---|---|
| PM10 | 0.96 |
| PM2.5 | 0.937 |
| Ratio | 0.98 |

CARB PMSIZE Profile No. 116 (STAT. I.C. ENGINE-DIESEL)

**Table 34**
**Tier 4 Exhaust Emission Standards**

| MAXIMUM ENGINE POWER | MODEL YEAR | TYPE | PM | NMHC+ NOx | NMHC | NOx | CO |
|---|---|---|---|---|---|---|---|
| | | | grams per horsepower-hour | | | | |
| hp<11 | 2008 and later | FINAL | 0.30 | 5.6 | - | - | 6.0 |
| 11<=hp<25 | | | | | | | 4.9 |
| 25<=hp<50 | 2008-2012 | INTERIM | 0.22 | 5.6 | - | - | 4.1 |
| | 2013 and later | FINAL | 0.02 | 3.5 | | | |
| 50<=hp<75 | 2008-2012 | INTERIM | 0.22 | 3.5 | - | - | 3.7 |
| | 2013 and later | FINAL | 0.02 | | | | |
| 75<=hp<100 | 2012-2014 | PHASE-IN | 0.01 | - | 0.14 | 0.3 | 3.7 |
| | | PHASE-OUT | | 3.5 | - | - | |
| | | or/ ALT NOx | | | 0.14 | 2.5 | |
| | 2015 and later | FINAL | | - | | 0.3 | |
| 100<=hp<175 | 2012-2014 | PHASE-IN | 0.01 | - | 0.14 | 0.3 | 3.7 |
| | | PHASE-OUT | | 3.0 | - | - | |
| | | or/ ALT NOx | | - | 0.14 | 2.5 | |
| | 2015 and later | FINAL | | | 0.14 | 0.3 | |
| 175<=hp<=750 | 2011-2013 | PHASE-IN | 0.01 | - | 0.14 | 0.3 | 2.6 |
| | 2014 and later | PHASE-OUT | | 3.0 | - | - | |
| | | or/ ALT NOx | | - | 0.14 | 1.5 | |
| | | FINAL | | | | 0.3 | |
| 750 hp<GEN<=1205 hp | 2011-2014 | INTERIM | 0.07 | - | 0.30 | 2.6 | 2.6 |
| | 2015 and later | FINAL | 0.02 | | 0.14 | 0.5 | |
| GEN>1205 hp | 2011-2014 | INTERIM | 0.07 | - | 0.30 | | 2.6 |
| | 2015 and later | FINAL | 0.02 | | 0.14 | 0.5 | |
| ELSE>750 hp | 2011-2014 | INTERIM | 0.07 | - | 0.30 | 2.6 | 2.6 |
| | 2015 and later | FINAL | 0.03 | - | 0.14 | | |

*Source: Title 13, California Code of Regulations, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."*

**Table 35**
**Engine Tier Matrix**

| | Year | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HP Range** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| hp <11 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T4 | T4 | T4 | T4 | T4 | T4 | T4 | T4 |
| 11<=hp<25 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T4 | T4 | T4 | T4 | T4 | T4 | T4 | T4 |
| 25<=hp<50 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T4I | T4I | T4I | T4I | T4I | T4 | T4 | T4 |
| 50<=hp<75 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T4I | T4I | T4I | T4I | T4I | T4 | T4 | T4 |
| 75<=hp<100 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 |
| 100<=hp<175 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 |
| 175<=hp<300 | T1 | T1 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 | T4 |
| 300<=hp<600 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 | T4 |
| 600<=hp<750 | T1 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 | T4 |
| hp>750 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T2 | T4I | T4I | T4I | T4I | T4 |

Key:

T0 = Tier 0 (Noncertified)
T1 = Tier 1
T2 = Tier 2
T3 = Tier 3
T4 = Tier 4
T4I = Tier 4 Interim

## AP-42 Emission Factors

### Table 36
### Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines [a]

| Pollutant | Gasoline Fuel Emission Factor (lb/hp-hr) (power output) | Gasoline Fuel Emission Factor (lb/MMBtu) (fuel input) | Diesel Fuel Emission Factor (lb/hp-hr) (power output) | Diesel Fuel Emission Factor (lb/MMBtu) (fuel input) | Emission Factor Rating |
|---|---|---|---|---|---|
| NOx | 0.011 | 1.63 | 0.031 | 4.41 | D |
| CO | 6.96E-03 [d] | 0.99 [d] | 6.68E-03 | 0.95 | D |
| SOx | 5.91E-04 | 0.084 | 2.05E-03 | 0.29 | D |
| PM-10 [b] | 7.21E-04 | 0.1 | 2.20E-03 | 0.31 | D |
| CO2 [c] | 1.08 | 154 | 1.15 | 164 | B |
| Aldehydes | 4.85E-04 | 0.07 | 4.63E-04 | 0.07 | D |
| TOC | | | | | |
| Exhaust | 0.015 | 2.1 | 2.47E-03 | 0.35 | D |
| Evaporative | 6.61E-04 | 0.09 | 0.00 | 0.00 | E |
| Crankcase | 4.85E-03 | 0.69 | 4.41E-05 | 0.01 | E |
| Refueling | 1.08E-03 | 0.15 | 0.00 | 0.00 | E |

*Source: U.S. Environmental Protection Agency. 1996. Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.3: Gasoline and Diesel Industrial Engines.*

Notes:

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kwhr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 :m aerodynamic diameter. All particulate is assumed to be 10 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

[d] Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

For large stationary diesel engines (greater than 600 horsepower [hp]) see Chapter 3.4: Large Stationary Diesel and All Stationary Dual-Fuel Engines.

**Table 37**
**Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines [a]**

| Pollutant | Emission Factor (lb/MMBtu) [b] (fuel input) | Emission Factor Rating |
|---|---|---|
| NOx [c] 90 - 105% Load | 4.08E+00 | B |
| NOx [c] <90% Load | 8.47E-01 | B |
| CO [c] 90 - 105% Load | 3.17E-01 | C |
| CO [c] <90% Load | 5.57E-01 | B |
| CO2 [d] | 1.10E+02 | A |
| SO2 [e] | 5.88E-04 | A |
| TOC [f] | 1.47E+00 | A |
| Methane[g] | 1.25E+00 | C |
| VOC [h] | 1.18E-01 | C |
| PM10 (filterable) [i] | 7.71E-05 | D |
| PM2.5 (filterable) [i] | 7.71E-05 | D |
| PM Condensable [j] | 9.91E-03 | D |

*Source: U.S. Environmental Protection Agency. 2000. Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.2: Natural Gas-Fired Reciprocating Engines. July.*
Notes:

[a] Reference 7. Factors represent uncontrolled levels. For NOx, CO, and PM10, “uncontrolled” means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, the data set may include units with control techniques used for NOx control, such as PCC“uncontrolled” means no oxidation control; and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (μ) aerodynamic diameter. A “<“ sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/$10^6$ scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

lb/hp-hr = (lb/MMBtu) (heat input, MMBtu/hr) (1/operating HP, 1/hp)

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO2. CO2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/$10^6$ scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60EF).

[e] Based on 100% conversion of fuel sulfur to SO2. Assumes sulfur content in natural gas of 2,000 gr/$10^b$scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered ≤ 1 μ in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

## Engine Size Summary

**Table 38**
**Engine Power Rating Summary by Fuel Type**

| Fuel Type | No. Engines | Avg. HP | Max HP | Min HP |
|---|---|---|---|---|
| Diesel | 26 | 140 | 250 | 62.1 |
| Electric | 38 | 110 | 250 | 30 |
| Natural Gas | 1 | 190 | 190 | 190 |

**Table 39. General Conformity Applicability Evaluation (Mitigated Emissions)**

| County/ Nonattainment Area | Emissions (tons per year) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | VOC | | NOx | | CO | SOx | PM10 | PM2.5 | |
| | Sacramento Metro[1] | Butte County | Sacramento Metro[1] | Butte County | Sacramento Area[2] | Sacramento[3,4] | Sacramento Co. | Sacramento[4] | Butte County |
| Butte | n/a | (0.1) | n/a | (0.3) | n/a | n/a | n/a | n/a | (4) |
| Colusa | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Glenn | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sacramento | 0.0 | n/a | 0.0 | n/a | 0.0 | 0.0000 | 0.0000 | 0.0000 | n/a |
| Shasta | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sutter[5] | (0.01) | n/a | 1.3 | n/a | n/a | 2.6 | n/a | 0.2 | n/a |
| Yolo | 0.55 | n/a | 5.9 | n/a | 4.4 | 1.1 | n/a | 0.5 | n/a |
| Total | 1 | (0) | 7 | (0) | 4 | 4 | 0 | 1 | (4) |
| Classification | Severe-15 | | | | Maintenance | PM2.5 Precursor | Maintenance | Nonattainment | |
| De Minimis Threshold (tpy) | 25 | | | | 100 | 100 | 100 | 100 | |
| Exceed? | No | No | No | No | No | No | No | No | No |

Note:

[1]The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the

[2]The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability

[3]All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

[4]The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis

[5]VOC and NOx emissions are excluded from Sutter County for Cranmore Farms, Garden Highway Mutual Water Company, Gilsizer Slough Ranch, Pleasant Grove-Verona Mutual Water Company,

**Table 40. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)**

| Water Agency | County | VOC | NOx |
|---|---|---|---|
| Biggs-West Gridley Water District | Sutter | n/a | n/a |
| Garden Highway Mutual Water Company | Sutter | Electric | Electric |
| Pelger Mutual Water Company | Sutter | 0.2 | 0.3 |
| Reclamation District 1004 | Sutter | 0.1 | 1.5 |
| Tule Basin Farms | Sutter | 0.2 | 0.8 |
| Total | | 0.5 | 2.6 |

## Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

**Table 40. Daily VOC Emissions**

| Water Agency | Daily VOC Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 8.52 | 8.52 |
| Eastside Mutual Water Company | 1.70 | | | | | | 1.70 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0.00 |
| Maxwell Irrigation District | 3.68 | | | | | | 3.68 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 2.80 | | 2.80 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 3.47 | | 3.47 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 1.58 | 1.58 | | | 1.58 | | 4.74 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 3.77 | | 3.77 |
| **Total** | **6.96** | **1.58** | **0.00** | **0.00** | **7.84** | **8.52** | **24.90** |

**Table 41. Daily NOx Emissions**

| Water Agency | Daily NOx Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 91.12 | 91.12 |
| Eastside Mutual Water Company | 32.26 | | | | | | 32.26 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 69.90 | | | | | | 69.90 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 5.89 | | 5.89 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 23.78 | | 23.78 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 23.57 | 23.57 | | | 23.57 | | 70.70 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 13.02 | | 13.02 |
| **Total** | **125.73** | **23.57** | **0.00** | **0.00** | **66.26** | **91.12** | **306.67** |

**Summary of Daily Groundwater Substitution Emissions by County (Mitigated)**

**Table 42. Daily CO Emissions**

| Water Agency | Daily CO Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 68.00 | 68.00 |
| Eastside Mutual Water Company | 29.71 | | | | | | 29.71 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 64.38 | | | | | | 64.38 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 51.51 | | 51.51 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 67.17 | | 67.17 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 13.22 | 13.22 | | | 13.22 | | 39.65 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 10.12 | | 10.12 |
| **Total** | **107.31** | **13.22** | **0.00** | **0.00** | **142.02** | **68.00** | **330.56** |

**Table 43. Daily SOx Emissions**

| Water Agency | Daily SOx Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 17.78 | 17.78 |
| Eastside Mutual Water Company | 10.58 | | | | | | 10.58 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 22.92 | | | | | | 22.92 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 18.34 | | 18.34 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 21.52 | | 21.52 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 3.99 | 3.99 | | | 3.99 | | 11.97 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.02 | | 0.02 |
| **Total** | **37.49** | **3.99** | **0.000** | **0.00** | **43.87** | **17.78** | **103.13** |

## Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

**Table 44. Daily PM10 Emissions**

| Water Agency | Daily PM10 Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 7.98 | 7.98 |
| Eastside Mutual Water Company | 1.70 | | | | | | 1.70 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 3.68 | | | | | | 3.68 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.29 | | 0.29 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.51 | | 1.51 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.83 | 0.83 | | | 0.83 | | 2.49 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **6.21** | **0.83** | **0.0000** | **0.00** | **2.63** | **7.98** | **17.65** |

**Table 45. Daily PM2.5 Emissions**

| Water Agency | Daily PM2.5 Emissions (lbs/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 7.98 | 7.98 |
| Eastside Mutual Water Company | 1.70 | | | | | | 1.70 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 3.68 | | | | | | 3.68 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.29 | | 0.29 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.47 | | 1.47 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.83 | 0.83 | | | 0.83 | | 2.48 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **6.20** | **0.83** | **0.0000** | **0.00** | **2.59** | **7.98** | **17.60** |

**Summary of Annual Groundwater Substitution Emissions by County (Mitigated)**

**Table 40. Annual VOC Emissions**

| Water Agency | Annual VOC Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 0.55 | 0.55 |
| Eastside Mutual Water Company | 0.10 | | | | | | 0.10 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0.00 |
| Maxwell Irrigation District | 0.24 | | | | | | 0.24 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.16 | | 0.16 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.21 | | 0.21 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.10 | 0.10 | | | 0.10 | | 0.31 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.23 | | 0.23 |
| **Total** | **0.44** | **0.10** | **0.00** | **0.00** | **0.47** | **0.55** | **1.56** |

**Table 41. Annual NOx Emissions**

| Water Agency | Annual NOx Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 5.89 | 5.89 |
| Eastside Mutual Water Company | 1.92 | | | | | | 1.92 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 4.51 | | | | | | 4.51 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.33 | | 0.33 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.32 | | 1.32 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 1.52 | 1.52 | | | 1.52 | | 4.57 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.79 | | 0.79 |
| **Total** | **7.96** | **1.52** | **0.00** | **0.00** | **3.95** | **5.89** | **19.32** |

## Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

**Table 42. Annual CO Emissions**

| Water Agency | Annual CO Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 4.39 | 4.39 |
| Eastside Mutual Water Company | 1.77 | | | | | | 1.77 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 4.16 | | | | | | 4.16 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 2.88 | | 2.88 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 4.14 | | 4.14 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.85 | 0.85 | | | 0.85 | | 2.56 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.61 | | 0.61 |
| **Total** | **6.78** | **0.85** | **0.00** | **0.00** | **8.48** | **4.39** | **20.51** |

**Table 43. Annual SOx Emissions**

| Water Agency | Annual SOx Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 1.15 | 1.15 |
| Eastside Mutual Water Company | 0.63 | | | | | | 0.63 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 1.48 | | | | | | 1.48 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 1.03 | | 1.03 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.33 | | 1.33 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.26 | 0.26 | | | 0.26 | | 0.77 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **2.37** | **0.26** | **0.000** | **0.00** | **2.61** | **1.15** | **6.39** |

**Summary of Annual Groundwater Substitution Emissions by County (Mitigated)**

**Table 44. Annual PM10 Emissions**

| Water Agency | Annual PM10 Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 0.52 | 0.52 |
| Eastside Mutual Water Company | 0.10 | | | | | | 0.10 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 0.24 | | | | | | 0.24 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.02 | | 0.02 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.08 | | 0.08 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.05 | 0.05 | | | 0.05 | | 0.16 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **0.39** | **0.05** | **0.0000** | **0.00** | **0.15** | **0.52** | **1.11** |

**Table 45. Annual PM2.5 Emissions**

| Water Agency | Annual PM2.5 Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | Electric | | | 0.00 |
| Conaway Preservation Group | | | | | | 0.52 | 0.52 |
| Eastside Mutual Water Company | 0.10 | | | | | | 0.10 |
| Garden Highway Mutual Water Company | | | | | Electric | | 0.00 |
| Goose Club Farms and Teichert Aggregate | | | | | Electric | | 0 |
| Maxwell Irrigation District | 0.24 | | | | | | 0.24 |
| Natomas Central Mutual Water Company | | | Electric | | Electric | | 0.00 |
| Pelger Mutual Water Company | | | | | 0.02 | | 0.02 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.08 | | 0.08 |
| Reclamation District 108 | Electric | | | | | Electric | 0.00 |
| Reclamation District 1004 | 0.05 | 0.05 | | | 0.05 | | 0.16 |
| River Garden Farms | | | | | | Electric | 0.00 |
| Sycamore Mutual Water Company | Electric | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | Electric | 0.00 |
| Tule Basin Farms | | | | | 0.00 | | 0.00 |
| **Total** | **0.39** | **0.05** | **0.0000** | **0.00** | **0.15** | **0.52** | **1.11** |

## Mitigated Groundwater Substitution Air Quality Emissions

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Agency | Pelger Mutual Water Company | | Federal Attainment Status | | | Peak Month | |
| Transfer Volume | 4,000 | acre feet/year | PM10 | A | *Engines subject to ATCM.* | 960 | AF/month |
| Location | Sutter | County | PM2.5 | N | | 7,008 | gallons/minute |
| | | | O3 | N | | 50% | peak pump rate |

**Table 46. Pelger Mutual Water Company Criteria Pollutant Emissions**

| | | | | | | | | | | | | | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operation (hours/day) | Operation (hours/year) | Fuel Consumption (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Pelger MWC Well 3 Klein | Well 3 Klein | Diesel | 2013 | 250 | T4I | 4,700 | 33% | 320 | 1,333 | 12 | 1,541 | 21,608 | 0.14 | 0.30 | 2.6 | 0.93 | 0.01 | 0.01 | 0.93 | 1.96 | 17.17 | 6.11 | 0.10 | 0.10 | 0.05 | 0.11 | 0.96 | 0.34 | 0.01 | 0.01 |
| Pelger MWC Well 1 Tucker | Well 1 Tucker | Diesel | 2013 | 250 | T4I | 4,700 | 33% | 320 | 1,333 | 12 | 1,541 | 21,608 | 0.14 | 0.30 | 2.6 | 0.93 | 0.01 | 0.01 | 0.93 | 1.96 | 17.17 | 6.11 | 0.10 | 0.10 | 0.05 | 0.11 | 0.96 | 0.34 | 0.01 | 0.01 |
| Pelger MWC Well 2 Flopet | Well 2 Flopet | Diesel | 2013 | 250 | T4I | 4,700 | 33% | 320 | 1,333 | 12 | 1,541 | 21,608 | 0.14 | 0.30 | 2.6 | 0.93 | 0.01 | 0.01 | 0.93 | 1.96 | 17.17 | 6.11 | 0.10 | 0.10 | 0.05 | 0.11 | 0.96 | 0.34 | 0.01 | 0.01 |
| | | | | | **Total** | **14,100** | **100%** | **960** | **4,000** | **36** | **4,622** | | | | | | | | **2.80** | **5.89** | **51.51** | **18.34** | **0.29** | **0.29** | **0.16** | **0.33** | **2.88** | **1.03** | **0.02** | **0.02** |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Pump rate based on Well Development & Test Report (October 13, 1993); maximum test pump rate. |
| | Fuel type assumed to be diesel (worst-case emissions) |
| | Engines converted to current model year as mitigation |
| | Emission factor from AP-42 |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

**Groundwater Substitution Air Quality Emissions**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Agency | Pleasant Grove-Verona Mutual Water Company | Maximum Pump Rate | 2,880 AF/month | Federal Attainment Status | | | Peak Month |
| Transfer Volume | 12,000 acre feet/year | | 21,023 gallons/minute | PM10 | A | *Engines subject to ATCM.* | 2,880 AF/month |
| Location | Sutter County | | | PM2.5 | N | | 21,023 gallons/minute |
| | | | | O3 | N | | 28% peak pump rate |

**Table 47. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions**

| | | | | | | | | | | | | Fuel | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power Rating | Emission | Pump Rate | | Transfer Volume | | Operation | | Consumption | | | | | | | | | | | | | | | | | | |
| Description | Well | Fuel Type | Model Year | (hp) | Tier | (gpm) | (% of Total) | (AF/month) | (AF/project) | (hours/day) | (hours/year) | (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| PGVMWC Well #1 | Well #1 | Electric | | 30 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #2 | Well #2 | Electric | | 250 | n/a | 5,000 | 7% | 189 | 788 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Monster Pump | Monster Pump | Electric | | 60 | n/a | 3,100 | 4% | 117 | 489 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #12&17 | Well #12&17 | Electric | | 50 | n/a | 1,500 | 2% | 57 | 237 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #11 | Well #11 | Diesel | 2013 | 250 | n/a | 4,200 | 6% | 159 | 662 | 7 | 856 | 12,011 | 0.14 | 0.3 | 2.6 | 0.93 | 0.01 | 0.01 | 0.52 | 1.09 | 9.54 | 3.40 | 0.05 | 0.05 | 0.03 | 0.07 | 0.62 | 0.22 | 0.00 | 0.00 |
| PGVMWC Well #13&15 | Well #13&15 | Electric | | 240 | n/a | 4,800 | 6% | 182 | 757 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #16 | Well #16 | Electric | | 240 | n/a | 1,700 | 2% | 64 | 268 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Willey #1 | Willey #1 | Diesel | 2013 | 168 | n/a | 3,000 | 4% | 114 | 473 | 7 | 856 | 8,071 | 0.14 | 0.3 | 3.0 | 0.93 | 0.01 | 0.01 | 0.35 | 0.73 | 7.44 | 2.28 | 0.04 | 0.04 | 0.02 | 0.05 | 0.48 | 0.15 | 0.00 | 0.00 |
| PGVMWC Willey #2 | Willey #2 | Electric | | 159 | n/a | 3,000 | 4% | 114 | 473 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Willey #3 | Willey #3 | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Willey #4 | Willey #4 | Diesel | 2013 | 150 | n/a | 3,000 | 4% | 114 | 473 | 7 | 856 | 7,207 | 0.14 | 0.3 | 3.0 | 0.93 | 0.01 | 0.01 | 0.31 | 0.65 | 6.64 | 2.04 | 0.03 | 0.03 | 0.02 | 0.04 | 0.43 | 0.13 | 0.00 | 0.00 |
| PGVMWC Well #30 | Well #30 | Diesel | 2013 | 100 | n/a | 1,500 | 2% | 57 | 237 | 7 | 856 | 4,804 | 0.14 | 0.3 | 3.0 | 0.93 | 0.01 | 0.01 | 0.21 | 0.44 | 4.43 | 1.36 | 0.02 | 0.02 | 0.01 | 0.03 | 0.29 | 0.09 | 0.00 | 0.00 |
| PGVMWC Well #31 | Well #31 | Electric | | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #32 | Well #32 | Electric | | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Well #33 | Well #33 | Electric | | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas Sand Field Well | Nicholas Sand Field Well | Diesel | 2013 | 62 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.16 | 3.02 | 2.75 | 0.84 | 0.20 | 0.20 | 0.01 | 0.20 | 0.18 | 0.05 | 0.01 | 0.01 |
| PGVMWC Nicholas Filipino Camp #2 | Nicholas Filipino Camp #2 | Electric | | 40 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.10 | 1.95 | 1.77 | 0.54 | 0.13 | 0.13 | | | | | | |
| PGVMWC Nicholas Filipino Camp South | Nicholas Filipino Camp South | Diesel | 2013 | 62 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.16 | 3.02 | 2.75 | 0.84 | 0.20 | 0.20 | 0.01 | 0.20 | 0.18 | 0.05 | 0.01 | 0.01 |
| PGVMWC Nicholas Johnston Field Well #2 | Nicholas Johnston Field Well #2 | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas Johnston Well | Nicholas Johnston Well | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas 72-Acre Field South | Nicholas 72-Acre Field South | Diesel | 2013 | 62 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.16 | 3.02 | 2.75 | 0.84 | 0.20 | 0.20 | 0.01 | 0.20 | 0.18 | 0.05 | 0.01 | 0.01 |
| PGVMWC Nicholas 72-Acre Field North | Nicholas 72-Acre Field North | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Nicholas BBC Well | Nicholas BBC Well | Electric | | 58 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Kelly 190 Field Well #2 | Kelly 190 Field Well #2 | Electric | | 30 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | n/a | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.08 | 1.46 | 1.33 | 0.41 | 0.10 | 0.10 | | | | | | |
| PGVMWC Kelly Windmill Field Well #2 | Kelly Windmill Field Well #2 | Diesel | 2013 | 62 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.16 | 3.02 | 2.75 | 0.84 | 0.20 | 0.20 | 0.01 | 0.20 | 0.18 | 0.05 | 0.01 | 0.01 |
| PGVMWC Kelly Windmill North Field Well | Kelly Windmill North Field Well | Diesel | 2013 | 62 | n/a | 2,000 | 3% | 76 | 315 | 7 | 856 | 2,984 | 0.2 | 3.3 | 3.0 | 0.93 | 0.22 | 0.22 | 0.16 | 3.02 | 2.75 | 0.84 | 0.20 | 0.20 | 0.01 | 0.20 | 0.18 | 0.05 | 0.01 | 0.01 |
| PGVMWC Kelly 306 Well | Kelly 306 Well | Electric | | 111 | n/a | 2,600 | 3% | 98 | 410 | 7 | 856 | n/a | | | | | | | | | | | | | | | | | | |
| PGVMWC Scheidel & Osterli #16 | Scheidel & Osterli #16 | Diesel | 2013 | 234 | n/a | 3,400 | 4% | 129 | 536 | 7 | 856 | 11,242 | 0.14 | 0.3 | 2.6 | 0.93 | 0.01 | 0.01 | 0.48 | 1.02 | 8.93 | 3.18 | 0.05 | 0.05 | 0.03 | 0.07 | 0.58 | 0.21 | 0.00 | 0.00 |
| PGVMWC Scheidel & Osterli #17 | Scheidel & Osterli #17 | Diesel | 2013 | 101 | n/a | 1,500 | 2% | 57 | 237 | 7 | 856 | 4,852 | 0.14 | 0.3 | 3.0 | 0.93 | 0.01 | 0.01 | 0.21 | 0.44 | 4.47 | 1.37 | 0.02 | 0.02 | 0.01 | 0.03 | 0.29 | 0.09 | 0.00 | 0.00 |
| PGVMWC Scheidel & Osterli #18A | Scheidel & Osterli #18A | Diesel | 2013 | 101 | n/a | 1,800 | 2% | 68 | 284 | 7 | 856 | 4,852 | 0.14 | 0.3 | 3.0 | 0.93 | 0.01 | 0.01 | 0.21 | 0.44 | 4.47 | 1.37 | 0.02 | 0.02 | 0.01 | 0.03 | 0.29 | 0.09 | 0.00 | 0.00 |
| PGVMWC River Ranch #19 | River Ranch #19 | Diesel | 2013 | 99 | n/a | 2,500 | 3% | 95 | 394 | 7 | 856 | 4,756 | 0.14 | 0.3 | 3.0 | 0.93 | 0.01 | 0.01 | 0.21 | 0.43 | 4.38 | 1.35 | 0.02 | 0.02 | 0.01 | 0.03 | 0.28 | 0.09 | 0.00 | 0.00 |
| | | | | | **Total** | **76,100** | **100%** | **2,880** | **12,000** | **206** | **26,548** | **72,714** | | | | | | | **3.47** | **23.78** | **67.17** | **21.52** | **1.51** | **1.47** | **0.21** | **1.32** | **4.14** | **1.33** | **0.08** | **0.08** |

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

| | |
|---|---|
| | Average HP estimated from pump rates |
| | HP interpolated from other pumps |
| | Emission factor from AP-42 |
| | Emission factor based on NMHC+NOx emission standard |
| | Current model year engine used for mitigation |

Conversion Factors

| | | | |
|---|---|---|---|
| 1 lb = | 453.6 | g | |
| 1 ton = | 2,000 | lbs | |
| 1 kW = | 1.34 | hp | |
| 1 day = | 24 | hours | |
| 1 hour = | 60 | minutes | |
| 1 month = | 31 | days | (peak occurs in July and August) |
| 1 acre-foot = | 325,851 | gallons | |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

**Mitigated Groundwater Substitution Air Quality Emissions**

Agency Tule Basin Farms
Transfer Volume 6,400 acre feet/year
Location Sutter County

**Table 48. Tule Basin Farms Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Fuel Consumption (MMBtu/hr) | Fuel Consumption (MMBtu/yr) | Emission Factors (lb/MMBtu) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (lbs/day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tule Basin Farms1 | 1 | Electric | | 125 | n/a | 3,750 | 31% | 2,000 | 2,896 | n/a | n/a | | | | | | | | | | | | | | | | | | |
| Tule Basin Farms2 | 2 | Natural Gas | 1985 | 190 | n/a | 3,750 | 31% | 2,000 | 2,896 | 1.33 | 3,852 | 0.118 | 4.08 | 0.317 | 0.00059 | 0.0000771 | 0.0000771 | 3.77 | 13.02 | 10.12 | 0.02 | 0.00 | 0.00 | 0.23 | 0.79 | 0.61 | 0.00 | 0.00 | 0.00 |
| Tule Basin Farms3 | 3 | Electric | | 125 | n/a | 4,500 | 38% | 2,400 | 2,896 | n/a | n/a | | | | | | | | | | | | | | | | | | |
| | | | | | | **Total** | **100%** | **6,400** | **8,689** | | | | | | | | | **3.77** | **13.02** | **10.12** | **0.02** | **0.00** | **0.00** | **0.23** | **0.79** | **0.61** | **0.00** | **0.00** | **0.00** |

Conversion Factors

| | | |
|---|---|---|
| 1 MMBtu = | 1,000,000 | Btu |
| 1 ton = | 2,000 | pounds |
| 1 day = | 24 | hours |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

| | | | |
|---|---|---|---|
| Estimated BSFC = | 7000 | Btu/bhp-hr | (Estimated from Waukesha engine specifications) |
| Higher Heating Value | 1,020 | Btu/scf | (AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines) |

| | |
|---|---|
| SCR Control Efficiency (NOx) | 90% |

## Summary of Crop Idling Emissions by Air District

**Table 49. Reduced Exhaust Emissions from Cropland Idling**

| | Peak Daily Emissions (lbs/day) | | | | | | Annual Project Emissions (tpy) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air District** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Butte County AQMD | | | | | | | | | | | | |
| Biggs-West Gridley Water District | (3) | (6) | (49) | (17) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Butte County AQMD Subtotal | (3) | (6) | (49) | (17) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Colusa County APCD | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (1) | (3) | (25) | (9) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Maxwell Irrigation District | (1) | (3) | (23) | (8) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Princeton-Codora-Glenn Irrigation District | (0) | (1) | (5) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Provident Irrigation District | (0) | (1) | (5) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Reclamation District 108 | (2) | (3) | (30) | (11) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Sycamore Mutual Water Company | (2) | (3) | (30) | (11) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Colusa County APCD Subtotal | (7) | (14) | (125) | (45) | (1) | (1) | (0) | (1) | (7) | (2) | (0) | (0) |
| Glenn County APCD | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (1) | (3) | (25) | (9) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Princeton-Codora-Glenn Irrigation District | (0) | (1) | (5) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Provident Irrigation District | (0) | (1) | (5) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Glenn County APCD Subtotal | (2) | (5) | (42) | (15) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Feather River AQMD | | | | | | | | | | | | |
| Biggs-West Gridley Water District | (3) | (6) | (49) | (17) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Goose Club Farms and Teichert Aggregate | (1) | (2) | (18) | (6) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Pelger Mutual Water Company | (0) | (1) | (6) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Pleasant Grove-Verona Mutual Water Company | (1) | (3) | (27) | (10) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Feather River AQMD Subtotal | (6) | (12) | (108) | (38) | (1) | (1) | (0) | (1) | (6) | (2) | (0) | (0) |
| Yolo-Solano AQMD | | | | | | | | | | | | |
| Conaway Preservation Group | (3) | (6) | (49) | (17) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Reclamation District 108 | (2) | (3) | (30) | (11) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Te Velde Revocable Family Trust | (1) | (2) | (16) | (6) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Yolo-Solano AQMD Subtotal | (5) | (11) | (95) | (34) | (1) | (1) | (0) | (1) | (5) | (2) | (0) | (0) |
| GRAND TOTAL | (23) | (48) | (418) | (149) | (2) | (2) | (1) | (3) | (23) | (8) | (0) | (0) |

Note:
No cropland idling would occur in Merced, Sacramento, and Shasta Counties.

**Table 50. Reduced Peak Daily Fugitive Dust Emissions from Cropland Idling**

| | Peak Daily PM10 Emissions (lbs/day) | | | | Peak Daily PM2.5 Emissions (lbs/day) | | | |
|---|---|---|---|---|---|---|---|---|
| **Air District** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** |
| Butte County AQMD | | | | | | | | |
| Biggs-West Gridley Water District | (267) | (22) | 10 | (280) | (40) | (3) | 2 | (41) |
| Butte County AQMD Subtotal | (267) | (22) | 10 | (280) | (40) | (3) | 2 | (41) |
| Colusa County APCD | | | | | | | | |
| Glenn-Colusa Irrigation District | (137) | (12) | 33 | (115) | (21) | (2) | 7 | (16) |
| Maxwell Irrigation District | (125) | (10) | 29 | (106) | (19) | (2) | 6 | (14) |
| Princeton-Codora-Glenn Irrigation District | (25) | (2) | 6 | (21) | (4) | (0) | 1 | (3) |
| Provident Irrigation District | (25) | (2) | 6 | (21) | (4) | (0) | 1 | (3) |
| Reclamation District 108 | (166) | (14) | 22 | (158) | (25) | (2) | 4 | (23) |
| Reclamation District 1004 | (42) | (3) | 7 | (38) | (6) | (1) | 1 | (5) |
| Sycamore Mutual Water Company | (166) | (14) | 39 | (141) | (25) | (2) | 8 | (19) |
| Colusa County APCD Subtotal | (685) | (58) | 142 | (600) | (103) | (9) | 28 | (83) |
| Glenn County APCD | | | | | | | | |
| Glenn-Colusa Irrigation District | (137) | (12) | 33 | (115) | (21) | (2) | 7 | (16) |
| Princeton-Codora-Glenn Irrigation District | (25) | (2) | 6 | (21) | (4) | (0) | 1 | (3) |
| Provident Irrigation District | (25) | (2) | 6 | (21) | (4) | (0) | 1 | (3) |
| Reclamation District 1004 | (42) | (3) | 7 | (38) | (6) | (1) | 1 | (5) |
| Glenn County APCD Subtotal | (228) | (19) | 52 | (195) | (34) | (3) | 10 | (27) |
| Feather River AQMD | | | | | | | | |
| Biggs-West Gridley Water District | (267) | (22) | 10 | (280) | (40) | (3) | 2 | (41) |
| Goose Club Farms and Teichert Aggregate | (100) | (8) | 2 | (106) | (15) | (1) | 0 | (16) |
| Pelger Mutual Water Company | (32) | (3) | 1 | (34) | (5) | (0) | 0 | (5) |
| Pleasant Grove-Verona Mutual Water Company | (149) | (13) | 3 | (159) | (22) | (2) | 1 | (24) |
| Reclamation District 1004 | (42) | (3) | 7 | (38) | (6) | (1) | 1 | (5) |
| Feather River AQMD Subtotal | (589) | (50) | 22 | (617) | (88) | (7) | 4 | (91) |
| Yolo-Solano AQMD | | | | | | | | |
| Conaway Preservation Group | (266) | (22) | 8 | (280) | (40) | (3) | 2 | (42) |
| Reclamation District 108 | (166) | (14) | 22 | (158) | (25) | (2) | 4 | (23) |
| Te Velde Revocable Family Trust | (89) | (8) | 3 | (94) | (13) | (1) | 1 | (14) |
| Yolo-Solano AQMD Subtotal | (521) | (44) | 33 | (532) | (78) | (7) | 7 | (78) |
| GRAND TOTAL | (2,291) | (192) | 260 | (2,224) | (343) | (29) | 52 | (320) |

Note:
No cropland idling would occur in Merced, Sacramento, and Shasta Counties.

**Table 51. Reduced Annual Fugitive Dust Emissions from Cropland Idling**

| | Annual PM10 Emissions (tpy) | | | | Annual PM2.5 Emissions (tpy) | | | |
|---|---|---|---|---|---|---|---|---|
| **Air District** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** |
| Butte County AQMD | | | | | | | | |
| Biggs-West Gridley Water District | (24) | (2) | 1 | (25) | (4) | (0) | 0 | (4) |
| Butte County AQMD Subtotal | (19) | 4 | 8 | (17) | 5 | 10 | 0 | (4) |
| Colusa County APCD | | | | | | | | |
| Glenn-Colusa Irrigation District | (12) | (1) | 3 | (10) | (2) | (0) | 1 | (1) |
| Maxwell Irrigation District | (11) | (1) | 3 | (10) | (2) | (0) | 1 | (1) |
| Princeton-Codora-Glenn Irrigation District | (2) | (0) | 1 | (2) | (0) | (0) | 0 | (0) |
| Provident Irrigation District | (2) | (0) | 1 | (2) | (0) | (0) | 0 | (0) |
| Reclamation District 108 | (15) | (1) | 2 | (14) | (2) | (0) | 0 | (2) |
| Reclamation District 1004 | (4) | (0) | 1 | (3) | (1) | (0) | 0 | (0) |
| Sycamore Mutual Water Company | (15) | (1) | 4 | (13) | (2) | (0) | 1 | (2) |
| Colusa County APCD Subtotal | (62) | (5) | 13 | (54) | (9) | (1) | 3 | (7) |
| Glenn County APCD | | | | | | | | |
| Glenn-Colusa Irrigation District | (12) | (1) | 3 | (10) | (2) | (0) | 1 | (1) |
| Princeton-Codora-Glenn Irrigation District | (2) | (0) | 1 | (2) | (0) | (0) | 0 | (0) |
| Provident Irrigation District | (2) | (0) | 1 | (2) | (0) | (0) | 0 | (0) |
| Reclamation District 1004 | (4) | (0) | 1 | (3) | (1) | (0) | 0 | (0) |
| Glenn County APCD Subtotal | (21) | (2) | 5 | (18) | (3) | (0) | 1 | (2) |
| Feather River AQMD | | | | | | | | |
| Biggs-West Gridley Water District | (24) | (2) | 1 | (25) | (4) | (0) | 0 | (4) |
| Goose Club Farms and Teichert Aggregate | (9) | (1) | 0 | (10) | (1) | (0) | 0 | (1) |
| Pelger Mutual Water Company | (3) | (0) | 0 | (3) | (0) | (0) | 0 | (0) |
| Pleasant Grove-Verona Mutual Water Company | (13) | (1) | 0 | (14) | (2) | (0) | 0 | (2) |
| Reclamation District 1004 | (4) | (0) | 1 | (3) | (1) | (0) | 0 | (0) |
| Feather River AQMD Subtotal | (53) | (4) | 2 | (55) | (8) | (1) | 0 | (8) |
| Yolo-Solano AQMD | | | | | | | | |
| Conaway Preservation Group | (24) | (2) | 1 | (25) | (4) | (0) | 0 | (4) |
| Reclamation District 108 | (15) | (1) | 2 | (14) | (2) | (0) | 0 | (2) |
| Te Velde Revocable Family Trust | (8) | (1) | 0 | (8) | (1) | (0) | 0 | (1) |
| Yolo-Solano AQMD Subtotal | (47) | (4) | 3 | (48) | (7) | (1) | 1 | (7) |
| GRAND TOTAL | (201) | (11) | 30 | (192) | (22) | 7 | 5 | (29) |

Note:
No cropland idling would occur in Merced, Sacramento, and Shasta Counties.

**Table 52. Combined Emissions by Air District**

| | Peak Daily Emissions (lbs/day) | | | | | | Annual Project Emissions (tpy) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air District** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Butte County AQMD | | | | | | | | | | | | |
| Biggs-West Gridley Water District | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Butte County AQMD Subtotal | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Colusa County APCD | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (1) | (3) | (25) | (9) | (116) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Maxwell Irrigation District | (1) | (3) | (23) | (8) | (106) | (15) | (0) | (0) | (1) | (0) | (10) | (1) |
| Princeton-Codora-Glenn Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Provident Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Reclamation District 108 | (2) | (3) | (30) | (11) | (158) | (23) | (0) | (0) | (2) | (1) | (14) | (2) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (38) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Sycamore Mutual Water Company | (2) | (3) | (30) | (11) | (141) | (19) | (0) | (0) | (2) | (1) | (13) | (2) |
| Colusa County APCD Subtotal | (7) | (14) | (125) | (45) | (601) | (84) | (0) | (1) | (7) | (2) | (54) | (7) |
| Glenn County APCD | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (1) | (3) | (25) | (9) | (116) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Princeton-Codora-Glenn Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Provident Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (38) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Glenn County APCD Subtotal | (2) | (5) | (42) | (15) | (196) | (27) | (0) | (0) | (2) | (1) | (18) | (2) |
| Feather River AQMD | | | | | | | | | | | | |
| Biggs-West Gridley Water District | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Goose Club Farms and Teichert Aggregate | (1) | (2) | (18) | (6) | (106) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Pelger Mutual Water Company | (0) | (1) | (6) | (2) | (34) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Pleasant Grove-Verona Mutual Water Company | (1) | (3) | (27) | (10) | (159) | (24) | (0) | (0) | (2) | (1) | (14) | (2) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (38) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Feather River AQMD Subtotal | (6) | (12) | (108) | (38) | (617) | (92) | (0) | (1) | (6) | (2) | (56) | (8) |
| Yolo-Solano AQMD | | | | | | | | | | | | |
| Conaway Preservation Group | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Reclamation District 108 | (2) | (3) | (30) | (11) | (158) | (23) | (0) | (0) | (2) | (1) | (14) | (2) |
| Te Velde Revocable Family Trust | (1) | (2) | (16) | (6) | (94) | (14) | (0) | (0) | (1) | (0) | (8) | (1) |
| Yolo-Solano AQMD Subtotal | (5) | (11) | (95) | (34) | (533) | (79) | (0) | (1) | (5) | (2) | (48) | (7) |
| GRAND TOTAL | (23) | (48) | (418) | (149) | (2,226) | (323) | (1) | (3) | (23) | (8) | (200) | (29) |

**Table 53. Summary of Cropland Idling Emissions by Water Agency**

| | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Agency** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Biggs-West Gridley Water District | | | | | | | | | | | | |
| Exhaust Emissions | (5) | (11) | (98) | (35) | (1) | (1) | (0) | (1) | (5) | (2) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (534) | (80) | -- | -- | -- | -- | (48) | (7) |
| Harvesting | -- | -- | -- | -- | (45) | (7) | -- | -- | -- | -- | (4) | (1) |
| Wind Erosion | -- | -- | -- | -- | 20 | 4 | -- | -- | -- | -- | 2 | 0 |
| Biggs-West Gridley Water District Subtotal | (5) | (11) | (98) | (35) | (560) | (83) | (0) | (1) | (5) | (2) | (50) | (7) |
| Conaway Preservation Group | | | | | | | | | | | | |
| Exhaust Emissions | (3) | (6) | (49) | (17) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (266) | (40) | -- | -- | -- | -- | (24) | (4) |
| Harvesting | -- | -- | -- | -- | (22) | (3) | -- | -- | -- | -- | (2) | (0) |
| Wind Erosion | -- | -- | -- | -- | 8 | 2 | -- | -- | -- | -- | 1 | 0 |
| Conaway Preservation Group Subtotal | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Glenn-Colusa Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (3) | (6) | (50) | (18) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (274) | (41) | -- | -- | -- | -- | (25) | (4) |
| Harvesting | -- | -- | -- | -- | (23) | (3) | -- | -- | -- | -- | (2) | (0) |
| Wind Erosion | -- | -- | -- | -- | 66 | 13 | -- | -- | -- | -- | 6 | 1 |
| Glenn-Colusa Irrigation District Subtotal | (3) | (6) | (50) | (18) | (231) | (32) | (0) | (0) | (3) | (1) | (21) | (3) |
| Goose Club Farms and Teichert Aggregate | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (2) | (18) | (6) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (100) | (15) | -- | -- | -- | -- | (9) | (1) |
| Harvesting | -- | -- | -- | -- | (8) | (1) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 2 | 0 | -- | -- | -- | -- | 0 | 0 |
| Goose Club Farms and Teichert Aggregate Subtotal | (1) | (2) | (18) | (6) | (106) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Maxwell Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (3) | (23) | (8) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (125) | (19) | -- | -- | -- | -- | (11) | (2) |
| Harvesting | -- | -- | -- | -- | (10) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 29 | 6 | -- | -- | -- | -- | 3 | 1 |
| Maxwell Irrigation District Subtotal | (1) | (3) | (23) | (8) | (106) | (15) | (0) | (0) | (1) | (0) | (10) | (1) |
| Pelger Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (0) | (1) | (6) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (32) | (5) | -- | -- | -- | -- | (3) | (0) |
| Harvesting | -- | -- | -- | -- | (3) | (0) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 1 | 0 | -- | -- | -- | -- | 0 | 0 |
| Pelger Mutual Water Company Subtotal | (0) | (1) | (6) | (2) | (34) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |

**Table 53. Summary of Cropland Idling Emissions by Water Agency**

| Water Agency | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Pleasant Grove-Verona Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (3) | (27) | (10) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (149) | (22) | -- | -- | -- | -- | (13) | (2) |
| Harvesting | -- | -- | -- | -- | (13) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 3 | 1 | -- | -- | -- | -- | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company Subtotal | (1) | (3) | (27) | (10) | (159) | (24) | (0) | (0) | (2) | (1) | (14) | (2) |
| Princeton-Codora-Glenn Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (0) | (1) | (9) | (3) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (50) | (7) | -- | -- | -- | -- | (4) | (1) |
| Harvesting | -- | -- | -- | -- | (4) | (1) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 12 | 2 | -- | -- | -- | -- | 1 | 0 |
| Princeton-Codora-Glenn Irrigation District Subtotal | (0) | (1) | (9) | (3) | (42) | (6) | (0) | (0) | (1) | (0) | (4) | (1) |
| Provident Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (0) | (1) | (9) | (3) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (50) | (7) | -- | -- | -- | -- | (4) | (1) |
| Harvesting | -- | -- | -- | -- | (4) | (1) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 12 | 2 | -- | -- | -- | -- | 1 | 0 |
| Provident Irrigation District Subtotal | (0) | (1) | (9) | (3) | (42) | (6) | (0) | (0) | (1) | (0) | (4) | (1) |
| Reclamation District 108 | | | | | | | | | | | | |
| Exhaust Emissions | (3) | (7) | (61) | (22) | (0) | (0) | (0) | (0) | (3) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (332) | (50) | -- | -- | -- | -- | (30) | (4) |
| Harvesting | -- | -- | -- | -- | (28) | (4) | -- | -- | -- | -- | (3) | (0) |
| Wind Erosion | -- | -- | -- | -- | 44 | 9 | -- | -- | -- | -- | 4 | 1 |
| Reclamation District 108 Subtotal | (3) | (7) | (61) | (22) | (316) | (45) | (0) | (0) | (3) | (1) | (28) | (4) |
| Reclamation District 1004 | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (3) | (23) | (8) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (125) | (19) | -- | -- | -- | -- | (11) | (2) |
| Harvesting | -- | -- | -- | -- | (10) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 21 | 4 | -- | -- | -- | -- | 2 | 0 |
| Reclamation District 1004 Subtotal | (1) | (3) | (23) | (8) | (114) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Sycamore Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (2) | (3) | (30) | (11) | (0) | (0) | (0) | (0) | (2) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (166) | (25) | -- | -- | -- | -- | (15) | (2) |
| Harvesting | -- | -- | -- | -- | (14) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 39 | 8 | -- | -- | -- | -- | 4 | 1 |
| Sycamore Mutual Water Company Subtotal | (2) | (3) | (30) | (11) | (141) | (19) | (0) | (0) | (2) | (1) | (13) | (2) |

**Table 53. Summary of Cropland Idling Emissions by Water Agency**

| | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Agency** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Te Velde Revocable Family Trust | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (2) | (16) | (6) | (0) | (0) | (0) | (0) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (89) | (13) | -- | -- | -- | -- | (8) | (1) |
| Harvesting | -- | -- | -- | -- | (8) | (1) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 3 | 1 | -- | -- | -- | -- | 0 | 0 |
| Te Velde Revocable Family Trust Subtotal | (1) | (2) | (16) | (6) | (94) | (14) | (0) | (0) | (1) | (0) | (8) | (1) |
| Exhaust Emissions Total | (23) | (48) | (418) | (149) | (2) | (2) | (1) | (3) | (23) | (8) | (0) | (0) |
| Land Preparation Total | 0 | 0 | 0 | 0 | (2,291) | (343) | 0 | 0 | 0 | 0 | (206) | (31) |
| Harvesting Total | 0 | 0 | 0 | 0 | (192) | (29) | 0 | 0 | 0 | 0 | (17) | (3) |
| Wind Erosion Total | 0 | 0 | 0 | 0 | 260 | 52 | 0 | 0 | 0 | 0 | 23 | 5 |
| **GRAND TOTAL** | **(23)** | **(48)** | **(418)** | **(149)** | **(2,226)** | **(323)** | **(1)** | **(3)** | **(23)** | **(8)** | **(200)** | **(29)** |

Size Fractions

| Description | PM10 | PM2.5 | Ratio |
|---|---|---|---|
| PM Profile ID No. 411, Windblown Dust - Agricultural | 0.5 | 0.1 | 0.2 |
| PM Profile ID No. 417, Agricultural Tilling Dust | 0.4543 | 0.0681 | 0.1499 |

**Table 54. Summary of Cropland Idling Emissions by County**

| | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **County** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Butte | | | | | | | | | | | | |
| Biggs-West Gridley Water District | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Butte County Subtotal | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Colusa | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (1) | (3) | (25) | (9) | (116) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Maxwell Irrigation District | (1) | (3) | (23) | (8) | (106) | (15) | (0) | (0) | (1) | (0) | (10) | (1) |
| Princeton-Codora-Glenn Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Provident Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Reclamation District 108 | (2) | (3) | (30) | (11) | (158) | (23) | (0) | (0) | (2) | (1) | (14) | (2) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (38) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Sycamore Mutual Water Company | (2) | (3) | (30) | (11) | (141) | (19) | (0) | (0) | (2) | (1) | (13) | (2) |
| Colusa Subtotal | (7) | (14) | (125) | (45) | (601) | (84) | (0) | (1) | (7) | (2) | (54) | (7) |
| Glenn | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (1) | (3) | (25) | (9) | (116) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Princeton-Codora-Glenn Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Provident Irrigation District | (0) | (1) | (5) | (2) | (21) | (3) | (0) | (0) | (0) | (0) | (2) | (0) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (38) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Glenn Subtotal | (2) | (5) | (42) | (15) | (196) | (27) | (0) | (0) | (2) | (1) | (18) | (2) |
| Sutter | | | | | | | | | | | | |
| Biggs-West Gridley Water District | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Goose Club Farms and Teichert Aggregate | (1) | (2) | (18) | (6) | (106) | (16) | (0) | (0) | (1) | (0) | (10) | (1) |
| Pelger Mutual Water Company | (0) | (1) | (6) | (2) | (34) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Pleasant Grove-Verona Mutual Water Company | (1) | (3) | (27) | (10) | (159) | (24) | (0) | (0) | (2) | (1) | (14) | (2) |
| Reclamation District 1004 | (0) | (1) | (8) | (3) | (38) | (5) | (0) | (0) | (0) | (0) | (3) | (0) |
| Sutter Subtotal | (6) | (12) | (108) | (38) | (617) | (92) | (0) | (1) | (6) | (2) | (56) | (8) |
| Yolo | | | | | | | | | | | | |
| Conaway Preservation Group | (3) | (6) | (49) | (17) | (280) | (42) | (0) | (0) | (3) | (1) | (25) | (4) |
| Reclamation District 108 | (2) | (3) | (30) | (11) | (158) | (23) | (0) | (0) | (2) | (1) | (14) | (2) |
| Te Velde Revocable Family Trust | (1) | (2) | (16) | (6) | (94) | (14) | (0) | (0) | (1) | (0) | (8) | (1) |
| Yolo Subtotal | (5) | (11) | (95) | (34) | (533) | (79) | (0) | (1) | (5) | (2) | (48) | (7) |
| **GRAND TOTAL** | (23) | (48) | (418) | (149) | (2,226) | (323) | (1) | (3) | (23) | (8) | (200) | (29) |

**Table 55. Reduced Exhaust Emissions from Cropland Idling**

| Water Agency | Groundwater Substitution | Cropland Idling/ Crop Shifting | GW Pumping Equivalent | Reduced Daily Emissions (lbs/day) | | | | | | Reduced Annual Emissions (tons/year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (acre-feet/year) | (acre-feet/year) | (acre-feet/year) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Biggs-West Gridley Water District | 0 | 32,190 | 7,574 | 5.29 | 11.15 | 97.54 | 34.72 | 0.56 | 0.54 | 0.30 | 0.62 | 5.45 | 1.94 | 0.03 | 0.03 |
| Conaway Preservation Group | 26,639 | 16,014 | 3,768 | 2.63 | 5.55 | 48.52 | 17.28 | 0.28 | 0.27 | 0.15 | 0.31 | 2.71 | 0.97 | 0.02 | 0.02 |
| Glenn-Colusa Irrigation District | 0 | 16,500 | 3,882 | 2.71 | 5.71 | 49.99 | 17.80 | 0.29 | 0.28 | 0.15 | 0.32 | 2.79 | 0.99 | 0.02 | 0.02 |
| Goose Club Farms and Teichert Aggregate | 2,000 | 6,000 | 1,412 | 0.99 | 2.08 | 18.18 | 6.47 | 0.10 | 0.10 | 0.06 | 0.12 | 1.02 | 0.36 | 0.01 | 0.01 |
| Maxwell Irrigation District | 4,700 | 7,500 | 1,765 | 1.23 | 2.60 | 22.73 | 8.09 | 0.13 | 0.13 | 0.07 | 0.15 | 1.27 | 0.45 | 0.01 | 0.01 |
| Pelger Mutual Water Company | 4,000 | 1,903 | 448 | 0.31 | 0.66 | 5.77 | 2.05 | 0.03 | 0.03 | 0.02 | 0.04 | 0.32 | 0.11 | 0.00 | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | 12,000 | 9,000 | 2,118 | 1.48 | 3.12 | 27.28 | 9.71 | 0.16 | 0.15 | 0.08 | 0.17 | 1.52 | 0.54 | 0.01 | 0.01 |
| Princeton-Codora-Glenn Irrigation District | 0 | 3,000 | 706 | 0.49 | 1.04 | 9.09 | 3.24 | 0.05 | 0.05 | 0.03 | 0.06 | 0.51 | 0.18 | 0.00 | 0.00 |
| Provident Irrigation District | 0 | 3,000 | 706 | 0.49 | 1.04 | 9.09 | 3.24 | 0.05 | 0.05 | 0.03 | 0.06 | 0.51 | 0.18 | 0.00 | 0.00 |
| Reclamation District 108 | 7,500 | 20,000 | 4,706 | 3.29 | 6.93 | 60.60 | 21.58 | 0.35 | 0.34 | 0.18 | 0.39 | 3.39 | 1.21 | 0.02 | 0.02 |
| Reclamation District 1004 | 5,400 | 7,500 | 1,765 | 1.23 | 2.60 | 22.73 | 8.09 | 0.13 | 0.13 | 0.07 | 0.15 | 1.27 | 0.45 | 0.01 | 0.01 |
| Sycamore Mutual Water Company | 8,000 | 10,000 | 2,353 | 1.64 | 3.46 | 30.30 | 10.79 | 0.17 | 0.17 | 0.09 | 0.19 | 1.69 | 0.60 | 0.01 | 0.01 |
| Te Velde Revocable Family Trust | 5,344 | 5,387 | 1,268 | 0.89 | 1.87 | 16.33 | 5.81 | 0.09 | 0.09 | 0.05 | 0.10 | 0.91 | 0.32 | 0.01 | 0.01 |
| **Total** | **75,583** | **137,994** | **32,471** | **22.70** | **47.79** | **418.16** | **148.87** | **2.39** | **2.33** | **1.27** | **2.67** | **23.37** | **8.32** | **0.13** | **0.13** |

Notes:

Pelger Mutual Water Company used to estimate emissions for other water agencies.

Engine power rating equal to 250 hp for Pelger Mutual Water Company engines.

The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).

Pelger Mutual Water Company engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing

*Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."*

## Fugitive Dust Emissions from Cropland Idling

**Table 56**
**Land Preparation (Reduced Emissions)**

| District | County | Acres | Daily PM10 Emissions (lbs/day) | Annual PM10 Emissions (tons per year) |
|---|---|---|---|---|
| | | Rice | Rice | Rice |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | Shasta | 0 | 0 | 0 |
| Conaway Preservation Group | Yolo | 4,853 | 266 | 24 |
| Eastside Mutual Water Company | Colusa | 0 | 0 | 0 |
| Glenn-Colusa Irrigation District | Glenn/Colusa | 5,000 | 274 | 25 |
| Maxwell Irrigation District | Colusa | 2,273 | 125 | 11 |
| Natomas Central Mutual Water Company | Sacramento/Sutter | 0 | 0 | 0 |
| Pelger Mutual Water Company | Sutter | 577 | 32 | 3 |
| Pleasant Grove-Verona Mutual Water Company | Sutter | 2,727 | 149 | 13 |
| Princeton-Codora-Glenn Irrigation District | Glenn/Colusa | 909 | 50 | 4 |
| Provident Irrigation District | Glenn/Colusa | 909 | 50 | 4 |
| Reclamation District 108 | Colusa/Yolo | 6,061 | 332 | 30 |
| Reclamation District 1004 | Colusa/Glenn/Sutter | 2,273 | 125 | 11 |
| River Garden Farms | Yolo | 0 | 0 | 0 |
| Sycamore Mutual Water Company | Colusa | 3,030 | 166 | 15 |
| Te Velde Revocable Family Trust | Yolo | 1,632 | 89 | 8 |
| **Yuba River Area of Analysis** | | | | |
| Browns Valley Irrigation District | Yuba | 0 | 0 | 0 |
| **Feather River Area of Analysis** | | | | |
| Biggs-West Gridley Water District | Butte/Sutter | 9,755 | 534 | 48 |
| Garden Highway Mutual Water Company | Sutter | 0 | 0 | 0 |
| Goose Club Farms and Teichert Aggregate | Sutter | 1,818 | 100 | 9 |
| Tule Basin Farms | Sutter | 0 | 0 | 0 |
| **Total** | | **41,816** | **2,291** | **206** |

**Table 57**
**Harvesting (Reduced Emissions)**

| District | County | Acres | Daily PM10 Emissions (lbs/day) | Annual PM10 Emissions (tons per year) |
|---|---|---|---|---|
| | | Rice | Rice | Rice |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | Shasta | 0 | 0 | 0 |
| Conaway Preservation Group | Yolo | 4,853 | 22 | 2 |
| Eastside Mutual Water Company | Colusa | 0 | 0 | 0 |
| Glenn-Colusa Irrigation District | Glenn/Colusa | 5,000 | 23 | 2 |
| Maxwell Irrigation District | Colusa | 2,273 | 10 | 1 |
| Natomas Central Mutual Water Company | Sacramento/Sutter | 0 | 0 | 0 |
| Pelger Mutual Water Company | Sutter | 577 | 3 | 0 |
| Pleasant Grove-Verona Mutual Water Company | Sutter | 2,727 | 13 | 1 |
| Princeton-Codora-Glenn Irrigation District | Glenn/Colusa | 909 | 4 | 0 |
| Provident Irrigation District | Glenn/Colusa | 909 | 4 | 0 |
| Reclamation District 108 | Colusa/Yolo | 6,061 | 28 | 3 |
| Reclamation District 1004 | Colusa/Glenn/Sutter | 2,273 | 10 | 1 |
| River Garden Farms | Yolo | 0 | 0 | 0 |
| Sycamore Mutual Water Company | Colusa | 3,030 | 14 | 1 |
| Te Velde Revocable Family Trust | Yolo | 1,632 | 8 | 1 |
| **Yuba River Area of Analysis** | | | | |
| Browns Valley Irrigation District | Yuba | 0 | 0 | 0 |
| **Feather River Area of Analysis** | | | | |
| Biggs-West Gridley Water District | Butte/Sutter | 9,755 | 45 | 4 |
| Garden Highway Mutual Water Company | Sutter | 0 | 0 | 0 |
| Goose Club Farms and Teichert Aggregate | Sutter | 1,818 | 8 | 1 |
| Tule Basin Farms | Sutter | 0 | 0 | 0 |
| **Total** | | **41,816** | **192** | **17** |

**Table 58**
**Windblown Dust (Increased Emissions)**

| District | County | Acres Rice | Daily PM10 Emissions (lbs/day) Rice | Annual PM10 Emissions (tons per year) Rice |
|---|---|---|---|---|
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | Shasta | 0 | -- | -- |
| Conaway Preservation Group | Yolo | 4,853 | 8 | 1 |
| Eastside Mutual Water Company | Colusa | 0 | -- | -- |
| Glenn-Colusa Irrigation District | Glenn/Colusa | 5,000 | 66 | 6 |
| Maxwell Irrigation District | Colusa | 2,273 | 29 | 3 |
| Natomas Central Mutual Water Company | Sacramento/Sutter | 0 | -- | -- |
| Pelger Mutual Water Company | Sutter | 577 | 1 | 0 |
| Pleasant Grove-Verona Mutual Water Company | Sutter | 2,727 | 3 | 0 |
| Princeton-Codora-Glenn Irrigation District | Glenn/Colusa | 909 | 12 | 1 |
| Provident Irrigation District | Glenn/Colusa | 909 | 12 | 1 |
| Reclamation District 108 | Colusa/Yolo | 6,061 | 44 | 4 |
| Reclamation District 1004 | Colusa/Glenn/Sutter | 2,273 | 21 | 2 |
| River Garden Farms | Yolo | 0 | -- | -- |
| Sycamore Mutual Water Company | Colusa | 3,030 | 39 | 4 |
| Te Velde Revocable Family Trust | Yolo | 1,632 | 3 | 0 |
| **Yuba River Area of Analysis** | | | | |
| Browns Valley Irrigation District | Yuba | 0 | -- | -- |
| **Feather River Area of Analysis** | | | | |
| Biggs-West Gridley Water District | Butte/Sutter | 9,755 | 20 | 2 |
| Garden Highway Mutual Water Company | Sutter | 0 | -- | -- |
| Goose Club Farms and Teichert Aggregate | Sutter | 1,818 | 2 | 0 |
| Tule Basin Farms | Sutter | 0 | -- | -- |
| **Total** | | **41,816** | **260** | **23** |

Note:
Fraction of PM10 (FRPM10) from wind erosion: 0.50
(PM10 Emissions = PM x FRPM10)

Conversions

| | | | |
|---|---|---|---|
| 1 ton = | 2,000 | pounds | |
| 1 year = | 365 | days | |
| Project duration = | 180 | days | (assumes 6-month crop idling season) |

Legend

| | |
|---|---|
| | Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available. |
| | Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Yolo County only). |
| | Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Sutter County only). |

## Agricultural Land Preparation

**Table 59**
**Summary of Crop Profile, Acre-Pass, and Emission Factor**

| Crop profile | Land Preparation Operations | Category | Acre-Pass | Emission Factor | |
|---|---|---|---|---|---|
| | | | | Operation (lbs/Acre-pass) | Crop (lbs/Acre/year) |
| Alfalfa | Unspecified | Discing | 1.25 | 1.2 | 4 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Almonds | Float | Land Planing | 0.25 | 12.5 | 3.13 |
| Citrus | Unspecified | Discing | 0.06 | 1.2 | 0.07 |
| Corn | List & Fertilize | Weeding | 1 | 0.8 | 6.9 |
| | Mulch Beds | Discing | 1 | 1.2 | |
| | Finish Disc | Discing | 1 | 1.2 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| Cotton | Land Preparation | Discing | 4 | 1.2 | 8.9 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Seed Bed Preparation | Weeding | 2 | 0.8 | |
| DryBeans | Land Maintenance | Land Planing | 0.2 | 12.5 | 7.7 |
| | Chisel | Discing | 1 | 1.2 | |
| | Shaping | Weeding | 1 | 0.8 | |
| | Disc | Discing | 2 | 1.2 | |
| | Listing | Weeding | 1 | 0.8 | |
| Garbanzo | Chisel | Discing | 1 | 1.2 | 7.7 |
| | Listing | Weeding | 1 | 0.8 | |
| | Shaping | Weeding | 1 | 0.8 | |
| | Disc | Discing | 2 | 1.2 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Garlic | Land Maintenance | Land Planing | 0.2 | 12.5 | 6.5 |
| | Disc & Roll | Discing | 1 | 1.2 | |
| | Chisel | Discing | 1 | 1.2 | |
| | List | Weeding | 1 | 0.8 | |
| | Shape Beds | Weeding | 1 | 0.8 | |
| Grapes-Raisin | Terrace | Weeding | 1 | 0.8 | 2.6 |
| | Spring Tooth | Weeding | 0.2 | 0.8 | |
| | Subsoil | Ripping | 0.05 | 4.6 | |
| | Disc & Furrow-out | Discing | 1 | 1.2 | |
| | Level (new vineyard) | Land Planing | 0.02 | 12.5 | |
| Grapes-Table | Subsoil | Ripping | 0.05 | 4.6 | 0.83 |
| | Disc & Furrow-out | Discing | 0.5 | 1.2 | |
| Grapes-Wine | Level (new vineyard) | Land Planing | 0.02 | 12.5 | 1.5 |
| | Spring Tooth | Weeding | 0.2 | 0.8 | |
| | Subsoil | Ripping | 0.05 | 4.6 | |
| | Disc & Furrow-out | Discing | 0.75 | 1.2 | |
| Lettuce* | Land Maintenance | Land Planing | 0.2 | 12.5 | 12.75 |
| | Disc & Roll | Discing | 2/2 | 1.2 | |
| | Chisel | Discing | 2/2 | 1.2 | |
| | List | Weeding | 2/2 | 0.8 | |
| | Plane | Land Planing | ½ | 12.5 | |
| | Shape Beds & Roll | Weeding | 2/2 | 0.8 | |
| Melon | Plow | Discing | 1 | 1.2 | 5.7 |
| | Shape Beds | Weeding | 1 | 0.8 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Disc | Discing | 1 | 1.2 | |
| No Land Prep. | Unspecified | Discing | 0 | 1.2 | 0 |
| Onions | List | Weeding | 1 | 0.8 | 6.5 |
| | Shape Beds | Weeding | 1 | 0.8 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Chisel | Discing | 1 | 1.2 | |
| | Disc & Roll | Discing | 1 | 1.2 | |

**Agricultural Land Preparation**

**Table 59**
**Summary of Crop Profile, Acre-Pass, and Emission Factor**

| Crop profile | Land Preparation Operations | Category | Acre-Pass | Emission Factor | |
|---|---|---|---|---|---|
| | | | | Operation (lbs/Acre-pass) | Crop (lbs/Acre/year) |
| Rice | Chisel | Discing | 1 | 1.2 | 20 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Post Burn/Harvest Disc | Discing | 0.5 | 1.2 | |
| | Roll | Weeding | 1 | 0.8 | |
| | 3 Wheel Plane | Land Planing | 1 | 12.5 | |
| | Harrow Disc | Discing | 1 | 1.2 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| Safflower | List | Weeding | 1 | 0.8 | 4.5 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| Sugar Beets | Disc | Discing | 1 | 1.2 | 22.8 |
| | Land Plane | Land Planing | 1 | 12.5 | |
| | Subsoil-deep chisel | Ripping | 1 | 4.6 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| | List | Weeding | 1 | 0.8 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Tomatoes | Bed Preparation | Weeding | 2 | 0.8 | 10.1 |
| | Land Preparation | Discing | 5 | 1.2 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Vegetables | Land Maintenance | Land Planing | 0.2 | 12.5 | 8.5 |
| | Unspecified | Discing | 5 | 1.2 | |
| Wheat | Stubble Disc | Discing | 1 | 1.2 | 3.7 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |

Source:
CARB. 2003. Emission Inventory Documentation, Section 7.4: Agricultural Land Preparation. January.
Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocfugwbdst.htm.

## Agricultural Harvest Operations

**Table 60**
**Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 101999 | WHEAT ALL | Wheat | Wheat/1 | 5.8 |
| 104999 | RYE FOR GRAIN | Wheat | Wheat/1 | 5.8 |
| 106199 | RICE, FOR MILLING | Rice | Cotton/2 | 1.68 |
| 106269 | FIELD CROP BY PRODUCTS | Cotton | Cotton/20 | 0.17 |
| 108999 | FOOD GRAINS, MISC | Corn | Cotton/2 | 1.68 |
| 111559 | CORN, WHITE | Corn | Cotton/40 | 0.08 |
| 111991 | CORN FOR GRAIN | Corn | Cotton/2 | 1.68 |
| 111992 | CORN FOR SILAGE | Corn | Cotton/20 | 0.17 |
| 112999 | OATS FOR GRAIN | Wheat | Wheat/1 | 5.8 |
| 113994 | BARLEY, MALTING | Wheat | Wheat/1 | 5.8 |
| 113995 | BARLEY, FEED | Wheat | Wheat/1 | 5.8 |
| 113999 | BARLEY, UNSPECIFIED | Wheat | Wheat/1 | 5.8 |
| 114991 | SORGHUM, GRAIN | Wheat | Wheat/1 | 5.8 |
| 121219 | COTTON LINT, UPLAND | Cotton | Cotton/1 | 3.37 |
| 121229 | COTTON LINT, PIMA | Cotton | Cotton/1 | 3.37 |
| 121299 | COTTON LINT, UNSPEC | Cotton | Cotton/1 | 3.37 |
| 132999 | SUGAR BEETS | Sugar Beets | Cotton/2 | 1.68 |
| 151999 | COTTONSEED | Cotton | Cotton/1 | 3.37 |
| 153999 | PEANUTS, ALL | Safflower | Cotton/2 | 1.68 |
| 158269 | SAFFLOWER | Safflower | Wheat/1 | 5.8 |
| 158316 | SUNFLOWER SEED, PLANTING | Corn | Wheat/1 | 5.8 |
| 158319 | SUNFLOWER SEED | Corn | Wheat/1 | 5.8 |
| 158499 | JOJOBA | Melon | Cotton/40 | 0.08 |
| 161131 | BEANS, LIMAS, LG. DRY | DryBeans | Cotton/2 | 1.68 |
| 161132 | BEANS, LIMAS, BABY DRY | DryBeans | Cotton/2 | 1.68 |
| 161199 | LIMA BEANS, UNSPECIFIED | DryBeans | Cotton/2 | 1.68 |
| 161717 | BEANS, RED KIDNEY | DryBeans | Cotton/2 | 1.68 |
| 161721 | BEANS, PINK | DryBeans | Cotton/2 | 1.68 |
| 161741 | BEANS, BLACKEYE (PEAS) | DryBeans | Cotton/2 | 1.68 |
| 161742 | BEANS, GARBANZO | Garbanzo | Cotton/2 | 1.68 |
| 162399 | BEANS, FAVA | DryBeans | Cotton/2 | 1.68 |
| 163999 | PEAS, DRY EDIBLE | DryBeans | Cotton/20 | 0.17 |
| 169999 | BEANS,UNSPEC. DRY EDIBLE | DryBeans | Cotton/2 | 1.68 |
| 171019 | SEED WHEAT | Wheat | Wheat/1 | 5.8 |
| 171049 | SEED RYE | Wheat | Wheat/1 | 5.8 |
| 171069 | SEED RICE | Rice | Cotton/2 | 1.68 |
| 171129 | SEED OATS | Wheat | Wheat/1 | 5.8 |
| 171139 | SEED BARLEY | Wheat | Wheat/1 | 5.8 |
| 171519 | SEED, COTTON FOR PLANTING | Cotton | Cotton/1 | 3.37 |
| 171582 | SEED, SAFFLOWER, PLANTING | Safflower | Wheat/1 | 5.8 |
| 171619 | SEED BEANS | DryBeans | Cotton/2 | 1.68 |
| 171639 | SEED PEAS | DryBeans | Cotton/20 | 0.17 |
| 171949 | SEED, MISC FIELD CROP | Corn | Cotton/20 | 0.17 |
| 171959 | SEED, VEG & VINECROP | Vegetables | Cotton/20 | 0.17 |
| 172119 | SEED, ALFALFA | Alfalfa | Zero/1 | 0 |
| 172289 | CLOVER, UNSPECIFIED SEED | Alfalfa | Zero/1 | 0 |
| 173079 | SEED, BERMUDA GRASS | Alfalfa | Zero/1 | 0 |
| 173669 | SEED, SUDAN GRASS | Alfalfa | Zero/1 | 0 |
| 173999 | SEED, GRASS, UNSPECIFIED | Alfalfa | Zero/1 | 0 |
| 178999 | SEED, OTHER (NO FLOWERS) | Alfalfa | Cotton/20 | 0.17 |
| 181999 | HAY, ALFALFA | Alfalfa | Zero/1 | 0 |

## Agricultural Harvest Operations

**Table 60**
**Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 188499 | HAY, GRAIN | Alfalfa | Cotton/2 | 1.68 |
| 188799 | HAY, WILD | Alfalfa | Cotton/2 | 1.68 |
| 188899 | HAY, SUDAN | Alfalfa | Zero/1 | 0 |
| 188999 | HAY, OTHER UNSPECIFIED | Alfalfa | Cotton/2 | 1.68 |
| 194599 | PASTURE, IRRIGATED | No Land | Zero/1 | 0 |
| 194699 | PASTURE, RANGE | No Land | Zero/1 | 0 |
| 194799 | PASTURE, MISC. FORAGE | No Land | Zero/1 | 0 |
| 195199 | SILAGE | Wheat | Cotton/20 | 0.17 |
| 195299 | HAY, GREEN CHOP | Alfalfa | Zero/1 | 0 |
| 195399 | STRAW | Alfalfa | Wheat/1 | 5.8 |
| 198199 | RICE, WILD | Rice | Cotton/2 | 1.68 |
| 198999 | FIELD CROPS, UNSPEC. | Corn | Cotton/20 | 0.17 |
| 201119 | ORANGES, NAVEL | Citrus | Cotton/40 | 0.08 |
| 201519 | ORANGES, VALENCIAS | Citrus | Cotton/40 | 0.08 |
| 201999 | ORANGES, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 202999 | GRAPEFRUIT, ALL | Citrus | Cotton/40 | 0.08 |
| 203999 | TANGERINES & MANDARINS | Citrus | Cotton/40 | 0.08 |
| 204999 | LEMONS, ALL | Citrus | Cotton/40 | 0.08 |
| 205999 | LIMES, ALL | Citrus | Cotton/40 | 0.08 |
| 206999 | TANGELOS | Citrus | Cotton/40 | 0.08 |
| 207999 | KUMQUATS | Citrus | Cotton/40 | 0.08 |
| 208059 | CITRUS, MISC BY-PROD | Citrus | Cotton/40 | 0.08 |
| 209999 | CITRUS, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 211999 | APPLES, ALL | Citrus | Cotton/40 | 0.08 |
| 212199 | PEACHES, FREESTONE | Citrus | Cotton/40 | 0.08 |
| 212399 | PEACHES, CLINGSTONE | Citrus | Cotton/40 | 0.08 |
| 212999 | PEACHES, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 213199 | CHERRIES, SWEET | Citrus | Cotton/40 | 0.08 |
| 214199 | PEARS, BARLETT | Citrus | Cotton/40 | 0.08 |
| 214899 | PEARS, ASIAN | Citrus | Cotton/40 | 0.08 |
| 214999 | PEARS, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 215199 | PLUMS | Citrus | Cotton/40 | 0.08 |
| 215399 | PLUMCOTS | Citrus | Cotton/40 | 0.08 |
| 215999 | PRUNES, DRIED | Citrus | Cotton/40 | 0.08 |
| 216199 | GRAPES, TABLE | Grapes-Table | Cotton/20 | 0.17 |
| 216299 | GRAPES, WINE | Grapes-Wine | Cotton/20 | 0.17 |
| 216399 | GRAPES, RAISIN | Grapes-Raisin | Cotton/20 | 0.17 |
| 216999 | GRAPES, UNSPECIFIED | Grapes-Wine | Cotton/20 | 0.17 |
| 217999 | APRICOTS, ALL | Citrus | Cotton/40 | 0.08 |
| 218199 | NECTARINES | Citrus | Cotton/40 | 0.08 |
| 218299 | PERSIMMONS | Citrus | Cotton/40 | 0.08 |
| 218399 | POMEGRANATES | Citrus | Cotton/40 | 0.08 |
| 218499 | QUINCE | Citrus | Cotton/40 | 0.08 |
| 218839 | CHERIMOYAS | Citrus | Cotton/40 | 0.08 |
| 218889 | ORCHARD BIOMASS | Almonds | Cotton/40 | 0.08 |
| 218899 | FRUITS & NUTS, UNSPEC. | Citrus | Cotton/40 | 0.08 |
| 221999 | AVOCADOS, ALL | Citrus | Cotton/40 | 0.08 |
| 224999 | DATES | Citrus | Almonds/20 | 2.04 |
| 225999 | FIGS, DRIED | Citrus | Almonds/20 | 2.04 |
| 226999 | OLIVES | Citrus | Cotton/40 | 0.08 |
| 228019 | GUAVAS | Citrus | Cotton/40 | 0.08 |

## Agricultural Harvest Operations

**Table 60**
**Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 229999 | KIWIFRUIT | Citrus | Cotton/40 | 0.08 |
| 230639 | BERRIES, BLACKBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 230869 | BERRIES, BOYSENBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 234799 | BERRIES, LOGANBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 236199 | BERRIES, RASPBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 237199 | STRAWBERRIES, FRESH MKT | Melon | Cotton/40 | 0.08 |
| 237299 | STRAWBERRIES, PROC | Melon | Cotton/40 | 0.08 |
| 237999 | STRAWBERRIES, UNSPECIFIED | Melon | Cotton/40 | 0.08 |
| 239999 | BERRIES, BUSH, UNSPECIFIED | Grapes-Table | Cotton/40 | 0.08 |
| 261999 | ALMONDS, ALL | Almonds | Almonds/1 | 40.77 |
| 263999 | WALNUTS, ENGLISH | Almonds | Almonds/1 | 40.77 |
| 264999 | PECANS | Almonds | Almonds/10 | 4.08 |
| 265999 | WALNUTS, BLACK | Almonds | Almonds/1 | 40.77 |
| 266999 | CHESTNUTS | Almonds | Almonds/10 | 4.08 |
| 267999 | MACADAMIA NUT | Almonds | Almonds/10 | 4.08 |
| 268079 | PISTACHIOS | Almonds | Almonds/10 | 4.08 |
| 268099 | ALMOND HULLS | Almonds | Almonds/1 | 40.77 |
| 301999 | ARTICHOKES | Melon | Cotton/40 | 0.08 |
| 302199 | ASPARAGUS, FRESH MKT | Melon | Cotton/2 | 1.68 |
| 302299 | ASPARAGUS, PROC | Melon | Cotton/2 | 1.68 |
| 302999 | ASPARAGUS, UNSPECIFIED | Melon | Cotton/2 | 1.68 |
| 303999 | BEANS, GREEN LIMAS | DryBeans | Cotton/2 | 1.68 |
| 304199 | BEANS, SNAP FR MKT | DryBeans | Cotton/20 | 0.17 |
| 304299 | BEANS, SNAP PROC | DryBeans | Cotton/20 | 0.17 |
| 304399 | BEANS FRESH UNSPECIFIED | DryBeans | Cotton/20 | 0.17 |
| 304999 | BEANS, UNSPECIFIED SNAP | DryBeans | Cotton/20 | 0.17 |
| 305999 | BEETS, GARDEN | Sugar Beets | Cotton/2 | 1.68 |
| 306999 | RAPINI | Sugar Beets | Cotton/40 | 0.08 |
| 307189 | BROCCOLI,FOOD SERV | Vegetables | Cotton/40 | 0.08 |
| 307199 | BROCCOLI, FR MKT | Vegetables | Cotton/40 | 0.08 |
| 307299 | BROCCOLI, PROC | Vegetables | Cotton/40 | 0.08 |
| 307919 | BROCCOLI, UNSPECIFIED | Vegetables | Cotton/40 | 0.08 |
| 308999 | BRUSSELS SPROUTS | Melon | Cotton/40 | 0.08 |
| 309999 | CABBAGE, CH. & SPECIALTY | Lettuce | Cotton/40 | 0.08 |
| 310999 | CABBAGE, HEAD | Lettuce | Cotton/40 | 0.08 |
| 313189 | CARROTS, FOOD SERV | Sugar Beets | Cotton/20 | 0.17 |
| 313199 | CARROTS, FR MKT | Sugar Beets | Cotton/20 | 0.17 |
| 313299 | CARROTS, PROC | Sugar Beets | Cotton/20 | 0.17 |
| 313999 | CARROTS, UNSPECIFIED | Sugar Beets | Cotton/20 | 0.17 |
| 314189 | CAULIFLOWER, FOOD SERV | Vegetables | Cotton/40 | 0.08 |
| 314199 | CAULIFLOWER, FR MKT | Vegetables | Cotton/40 | 0.08 |
| 314299 | CAULIFLOWER, PROC | Vegetables | Cotton/40 | 0.08 |
| 314999 | CAULIFLOWER, UNSPECIFIED | Vegetables | Cotton/40 | 0.08 |
| 316189 | CELERY, FOOD SERV | Lettuce | Cotton/40 | 0.08 |
| 316199 | CELERY, FR MKT | Lettuce | Cotton/40 | 0.08 |
| 316299 | CELERY, PROC | Lettuce | Cotton/40 | 0.08 |
| 316999 | CELERY, UNSPECIFIED | Lettuce | Cotton/40 | 0.08 |
| 318999 | RADICCHIO | Lettuce | Cotton/40 | 0.08 |
| 320999 | CHIVES | Lettuce | Cotton/40 | 0.08 |
| 322999 | COLLARD GREENS | Lettuce | Cotton/40 | 0.08 |
| 323999 | CORN, SWEET ALL | Corn | Cotton/40 | 0.08 |

## Agricultural Harvest Operations

**Table 60**
**Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 325999 | CUCUMBERS | Vegetables | Cotton/40 | 0.08 |
| 330999 | EGGPLANT, ALL | Vegetables | Cotton/40 | 0.08 |
| 331999 | ENDIVE, ALL | Lettuce | Cotton/40 | 0.08 |
| 332999 | ESCAROLE, ALL | Lettuce | Cotton/40 | 0.08 |
| 333999 | ANISE (FENNEL) | Lettuce | Cotton/2 | 1.68 |
| 335999 | GARLIC, ALL | Garlic | Cotton/2 | 1.68 |
| 337999 | KALE | Lettuce | Cotton/40 | 0.08 |
| 338999 | KOHLRABI | Lettuce | Cotton/40 | 0.08 |
| 339196 | LETTUCE, BULK SALAD PRODS. | Lettuce | Cotton/40 | 0.08 |
| 339999 | LETTUCE, UNSPECIFIED | Lettuce | Cotton/40 | 0.08 |
| 340999 | LETTUCE, HEAD | Lettuce | Cotton/40 | 0.08 |
| 341999 | LETTUCE, ROMAINE | Lettuce | Cotton/40 | 0.08 |
| 342999 | LETTUCE, LEAF | Lettuce | Cotton/40 | 0.08 |
| 343999 | MELON, CANTALOUPE | Melon | Cotton/40 | 0.08 |
| 348999 | MELON, HONEYDEW | Melon | Cotton/40 | 0.08 |
| 354299 | MELON, UNSPECIFIED | Melon | Cotton/40 | 0.08 |
| 354999 | MELON, WATER MELONS | Melon | Cotton/40 | 0.08 |
| 355999 | MUSHROOMS | No Land Prep. | Zero/1 | 0 |
| 356999 | MUSTARD | Lettuce | Cotton/40 | 0.08 |
| 357999 | OKRA | Lettuce | Cotton/40 | 0.08 |
| 358999 | ONIONS | Onions | Cotton/2 | 1.68 |
| 359999 | PARSLEY | Lettuce | Cotton/40 | 0.08 |
| 361299 | PEAS, GREEN, PROCESSING | DryBeans | Cotton/20 | 0.17 |
| 361999 | PEAS, GREEN, UNSPECIFIED | DryBeans | Cotton/20 | 0.17 |
| 363999 | PEPPERS, BELL | Tomatoes | Cotton/40 | 0.08 |
| 364999 | PEPPERS, CHILI, HOT | Tomatoes | Cotton/40 | 0.08 |
| 366999 | PUMPKINS | Melon | Cotton/20 | 0.17 |
| 367999 | RADISHES | Sugar Beets | Cotton/40 | 0.08 |
| 368999 | RHUBARB | Lettuce | Cotton/40 | 0.08 |
| 370999 | RUTABAGAS | Sugar Beets | Cotton/2 | 1.68 |
| 372999 | ONIONS, GREEN & SHALLOTS | Onions | Cotton/40 | 0.08 |
| 374189 | SPINACH, FOOD SERV | Lettuce | Cotton/40 | 0.08 |
| 374199 | SPINACH, FR MKT | Lettuce | Cotton/40 | 0.08 |
| 374299 | SPINACH, PROC | Lettuce | Cotton/40 | 0.08 |
| 374999 | SPINACH UNSPECIFIED | Lettuce | Cotton/40 | 0.08 |
| 375999 | SQUASH | Melon | Cotton/20 | 0.17 |
| 376999 | SWISSCHARD | Lettuce | Cotton/40 | 0.08 |
| 378199 | TOMATOES, FRESH MARKET | Tomatoes | Cotton/40 | 0.08 |
| 378299 | TOMATOES, PROCESSING | Tomatoes | Cotton/20 | 0.17 |
| 378999 | TOMATOES, UNSPECIFIED | Tomatoes | Cotton/20 | 0.17 |
| 380999 | TURNIPS, ALL | Sugar Beets | Cotton/2 | 1.68 |
| 381999 | GREENS, TURNIP & MUSTARD | Lettuce | Cotton/40 | 0.08 |
| 387999 | LEEKS | Onions | Cotton/40 | 0.08 |
| 391999 | POTATOES, IRISH ALL | Sugar Beets | Cotton/2 | 1.68 |
| 392999 | SWEET POTATOES | Sugar Beets | Cotton/2 | 1.68 |
| 393999 | HORSERADISH | Onions | Cotton/40 | 0.08 |
| 394199 | SALAD GREENS NEC | Lettuce | Cotton/40 | 0.08 |
| 394999 | PEAS, EDIBLE POD (SNOW) | DryBeans | Cotton/20 | 0.17 |
| 395999 | VEGETABLES, ORIENTAL, ALL | Vegetables | Cotton/40 | 0.08 |
| 396999 | SPROUTS, ALFALFA & BEAN | Lettuce | Cotton/40 | 0.08 |
| 398199 | CUCUMBERS, GREENHOUSE | No Land Prep. | Zero/1 | 0 |

## Agricultural Harvest Operations

**Table 60**
**Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 398299 | TOMATOES, GREENHOUSE | No Land Prep. | Zero/1 | 0 |
| 398399 | TOMATOES, CHERRY | Tomatoes | Cotton/40 | 0.08 |
| 398499 | TOMATILLO | Tomatoes | Cotton/40 | 0.08 |
| 398559 | CILANTRO | Lettuce | Cotton/40 | 0.08 |
| 398599 | SPICES AND HERBS | Lettuce | Cotton/40 | 0.08 |
| 398899 | VEGETABLES, BABY | Vegetables | Cotton/40 | 0.08 |
| 398999 | VEGETABLES, UNSPECIFIED | Vegetables | Cotton/20 | 0.17 |
| 832919 | POTATOES SEED | Sugar Beets | Cotton/2 | 1.68 |
| 892999 | NURSERY TURF | No Land Prep. | Zero 1 | 0 |

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.5: Agricultural Harvest Operations. January. Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm.

## Windblown Dust - Agricultural Lands

**Table 61**
**Windblown Dust - Agricultural Lands**

| Air Basin Code | County Name | Emission Factor (tons/acre/yr) | Process Rate (acres) | PM Emissions (tons/year) |
|---|---|---|---|---|
| NCC | Monterey | 0.020478 | 279,178.00 | 5,717.07 |
| | San Benito | 0.015936 | 50,009.00 | 796.96 |
| | Santa Cruz | 0.002485 | 14,873.00 | 36.97 |
| SCC | San Luis Obispo | 0.006876 | 109,694.00 | 754.2 |
| | Santa Barbara | 0.00319 | 80,732.00 | 257.56 |
| | Ventura | 0.018418 | 54,568.00 | 1,005.02 |
| SED | Imperial | 0.141666 | 490,409.00 | 69,474.43 |
| SJV | Fresno | 0.013761 | 864,164.00 | 11,891.35 |
| | Kern | 0.008662 | 408,313.48 | 3,536.73 |
| | Kings | 0.012856 | 473,817.00 | 6,091.62 |
| | Madera | 0.008032 | 141,617.00 | 1,137.47 |
| | Merced | 0.013659 | 364,804.00 | 4,982.86 |
| | San Joaquin | 0.003527 | 387,278.00 | 1,365.96 |
| | Stanislaus | 0.009052 | 229,805.00 | 2,080.26 |
| | Tulare | 0.004693 | 471,664.00 | 2,213.29 |
| SV | Butte | 0.001154 | 116,869.00 | 134.87 |
| | Colusa | 0.004702 | 229,747.00 | 1,080.31 |
| | Glenn | 0.004957 | 186,067.00 | 922.39 |
| | Placer | 0.002172 | 6,962.90 | 15.12 |
| | Sacramento | 0.002479 | 117,770.00 | 291.92 |

Note:
Fraction of PM10 (FRPM10): 0.50
(PM10 Emissions = PM x FRPM10)

**Table 62**
**Windblown Dust - Pasture Lands**

| Air Basin Code | County Name | Emission Factor (tons/acre/yr) | Process Rate (acres) | PM Emissions (tons/year) |
|---|---|---|---|---|
| NCC | Monterey | 0.00110562 | 1,108,000 | 1,225.03 |
| | San Benito | 0.00109336 | 512,000 | 559.8 |
| | Santa Cruz | 0.0001605 | 8,000 | 1.28 |
| SCC | Santa Barbara | 0.00021801 | 602,913 | 131.44 |
| | San Luis Obispo | 0.00046964 | 1,102,500 | 517.78 |
| | Ventura | 0.00050356 | 210,918 | 106.21 |
| SED | Imperial | 0.00867346 | 158,449 | 1,374.30 |
| SJV | Fresno | 0.00149089 | 907,300 | 1,352.69 |
| | Kern | 0.00082834 | 1,527,603 | 1,265.37 |
| | Kings | 0.00146875 | 142,777 | 209.7 |
| | Madera | 0.00116178 | 421,000 | 489.11 |
| | Merced | 0.00155578 | 642,700 | 999.9 |
| | San Joaquin | 0.0005228 | 167,700 | 87.67 |
| | Stanislaus | 0.00107875 | 434,300 | 468.5 |
| | Tulare | 0.00063424 | 713,400 | 452.47 |
| SV | Butte | 0.00014292 | 288,500 | 41.23 |
| | Colusa | 0.00046444 | 181,900 | 84.48 |
| | Glenn | 0.00048846 | 256,575 | 125.33 |
| | Placer | 0.00026499 | 65,656 | 17.4 |
| | Sacramento | 0.00019538 | 118,000 | 23.05 |
| | Shasta | 0.00034146 | 459,000 | 156.73 |
| | Solano | 0.00039453 | 131,360 | 51.83 |
| | Sutter | 0.00037084 | 71,500 | 26.51 |
| | Tehama | 0.00035146 | 955,350 | 335.76 |
| | Yolo | 0.00061919 | 136,870 | 84.75 |
| | Yuba | 0.00023892 | 207,600 | 49.6 |

Note:
Fraction of PM10 (FRPM10): 0.50
(PM10 Emissions = PM x FRPM10)

**Table 63**
**County Size**

| County | Area (acres) | |
|---|---|---|
| | Non-Pasture | Pasture |
| Butte | n/a | n/a |
| Colusa | n/a | n/a |
| Fresno | n/a | n/a |
| Glenn | n/a | n/a |
| Imperial | n/a | n/a |
| Kern | n/a | n/a |
| Kings | n/a | n/a |
| Madera | n/a | n/a |
| Merced | n/a | n/a |
| Monterey | n/a | n/a |
| Placer | n/a | n/a |
| Sacramento | n/a | n/a |
| San Benito | n/a | n/a |
| San Joaquin | n/a | n/a |
| San Luis Obispo | n/a | n/a |
| Santa Barbara | n/a | n/a |
| Santa Cruz | n/a | n/a |
| Shasta | n/a | n/a |
| Solano | n/a | n/a |
| Stanislaus | n/a | n/a |
| Sutter | n/a | n/a |
| Tehama | n/a | n/a |
| Tulare | n/a | n/a |
| Ventura | n/a | n/a |
| Yolo | n/a | n/a |
| Yuba | n/a | n/a |
| **Total** | **0** | **0** |

Source:
CARB. 1997. Emission Inventory Documentation, Section 7.12: Windblown Dust - Agricultural Lands. July.
Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocfugwbdst.htm.

# Appendix C

# Special Status Wildlife Species with Potential to Occur

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| **Common Name** *Scientific Name* | **Special Status*** | | **Distribution** | **Habitat Association** | **Seasonal Occurrence** | **Potential Impact** |
|---|---|---|---|---|---|---|
| | **Federal** | **State** | | | | |
| **Invertebrates** | | | | | | |
| **Conservancy fairy shrimp** *Branchinecta conservation* | **E, X** | **--** | Northern two-thirds of the Central Valley. It ranges from Vina Plains of Tehama County; Sacramento NWR in Glenn County; Jepson Prairie Preserve and surrounding area east of Travis Air Force Base, Solano County; Mapes Ranch west of Modesto, Stanislaus County. | Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grass or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands. | Has been collected from early December to early May. | None. Occurrences have been documented within the Seller Service Area. Suitable habitat occurs within the project area. No impacts to vernal pool or other habitats occupied by this species are anticipated. The species is not likely to occur to occur in rice fields and canals due to predators (i.e. fish). |
| **Lange's metalmark butterfly** *Apodemia mormo langei* | **E** | **--** | Restricted to sand dunes along the southern bank of the Sacramento-San Joaquin River, and is currently found only at Antioch Sand Dunes in Contra Costa County. | Found only in the Antioch sand dunes. | Breeding season is August -September, Larvae hatch during rainy months. | None. CNDDB occurrences have been documented within the Buyer Service Area; however, transfers would not affect sand dunes. |
| **Longhorn fairy shrimp** *Branchinecta longiantenna* | **E, X** | **--** | Restricted to northern, central, and portions of southern California; populations along the eastern margin of the Central Coast Mountains from Concord, Contra Costa County south to Soda Lake in San Luis Obispo County; the Kellogg Creek watershed; the Altamont Pass area; the western and northern boundaries of Soda Lake on the Carrizo Plain; and Kesterson National Wildlife Refuge in the Central Valley. | Found in ephemeral freshwater habitats, such as vernal pools and swales. | Has been observed from late December until late April | None. Occurrences have been documented within the Seller Service Area. Suitable habitat may occur within the project area. The species is not likely to occur to occur in rice fields and canals due to predators (i.e. fish). Transfers are not expected to impact any suitable grassland vernal pools or swales. |
| **Mid-valley fairy shrimp** *Branchinecta mesovallensis* | **Under review** | **--** | Counties within the Great Central Valley, including Sacramento, Solano, Merced, Madera, San Joaquin, Fresno, and Contra Costa Counties. | Found in vernal pools, seasonal wetlands that fill with water during fall and winter rains | Has been collected from early December to early May. | Suitable habitat may occur within the project area. Low potential for occurrence due to predators (i.e. fish). |
| **Valley elderberry longhorn beetle** *Desmocerus californicus dimorphus* | **T, X** | **--** | Central Valley and surrounding foothills below 3,000 feet elevation. | Dependent on elderberry shrubs (host plant) as a food source. Potential habitat is shrubs with stems 1 inch in diameter within Central Valley. | Year round for host plant and exit holes; March-June for adults | Elderberry shrubs would not be impacted, therefore no impact to beetles would occur. |
| **Vernal pool fairy shrimp** *Branchinecta lynchi* | **T, X** | **--** | Endemic to the Central Valley, Central Coast Mountains, and South Coast Mountains of California. It ranges from the Vina Plains in Tehama County, through the Central Valley, and south along the Central Coast to northern Santa Barbara County. | Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grassed or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands. | Has been collected from early December to early May. | None. Occurrences have been documented in both the Buyer and the Seller Service areas. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish), therefore no impacts are anticipated to the species. Transfers are not expected to impact vernal pools or natural wetlands. |

| **Common Name** *Scientific Name* | **Special Status*** | | **Distribution** | **Habitat Association** | **Seasonal Occurrence** | **Potential Impact** |
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| | **Federal** | **State** | | | | |
| **Vernal pool tadpole shrimp** *Lepidurus packardi* | **E, X** | -- | Endemic to the northern portion of the Central Valley of California. This species occurs from the Millville Plains and Stillwater Plains in Shasta County south throughout the Central Valley to Merced County. | Found in a variety of natural and artificial seasonally ponded habitat types including: vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits, and ruts caused by vehicular activities. | Has been collected from early December to early May. | None. Occurrences have been documented in both the Buyer and the Seller Service area. Suitable habitat is present in the project area. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish),therefore there is a low potential for impacts to the species. Transfers are not expected to impact vernal pools or natural wetlands. No impacts to the species are expected. |
| **Amphibians** | | | | | | |
| **California red-legged frog** *Rana aurora draytonii* | **T, PX** | **SSC** | Northwestern California to northwestern Baja California. May now be extirpated in the southern Sierra Nevada; other Sierra Nevada foothill populations are small and highly localized. Nearly all current Central Valley sites are on the Coast Range slope of | Usually found in or near quiet permanent water of streams, freshwater marshes, or (less often) ponds and other quiet bodies of water; also damp woods and meadows some distance from water. Occurs in sites with dense vegetation (e.g., willows) close to water. | Year round | None. Suitable habitat is present within the project area and occurrences of this species have been previously documented in the Buyer Service Area. Transfers would not adversely affect habitat. |
| **California tiger salamander** *Ambystoma californiense* | **T[1], E[2], X** | **CE, SSC** | Found in annual grassland habitat, grassy understories of valley-foothill hardwood habitats, and uncommonly along stream courses in valley-foothill riparian habitats. Occurs from near Petaluma, Sonoma Co., east through the Central Valley to Yolo and Sacramento Counties and south to Tulare Co.; and from the vicinity of San Francisco Bay south to Santa Barbara Co. | Lives in vacant or mammal-occupied burrows, occasionally other underground retreats, throughout most of the year, in grassland, savanna, or open woodland habitats. Lays eggs on submerged stems and leaves, usually in shallow ephemeral or semi permanent pools and ponds that fill during heavy winter rains, sometimes in permanent ponds; breeding takes place in fish free pools and ponds. | Migrates up to about 2 km between terrestrial habitat and breeding pond. Migrations may occur from November through April. | None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat may occur within the project area, but will not be impacted by transfers. This species is not expected to occur in rice fields due to predatory fish. |
| **Foothill yellow-legged frog** *Rana boylii* | **SC** | **SSC** | This species is known from the Pacific drainages from Oregon to the upper San Gabriel River, Los Angeles County, California, including the coast ranges and Sierra Nevada foothills in the United States. | This species inhabits partially shaded, rocky streams at low to moderate elevations, in areas of chaparral, open woodland, and forest. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat is present within the project area. However transfers are not expected to impact any suitable rocky stream and woodland habitats. No impact to the species is expected. |
| **Western spadefoot toad** *Spea hammondii* | -- | **SSC** | This species occurs in the Central Valley and bordering foothills of California and along the Coast Ranges into northwestern Baja California, Mexico. | Lowlands to foothills, grasslands, open chaparral, pine-oak woodlands. Prefers shortgrass plains, sandy or gravelly soil. It is fossorial and breeds in temporary rain pools and slow-moving streams that do not contain bullfrogs, fish, or crayfish. | Year round. Usually in underground burrows most of year, but will travel several meters on rainy nights. Movement is rarely extensive. | None. Occurrences have been documented from both the Buyer and Seller Service Areas. Suitable habitat is present in the project area. Transfers would not impact suitable upland habitat types. The species is not likely to occur in rice fields due to the |

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| | **Federal** | **State** | | | | |
| **Reptiles** | | | | | | |
| **Giant garter snake** *Thamnophis gigas* | **T** | **T** | Sacramento and San Joaquin Valleys from Butte County in the north to Kern County in the south. | Primarily associated with marshes, sloughs, and irrigation ditches. Generally absent in larger rivers. | Year round | High. Suitable habitat is present within the Buyer and Seller Service Areas. Suitable habitat in the Seller Service Area is intermittent based on normal variation in cropping. Direct impacts may include reduction in suitable aquatic habitat within the Seller Service Area. The most impact would occur during the breeding season. Species is further analyzed in Chapter 3. |
| **Western pond turtle** *Actinemys marmorata* | **Under review** | **SSC** | Ranged from extreme western Washington and British Columbia to northern Baja California, mostly to the west of the Cascade-Sierra crest. | The western pond turtle occupies a wide variety of wetland habitats including rivers and streams (both permanent and intermittent), lakes, ponds, reservoirs, permanent and ephemeral shallow wetlands, abandoned gravel pits, stock ponds, and sewage treatment. | Year round | High. Suitable habitat occurs within the project area. Pond turtles may occur in ditches, canals, rice fields, etc. Species is further analyzed in Chapter 3. |
| **Birds** | | | | | | |
| **Aleutian Canada goose** *Branta canadensis leucopareia* | **D** | **--** | Alaska to California | Found grazing in golf courses, agricultural lands, and any open ground adjacent to water. Nests in grasses and marshes. | Year round | Suitable habitat is present in project area. Low impact would occur. Can relocate to other habitats within the area. |
| **American peregrine falcon** *Falco peregrinus anatum* | **D, NMBMC** | **E, FP** | Throughout California. | Breeds in woodland, forest and coastal habitats on protected cliffs and ledges. Riparian areas and coastal and inland wetlands are important habitats yearlong especially during the non-breeding season. | Year round | None. Rice fields may provide suitable foraging habitat for the species, but birds could relocate to other habitat areas in the vicinity. No nesting habitat would be affected by transfers. |
| **Bald eagle** *Haliaeetus leucocephalus* | **D** | **E** | Throughout California. | Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Area and both areas provide suitable habitat. No impacts to suitable nesting habitat are anticipated. Rice fields represent marginal foraging habitat. Birds would be able to relocate to other suitable habitat areas in the vicinity if fields were fallowed. |

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| | **Federal** | **State** | | | | |
| **Bank swallow** *Riparia riparia* | -- | **T, SSC** | A neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. Breeding population in California occurs along banks of the Sacramento and Feather rivers in the northern Central Valley. | Requires vertical banks and cliffs with fine-textured or sandy soils near streams, rivers, ponds, lakes, and the ocean for nesting. Feeds primarily over grassland, shrub land, savannah, and open riparian areas during breeding season and over grassland, brushland, wetlands, and cropland during migration. | March-mid-September | None. No suitable nesting habitat (i.e. cliffs) would be affected. There is potential that transfers would reduce the area of cropland habitat used for foraging during migration (wetlands and croplands) due to changes in water application. However, fallow cropland would still provide suitable foraging habitat, and birds could forage at other croplands in the vicinity. |
| **Black tern** *Chlidonias niger* | -- | **SSC** | Common spring and summer visitor to fresh emergent wetlands of California. | Uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields. In migration, some take coastal routes and forage offshore. | April-September | High. No occurrences have been documented within either the Buyer or Seller Service Areas. However, suitable habitat (i.e. rice fields) is present, and the project area is within the known range for the species. Therefore it has moderate potential to occur Water transfers could reduce suitable habitat for the species within the Seller Service Area. Species is further analyzed in Chapter 3. |
| **Black-crowned night heron** *Nycticorax nycticorax* | **SC** | -- | Resident in lowlands and foothills throughout most of California, including the Salton Sea and Colorado River areas, and very common locally in large nesting colonies. | Feeds along the margins of lacustrine, large riverine, and fresh and saline emergent habitats. Nests and roosts in dense-foliaged trees and dense emergent wetlands. | Year round | None. No occurrences of black-crowned night heron have been documented within either the Buyer or Seller Service Areas. Suitable habitat is present in project area, however no nesting or roosting habitats would be affected. |
| **California yellow warbler** *Dendroica petechia brewsteri* | -- | **SSC** | Throughout California | Frequents open to medium-density woodlands and forests with a heavy brush understory in breeding season. In migration, found in a variety of sparse to dense woodland and forest habitats. | April-October | None. No occurrences have been documented in the project area. The species is not likely to occur in rice fields, and no suitable habitat would be impacted (i.e. dense woodland and forest habitats). |
| **Cooper's hawk** *Accipiter cooperii* | -- | **WL** | Throughout California | Frequents landscapes where wooded areas occur in patches and groves. Often uses patchy woodlands and edges with snags for perching. Dense stands with moderate crown-depths used for nesting. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. No potential impacts to preferred foraging or nesting habitat are anticipated. |

| **Common Name** *Scientific Name* | **Special Status*** | | **Distribution** | **Habitat Association** | **Seasonal Occurrence** | **Potential Impact** |
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| | **Federal** | **State** | | | | |
| **Double-crested cormorant** *Phalacrocorax pelagicus* | -- | **WL** | Along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. | Open water with offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Requires undisturbed nest-sites beside water, on islands or mainland. Uses wide rock ledges on cliffs; rugged slopes; and live or dead trees, especially tall ones. | Year round | None. No occurrences have been documented within the project area, but the species could occur at reservoirs and inland ponds. No negative impacts to foraging or breeding habitat are expected. |
| **Golden eagle** *Aquila chrysaetos* | **T** | **E** | Throughout California | Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat occurs within the project area. No impacts to nesting habitat are expected. |
| **Great blue heron** *Ardea herodias* | -- | -- | Throughout California | Found in shallow estuaries, fresh and saline emergent wetlands, along riverine and rocky marine shores, in croplands, pastures, salt ponds, and in mountains above foothills. Nests roosts in large trees. | Year round | None. Rookeries have been documented within the Buyer and Seller Service Areas. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited, and birds could use alternative suitable foraging areas in the vicinity. |
| **Great egret** *Ardea alba* | -- | -- | Throughout California | Feeds and rests in fresh, and saline emergent wetlands, along the margins of estuaries, lakes, and slow-moving streams, on mudflats and salt ponds, and in irrigated croplands and pastures. Nests roosts in large trees. | Year round | None. Occurrences have been documented in the Seller Service Area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited, and birds could use alternative suitable foraging areas in the vicinity. |
| **Greater sandhill crane** *Grus canadensis tabida* | -- | **T, FP** | Breeds only in Siskiyou, Modoc and Lassen counties and in Sierra Valley, Plumas and Sierra counties. Winters primarily in the Sacramento and San Joaquin valleys from Tehama south to Kings Counties. | In summer, this race occurs in and near wet meadow, shallow lacustrine, and fresh emergent wetland habitats. Frequents annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. It prefers relatively treeless plains. | Migration southward is September-October and northward is March-April. | High. No occurrences have been documented within the project area, but occurrences have been recorded in Butte and Sutter Counties. Suitable foraging and winter roosting habitat is present within the project area (i.e. rice fields). Conservation strategies are in place for this species and birds will have other suitable nesting sites available. |

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| | **Federal** | **State** | | | | |
| **Least bell's vireo** *Vireo bellii pusillus* | **E** | **E** | California to northern Baja. | Inhabits low, dense riparian growth along water or along dry parts of intermittent streams. Typically associated with willow, cottonwood, baccharis, wild blackberry, or mesquite in desert localities. | March-August | None. Occurrences have been documented in the Buyer Service Area. Suitable habitat may occur within the project action area. Tansfers are not expected to impact any suitable willow or dense riparian habitat, therefore no impacts to the species are anticipated. |
| **Little willow flycatcher** *Empidonax traillii brewsteri* | -- | **E** | Migrant at lower elevations, primarily in riparian habitats throughout California | Most numerous where extensive thickets of low, dense willows edge on wet meadows, ponds, or backwaters. | Spring (mid-May to early June) and fall (mid-August to early September) | None. This species has not been documented within the project area according to CNDDB. Suitable habitat may be present within the project area (i.e. dense willows), but would not be impacted by transfers. |
| **Long-billed curlew** *Numenius americanus* | **SC** | **WL** | Along the California coast, and in the Central and Imperial valleys. | Upland shortgrass prairies and wet meadows are used for nesting; coastal estuaries, open grasslands, and croplands are used in winter. | Winter migrant from July-April | Low. No CNDDB occurrences have been documented within the project area, but the species is known to occur within the area during winter migration. There is potential for impacts to suitable foraging habitat (i.e. cropland), although this may be reduced by environmental commitments, which protect winter foraging habitat in Butte Sink, and other wildlife management areas downstream. Birds can relocate to other suitable habitats within the area. |
| **Long-eared owl** *Asio otus* | -- | **SSC** | Throughout California | Frequents dense, riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats. Also found in dense conifer stands at higher elevations. | Year round | None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the project area. Transfers would not impact any suitable habitat (i.e. forest and woodland habitats). |
| **Merlin** *Falco columbarius* | -- | **WL** | Occurs in most of the western half of California below 3900 ft. | Frequents coastlines, open grasslands, savannahs, woodlands, lakes, wetlands, edges, and early successional stages. Ranges from annual grasslands to ponderosa pine and montane hardwood-conifer habitats. | Winter migrant from September-May | None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in project area. Foraging habitat may be altered, but transfers would not decrease suitability. No adverse impacts are anticipated. |

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| | **Federal** | **State** | | | | |
| **Northern harrier** *Circus cyaneus* | -- | **SSC** | Throughout lowland California, concentrated in the Central Valley and coastal valleys. | Breeds in annual grasslands and wetlands. Prefers marshes and grasslands for foraging and nesting. Also uses agricultural fields for nesting and foraging, although nests may be destroyed by agricultural activities. | Year round | None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in project area. Foraging and breeding habitat may be affected, but fallow fields would still represent suitable habitat. Birds can relocate to other habitats within the area. |
| **Osprey** *Pandion haliaetus* | -- | **WL** | Northern California from Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County. | Associated strictly with large, fish-bearing waters, primarily in ponderosa pine through mixed conifer habitats. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. Water transfers would be subject to flow requirements. Therefore no impacts to foraging area expected. No impacts to nesting sites are anticipated. |
| **Short-eared owl** *Asio flammeus* | -- | **SSC** | Endemic to marshes bordering the San Francisco, San Pablo Bays and Suisun Bay . | Open country, including grasslands, wet meadows and cleared forests. Occasionally in estuaries during breeding season. | Year round | None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the project area. No impacts to breeding habitat would occur. Fallow rice fields would still represent suitable foraging habitat for the species. |
| **Snowy egret** *Egretta thula* | -- | -- | Throughout California | Found along shores of coastal estuaries, fresh and saline emergent wetlands, ponds, slow-moving rivers, irrigation ditches, and wet fields. | Year round | None. Occurrences have been documented in the Buyer Service Area, however suitable habitat is present in both the Buyer and Seller Service area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity. |

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| | **Federal** | **State** | | | | |
| **Swainson's hawk** *Buteo swainsoni* | **SC, MNBMC** | **T** | Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. | Nests in mature trees, including valley oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain and row crop fields. | Spring and Summer; small wintering population in the Delta | None. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Transfers may alter the composition of foraging habitat in the Buyer and Seller Service Areas, but these areas would still be suitable for the species, and additional habitats in the vicinity would be available. No impacts to breeding habitat are expected. |
| **Tricolored blackbird** *Agelaius tricolor* | -- | **SSC** | A resident in California found throughout the Central Valley and in coastal districts from Sonoma Co. south. | Breeds near fresh water, preferably in emergent wetlands with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, tall herbs. Feeds in grassland and cropland habitats. | Year round | Low. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat may be affected by the project. Birds can relocate to other adjacent foraging habitats within the area. |
| **Western burrowing owl** *Athene cunicularia hypugaea* | -- | **SSC** | Central and southern coastal habitats, Central Valley, Great Basin, and deserts. | Open annual grasslands or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Dependent upon burrowing mammals (especially California ground squirrel) for burrows. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. Agricultural ditches may be suitable habitat for burrowing owl burrow and nesting activity. Water transfers would not affect the suitability of habitat for burrowing owl in the project area. |
| **Western snowy plover** *Charadrius alexandrinus* | **T** | **SSC** | Along the west coast states, with inland nesting taking place at the Salton Sea, Mono Lake, and at isolated sites on the shores of alkali lakes in northeastern California, in the Central Valley, and southeastern deserts. | Nests, feeds, and takes cover on sandy or gravelly beaches along the coast, on estuarine salt ponds, alkali lakes, and at the Salton Sea. | Migration is from July-March (some year round populations). | None. Occurrences have been documented in the Buyer Service Area. There is a CNDDB occurrence in Yolo County, however this species is not likely to occur in rice fields. Suitable habitat may occur within the project area. However, transfers are not expected to impact any suitable breeding or foraging habitat (i.e. sandy beaches or estuarine salt ponds). |

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| | **Federal** | **State** | | | | |
| **Western yellow-billed cuckoo** *Coccyzus americanus* | **SC, C** | **E** | Uncommon to rare summer resident in scattered locations throughout California. | Deciduous riparian thickets or forests with dense, low-level or understory foliage, and which abut on slow-moving watercourses, backwaters, or seeps. Willow almost always a dominant component of the vegetation. In Sacramento Valley, also utilizes adjacent orchards, especially of walnut. Nests in sites with some willows, dense low-level or understory foliage, high humidity, and wooded foraging spaces. | Summer migration is from June-September. | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present within the project area. However this species is not likely to occur in rice fields due to lack of suitable foraging and roosting habitat (i.e. dense riparian thickets). No impacts are anticipated. |
| **White-faced ibis** *Plegadis chihi* | **--** | **WL** | Uncommon summer resident in sections of southern California, a rare visitor in the Central Valley, and is more widespread in migration. | Feeds in fresh emergent wetlands, shallow lacustrine waters, muddy grounds of wet meadows, and irrigated or flooded pastures and croplands. Nests in dense, fresh emergent wetlands. | Present in California from April-October. | Low. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. Low potential impact to foraging habitat in the Seller Service Area. No potential impacts are expected to roosting habitat. Can relocate to other habitats within the area. |
| **White-tailed kite** *Elanus leucurus* | **SC, MNBMC** | **FP** | Central Valley, coastal valleys, San Francisco Bay area, and low foothills of Sierra Nevada. | Savanna, open woodlands, marshes, partially cleared lands and cultivated fields, mostly in lowland situations (Tropical to Temperate zones). | Year round | None. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat may be altered, but would still be suitable for the species. No potential impacts to breeding habitat are anticipated. |

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| | **Federal** | **State** | | | | |
| **Mammals** | | | | | | |
| **California wolverine** *Gulo gulo* | **SC** | **T, FP** | A scarce resident of North Coast mountains and Sierra Nevada. Sightings range from Del Norte and Trinity cos. east through Siskiyou and Shasta cos., and south through Tulare Co. A few possible sightings occur in the north coastal region as far south as Lake Co. Habitat distribution in California is poorly known for the North Coast and northern Sierra Nevada. | In north coastal areas, has been observed in Douglas-fir and mixed conifer habitats. In the northern Sierra Nevada, have been found in mixed conifer, red fir, and lodgepole habitats, and probably use subalpine conifer, alpine dwarf-shrub, wet meadow, and montane riparian habitats. In the southern Sierra Nevada occur in red fir, mixed conifer, lodgepole, subalpine conifer, alpine dwarf-shrub, barren, and probably wet meadows, montane chaparral, and Jeffrey pine. | Year round (largely nocturnal) | None. Suitable habitat may occur within the project area, however no CNDDB occurrences have been documented in the Buyer or Seller Service area. The species is not likely to occur in agriculture fields. No impacts are anticipated. |
| **Greater western mastiff bat** *Eumops perotis californicus* | **SC** | **SSC** | Uncommon resident in southeastern San Joaquin Valley and Coastal Ranges from Monterey Co. southward through southern California, from the coast eastward to the Colorado Desert. | Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban areas. Crevices in cliff faces, high buildings, trees, and tunnels are required for roosting. | Year round (nocturnal activity) | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area, but transfers would not result in adverse impacts to the species. |
| **Ring-tailed cat** *Brassariscus astutus* | **SC** | **FP** | Ringtails are found in a variety of habitats centered around the semi-arid to arid climates of the west and southwest. Little information available on distribution and relative abundance among habitats. | Occurs in various riparian habitats, and in brush stands of most forest and shrub habitats, at low to middle elevations. Uses hollow trees, logs, snags, cavities in talus and other rocky areas, and other recesses are for cover. | Year round (nocturnal) | None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in project area, but the species is not likely to occur in rice fields. No potential impact to suitable habitat are expected. |
| **Riparian brush rabbit** *Sylvilagus bachmani riparius* | **E** | **E** | Isolated populations on Caswell Memorial State Park on the Stanislaus River and along an overflow channel of the San Joaquin River. | Riparian thickets | Year round | None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in the project area, however, no potential impacts are expected to suitable habitat (i.e. riparian thickets). |
| **Riparian (San Joaquin Valley) woodrat** *Neotoma fuscipes riparia* | **E** | **SSC** | Found along the lower portions of the San Joaquin and Stanislaus rivers in the northern San Joaquin Valley. Historical records for the riparian woodrat are distributed along the San Joaquin, Stanislaus, and Tuolumne rivers, and Corral Hollow, in San Joaquin, Stanislaus, and Merced Counties. | Most numerous where shrub cover is dense and least abundant in open areas. Dens are usually built in willow thickets with oak overstory. | Year round (nocturnal activity) | None. Suitable habitat present (i.e. dense shrubs) in both the Buyer and Seller Service Areas, however no CNDDB occurrences have been documented. No potential impacts are expected. |

| **Common Name** *Scientific Name* | **Special Status*** | | **Distribution** | **Habitat Association** | **Seasonal Occurrence** | **Potential Impact** |
|---|---|---|---|---|---|---|
| | **Federal** | **State** | | | | |
| **San Joaquin kit fox**<br>*Vulpes macrotis mutica* | **E** | **T** | Found only in the Central Valley area of California. Kit foxes currently inhabit suitable habitat in the San Joaquin valley and in surrounding foothills of the Coast Ranges, Sierra Nevada, and Tehachapi Mountains; from southern Kern County north to Contra Costa, Alameda, and San Joaquin counties on the west; and near La Grange, Stanislaus County on the east. | Found in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. Build dens for cover. | Year round (mostly nocturnal, but often active during daytime in cool weather) | None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat is present within the project area. San Joaquin kit fox have the potential to occur in inland and southern portions of the project area. Transfers would not change cropping patterns. Species is evaluated under long-term and interim CVP contracts. |

[1]Central CA DPS

[2]Santa Barbara and Sonoma Counties

**Green Shading: potential to be affected, further evaluated in Chapter 3**

*** Status explanations:**

**Federal**

E = listed as endangered under the federal Endangered Species Act

T = listed as threatened under the federal Endangered Species Act

MNBMC = Fish and Wildlife Service: Migratory Nongame Birds of Management Concern

SC = species of concern; formerly Category 2 candidate for federal listing

C = Candidate for listing as threatened or endangered

-- = no designations

X = critical habitat

PX = potential critical habitat

D = delisted

**State**

E = listed as endangered under the California Endangered Species Act

T = listed as threatened under the California Endangered Species Act

CE = candidate endangered under the California Endangered Species Act

FP = fully protected under the California Fish and Game Code

SSC = species of special concern

WL = Watch List

-- = no designations

# Appendix D

# Special Status Plant Species with Potential to Occur

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| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Ahart's dwarf rush** *Juncus leiospermus* var. *ahartii* | -/-/ 1B | Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba Counties. | Valley and foothill grassland (mesic). | March-May | Not likely to occur in rice fields, no suitable habitat present. |
| **Ahart's paronychia** *Paronychia ahartii* | -/-/ 1B | Butte, Shasta, and Tehama Counties. | Cismontane woodland, valley and foothill grassland, and vernal pools. | March-June | Not likely to occur in rice fields, no suitable habitat present. |
| **Alkali milk-vetch** *Astragalus tener var. tener* | -/-/ 1B | Central western California including Yolo County. | Subalkaline flats and areas around vernal pools. | March-June | Not likely to occur in rice fields, no suitable habitat present (i.e. subalkali flats). |
| **Antioch Dunes evening-primrose** *Oenothera deltoides* ssp. *howellii* | E/E/ 1B | Found only in Contra Costa and Sacramento Counties. | Occurs in inland dunes. | March-September | Not likely to occur in rice fields, no suitable habitat present. Located outside of the project area. |
| **Brittlescale** *Atriplex depressa* | -/-/1B | Western Central Valley and valleys of adjacent foothills. | Alkali grassland, alkali meadow, alkali scrub, and vernal pools. | April-October | There is a CNDDB occurrence within Glenn, Colusa, and Yolo counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali and vernal pools). |
| **Boggs Lake hedge-hyssop** *Gratiola hetersepela* | -/-/1B | Dispersed throughout the Sacramento and Central Valley. Also in Oregon. | Marsh's, swamps, and vernal pools (clay). | April-August | There is a CNDDB occurrence within Sacramento County. Suitable habitat is present but has low potential to occur. |
| **Butte County meadowfoam** *Limnanthes floccosa* ssp. *californica* | E/E/1B | Only located in Butte County. | Valley and foothill grassland (mesic), and vernal pools. | March-May | Not likely to occur in rice fields, no suitable habitat present. |

| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Contra Costa goldfields** *Lasthenia conjugens* | E/SSC/1B | San Francisco Bay Delta Regions, and scattered coastal areas. | Cismontane woodlands, playas, valley and foothill grasslands, and vernal pools. | March-June | No CNDDB occurrences; not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools, playas). |
| **Colusa grass** *Neostapfia colusana* | T/E/1B | Southern Sacramento Valley, and northern San Joaquin Valley. | Vernal pools. | May-July | There is a CNDDB occurrence within Glenn and Colusa counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **Crampton's tuctoria (Solano grass)** *Tuctoria mucronata* | E/E/1B | Located only in Yolo and Solano Counties. | Valley and foothill grassland (mesic), and vernal pools. | April-August | Not likely to occur in rice fields, no suitable habitat present. |
| **Delta coyote-thistle (button celery)** *Eryngium racemosum* | -/E/1B | Calaveras, Contra Costa, Merced, San Joaquin, and Stanislaus Counties. | Riparian scrub and vernally mesic clay depressions. | June-October | Not likely to occur in rice fields, no suitable habitat present. Is not located in areas to be fallowed. |
| **Ferris' milk-vetch** *Astragalus tener* var. *ferrisae* | -/-/1B | Sacramento Valley. | Subalkaline flats and areas around vernal pools. | March-June | Not likely to occur in rice fields, no suitable habitat present. |
| **Fox sedge** *Carex vulpinoidea* | -/-/2 | Northern Sacramento Valley, including Butte County, isolated populations in San Joaquin County. | Riparian woodland, marshes and swamps. | May-June | Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields. |
| **Greene's tuctoria** *Tuctoria greeni* | E/SSC/1B | Butte, Colusa, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tehama, and Tulare Counties. | Vernal pools. | May-July | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |

| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Hairy Orcutt grass** *Orcuttia pilosa* | E/E/1B | Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento counties. | Vernal pools. | May-September | There is a CNDDB occurrence within Butte and Glenn counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **Hartweg's golden sunburst** *Pseudobahia bahiifolia* | E/E/1B | Found in El Dorado, Fresno, Madera, Merced, Stanislaus, Tuolumne, and Yuba Counties. | Cismontane woodland, valley and foothill grassland, often acidic. | April-May | There is a CNDDB occurrence within Yolo County, however this species is not likely to occur in rice fields due to lack of suitable habitat |
| **Heartscale** *Atriplex cordulata* | -/-/1B | Western Central Valley and valleys of adjacent foothills. | Alkali grasslands, alkali meadows, and alkali scrub. | May-October | There is a CNDDB occurrence within Butte, Colusa, Yolo, and Glenn counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali areas). |
| **Heckard's pepper-grass** *Lepidium latipes* var**.** *heckardii* | -/-/1B | Glenn, Solano, and Yolo Counties. | Valley and foothill grassland alkaline flats. | March-May | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali flats). |
| **Henderson's bent grass** *Agrostis hendersonii* | - /-/ 3 | Found in Butte, Calaveras, Merced, Placer, Shasta, and Tehama counties. Also found in Oregon. | Vernal pools. | March- June | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **Hispid bird's beak** *Cordylanthus mollis* ssp. *hispidus* | -/-/1B | Alameda, Kern, Fresno, Merced, Placer, and Solano Counties. | Meadows and seeps, playas, valley and foothill grasslands (alkali). | June-September | Not likely to occur in rice fields, no suitable habitat present. |

| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Hoover's spurge** *Chamaesyce hooveri* | T/-/ 1B | Scattered in Glenn, Butte, Colusa, Merced, Stanislaus, Tehama, and Tulare Counties. | Vernal pools. | July-September | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **Indian valley brodiaea** *Broiaea coronaria* ssp. *rosea* | -/E/1B | Scattered in Glenn, Lake, Colusa, and Tehama Counties. | Closed cone coniferous forest, chaparral, valley and foothill grasslands (serpentinite). | May-June | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat. |
| **Jepson's milk-vetch** *Astragalus rattanii var. jepsonianus* | -/-/1B | Colusa, Glenn, Lake, Napa, Tehama, and Yolo counties. | Chaparral, cismontane woodland, valley and foothill grassland, often serpentinite. | April-June | There is a CNDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat. |
| **Keck's checkerbloom** *Sidalcea keckii* | E/-/1B | Colusa, Fresno, Merced, Napa, Solano, Tulare, and Yolo counties. | Cismontane woodlands, foothill and valley grasslands (serpentinite). | April-May | There is a CNDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat. |
| **Layne's ragwort** *Packera layneae* | T/-/1B | Butte, El Dorado, Tuolumne, and Yuba Counties. | Chaparral and cismontane woodland, rocky and often serpentinite. | April-August | There is a CNDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat. |
| **Legenere** *Legenere limosa* | SC/-/1B | Sacramento Valley and south of the North Coast Ranges. | Vernal pools. | May-June | Not likely to occur in rice fields, no suitable habitat present (i.e. vernal pools) |
| **Lesser saltscale** *Atriplex minuscula* | -/-/1B | Found in Butte, Fresno, Kern, Madera, Merced, Stanislaus, and Tulare Counties. | Chenopod scrub, playas, valley and foothill grasslands (alkali and sandy). | May-October | Not likely to occur in rice fields, no suitable habitat present (i.e. alkali, sandy) |

| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Lone buckwheat** *Eriogonum apricum* var. *apricum* | E/E/1B | Found in Amador and Sacramento Counties. | Chaparral. | July-October | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (chaparral). |
| **Marsh checkerbloom** *Sidalcea oregana* ssp. *hydrophila* | -/-/1B | Glenn, Lake, Mendocino, and Napa Counties. | Meadows and seeps, and riparian forest. | June-August | Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields. |
| **Milo Baker's lupine** *Lupinus milo-bakeri* | -/T/1B | Glenn and Mendocino Counties. | Cismontane woodlands, foothill and valley grasslands. | June-September | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat. |
| **Northern California black walnut** *Juglans hindsii* | -/-/1B | Native stands reported in Napa and Contra Costa Counties. | Riparian woodland. | April-May | Not likely to occur in rice fields, no suitable habitat present. |
| **Palmate-bracted bird's-beak** *Cordylanthus palmatus* | E/E/1B | Found in Glenn and Colusa Counties and within the Central Valley. | Alkali meadow, alkali scrub, valley and grasslands. | May-October | Not likely to occur in rice fields, no suitable habitat present (i.e. alkali). |
| **Pincushion navarretia** *Navarretia myersii* ssp. *myersii* | -/-/1B | Alamdor, Calaveras, Merced, Placer, and Sacramento Counties. | Vernal pools (often acidic). | May | No CNDDB occurrences; not likely to occur due to lack of suitable habitat (i.e. vernal pools). |
| **Recurved larkspur** *Delphinium recurvatum* | -/-/1B | Disbursed throughout the Sacramento and Central Valley. | Chenopod scrub, cismontane, valley and foothill grasslands (alkali). | March-June | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali). |

| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Red mountain catchfly** *Silene campanulata* ssp. *campanulata* | -/E/1B | Found in Colusa, Glenn, Mendocino, Shasta, Tehama, and Trinity Counties. | Chaparral and lower montane coniferous forest, usually sepentinite and rocky. | April-July | There is a CNDDB occurrence in Colusa County, however this species is not likely to occur in rice fields due to lack of suitable habitat. |
| **Rose-mallow** *Hibiscus laiocarpos* | -/-/2 | Northern Sacramento County. | Marshes and swamps. | June-September | Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields. |
| **Sacramento orcutt grass** *Orcuttia viscida* | E/E/1B | Valley grasslands and freshwater wetlands. | Vernal pools. | May-June | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **San Joaquin orcutt grass** *Orcuttia inaequalis* | T/E/1B | Fresno, Madera, Merced, Solano, Stanislaus, and Tulare Counties. | Vernal pools. | April-September | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **San Joaquin spearscale** *Atriplex joaquiniana* | -/-/1B | Western Central Valley and valleys of adjacent foothills. | Alkali grasslands, and alkali scrub. | April-September | Not likely to occur in rice fields, no suitable habitat present (i.e. alkali). |
| **Sanford's arrowhead** *Sagittaria sanfordii* | -/-/1B | Central Valley. | Freshwater marshes, shallow streams, and ditches. | May-August | Suitable habitat on present in ditches; not yet detected. Not likely to establish in rice fields. |
| **Saw-toothed lewisia** *Lewisia serrata* | -/-/1B | Eldorado and Placer Counties. | Riparian forest. | May-June | Not likely to occur in rice fields, no suitable habitat present. |

| **Common Name** *Scientific name* | **Special Status* (F/S/CNPS)** | **Distribution** | **Habitat Association** | **Blooming Period** | **Potential Impact** |
|---|---|---|---|---|---|
| **Silky cryptantha** *Cryptantha crinita* | -/-/1B | Shasta and Tehama Counties. | Cismontane woodland, lower montane coniferous forest, riparian forest and woodland, valley foothill and grasslands. | April-May | Not likely to occur in rice fields, no suitable habitat present. Located outside of the project area. |
| **Slender Orcutt grass** *Orcuttia tenuis* | T/E/1B | Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento Counties | Vernal pools. | May-July | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |
| **Soft bird's beak** *Cordylanthus mollis* ssp. *mollis* | E/SSC/1B | Located in Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma Counties. | Coastal salt marshes and swamps. | July-November | There is a CNDDB occurrence in Sacramento County, however this species is not likely to occur in rice fields due to lack of suitable habitat. |
| **Succulent owl's clover** *Castilleja campestris* ssp. *succulenta* | T/E/1B | Fresno, Madera, Merced, Mariposa, San Joaquin, and Stanislaus Counties. | Vernal pools. | April-May | There is a CNDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools). |

***Status explanations:**

**F=Federal**
E=Endangered
T=Threatened
SC= Special Concern

**S=State**
E=Endangered
T=Threatened
SSC=Species of Special Concern

**CNPS=California Native Plant Society**
1B=Rare, threatened, or endangered in California and elsewhere
2=Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere
3=Plants about which we need more information - A review list

# Appendix E

# Greenhouse Gas Emission Calculations

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## Summary of Annual Greenhouse Gas Emissions

**Table 1. GHG Emissions from Groundwater Substitution**

| Water Agency | Emissions (MTCO2e/year) | | | |
|---|---|---|---|---|
| | CO2 | CH4 | N2O | Total |
| Anderson-Cottonwood Irrigation District | 134 | 0.21 | 0.65 | 135 |
| Conaway Preservation Group | 1,319 | 1.59 | 4.91 | 1,325 |
| Eastside Mutual Water Company | 352 | 0.30 | 0.88 | 353 |
| Garden Highway Mutual Water Company | 230 | 0.36 | 1.12 | 232 |
| Goose Club Farms and Teichert Aggregate | 130 | 0.20 | 0.63 | 131 |
| Maxwell Irrigation District | 827 | 0.70 | 2.08 | 830 |
| Natomas Central Mutual Water Company | 620 | 0.88 | 2.76 | 624 |
| Pelger Mutual Water Company | 662 | 0.56 | 1.66 | 664 |
| Pleasant Grove-Verona Mutual Water Company | 1,000 | 0.99 | 2.98 | 1,004 |
| Reclamation District 108 | 299 | 0.46 | 1.46 | 301 |
| Reclamation District 1004 | 482 | 0.44 | 1.33 | 483 |
| River Garden Farms | 192 | 0.30 | 0.93 | 193 |
| Sycamore Mutual Water Company | 231 | 0.36 | 1.13 | 233 |
| Te Velde Revocable Family Trust | 144 | 0.22 | 0.70 | 145 |
| Tule Basin Farms | 301 | 0.23 | 0.00 | 301 |
| **Total** | **6,923** | **7.81** | **23.23** | **6,954** |

**Table 2. Summary of Project Greenhouse Gas Emissions**

| | Annual Emissions (MTCO2e/year) | | | |
|---|---|---|---|---|
| **Emission Source** | **CO2** | **CH4** | **N2O** | **Total** |
| Groundwater Substitution | 6,923 | 8 | 23 | 6,954 |
| Crop Idling | (5,373) | (5) | (14) | (5,391) |
| **Total (metric tons/year)** | **1,550** | **3** | **10** | **1,563** |
| Total (short tons/year) | 1,709 | 4 | 11 | 1,723 |

1 short ton = 0.9072 metric tons

## Groundwater Substitution GHG Emissions

| | | |
|---|---|---|
| Agency | Anderson-Cottonwood Irrigation District | |
| Transfer Volume | 4,800 | acre feet/year |
| Location | Shasta | County |

**Table 3. Anderson-Cottonwood Irrigation District GHG Emissions**

| Description | Well | Fuel Type | Power Rating | Pump Rate | | | Transfer Volume | Operation | | Fuel Consumption | GHG Emissions (tonnes per year) | | | GHG Emissions (MTCO2e per year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (hp) | (AF) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| | Barney Street | Electric | 200 | 4,350 | 5,500 | 83% | 3,996 | 3,946 | 588,945 | n/a | 105 | 0.0077 | 0.0016 | 105 | 0.16 | 0.51 | 106 |
| | Crowley Gulch | Electric | 50 | 875 | 1,000 | 17% | 804 | 4,365 | 162,891 | n/a | 29 | 0.0021 | 0.0005 | 29 | 0.04 | 0.14 | 29 |
| | | | | | **Total** | **100%** | **4,800** | **8,311** | **751,835** | **0** | **134** | **0.0099** | **0.0021** | **134** | **0.21** | **0.65** | **135** |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

**Groundwater Substitution GHG Emissions**

Agency Conaway Preservation Group
Transfer Volume 26,639 acre feet/year
Location Yolo County

**Table 4. Conaway Preservation Group GHG Emissions**

| | | | | | | | | | | | GHG Emissions | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | (tonnes per year) | | | (MTCO2e per year) | | | |
| Description | Well | Fuel Type | Model Year | (hp) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Conaway PG6W-3 | 6W-3 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG5W-3 | 5W-3 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG7W-4 | 7W-4 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG12W-5 | 12W-5 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG1W-3 | 1W-3 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG12W-1 | 12W-1 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG7W-2 | 7W-2 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG13W-3 | 13W-3 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG7W-5 | 7W-5 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG32NW-2 | 32NW-2 | Electric | TBD | 114 | 3,500 | 4% | 1,062 | 1,648 | 140,182 | n/a | 25 | 0.0018 | 0.0004 | 25 | 0.04 | 0.12 | 25 |
| Conaway PG33NW-4 | 33NW-4 | Electric | | 100 | 3,400 | 4% | 1,032 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PGOW-2 | OW-2 | Electric | | 100 | 3,400 | 4% | 1,032 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PGOW-3 | OW-3 | Electric | | 125 | 3,400 | 4% | 1,032 | 1,648 | 153,708 | n/a | 27 | 0.0020 | 0.0004 | 27 | 0.04 | 0.13 | 28 |
| Conaway PG32NW-1 | 32NW-1 | Electric | | 100 | 3,300 | 4% | 1,001 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG6-2 | 6-2 | Electric | | 100 | 2,700 | 3% | 819 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PGOW-1 | OW-1 | Electric | | 100 | 2,600 | 3% | 789 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG20-1 | 20-1 | Electric | | 100 | 2,500 | 3% | 759 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG21W-1 | 21W-1 | Electric | | 100 | 2,500 | 3% | 759 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG31W-1 | 31W-1 | Electric | | 100 | 2,300 | 3% | 698 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG33NW-1 | 33NW-1 | Electric | | 100 | 2,300 | 3% | 698 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG8-1 | 8-1 | Diesel | 2007 | 170 | 2,300 | 3% | 698 | 1,648 | n/a | 15,715 | 160 | 0.0065 | 0.0013 | 160 | 0.14 | 0.40 | 161 |
| Conaway PG33NW-2 | 33NW-2 | Electric | | 100 | 2,200 | 3% | 667 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG33NW-8 | 33NW-8 | Electric | | 100 | 2,200 | 3% | 667 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG33NW-3 | 33NW-3 | Electric | | 100 | 2,100 | 2% | 637 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG33NW-6 | 33NW-6 | Electric | | 100 | 2,100 | 2% | 637 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PGOW-5 | OW-5 | Electric | | 125 | 2,000 | 2% | 607 | 1,648 | 153,708 | n/a | 27 | 0.0020 | 0.0004 | 27 | 0.04 | 0.13 | 28 |
| Conaway PG33NW-5 | 33NW-5 | Electric | | 100 | 1,800 | 2% | 546 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG7W-1 | 7W-1 | Electric | | 100 | 1,800 | 2% | 546 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG17W-3 | 17W-3 | Diesel | 2005 | 170 | 1,700 | 2% | 516 | 1,648 | n/a | 15,715 | 160 | 0.0065 | 0.0013 | 160 | 0.14 | 0.40 | 161 |
| Conaway PGOW-4 | OW-4 | Electric | | 100 | 1,700 | 2% | 516 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| Conaway PG16W-2 | 16W-2 | Diesel | 2005 | 170 | 1,600 | 2% | 485 | 1,648 | n/a | 15,715 | 160 | 0.0065 | 0.0013 | 160 | 0.14 | 0.40 | 161 |
| Conaway PG8-2 | 8-2 | Diesel | 2002 | 170 | 1,500 | 2% | 455 | 1,648 | n/a | 15,715 | 160 | 0.0065 | 0.0013 | 160 | 0.14 | 0.40 | 161 |
| Conaway PG33NW-7 | 33NW-7 | Electric | | 100 | 1,400 | 2% | 425 | 1,648 | 122,966 | n/a | 22 | 0.0016 | 0.0003 | 22 | 0.03 | 0.11 | 22 |
| | | | | | **Total** | **100%** | **26,639** | **54,376** | **3,799,661** | **62,859** | **1,319** | **0.0759** | **0.0158** | **1,319** | **1.59** | **4.91** | **1,325** |

Legend
Average HP from all pumps

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Eastside Mutual Water Company
Transfer Volume 2,000 acre feet/year
Location Colusa County

**Table 5. Eastside Mutual Water Company GHG Emissions**

| | | | | | | | | | | | GHG Emissions | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | (tonnes per year) | | | (MTCO2e per year) | | | |
| Description | Well | Fuel Type | Model Year | (hp) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Eastside MWC7631T | 7631T | Diesel | 2006 | 215 | 3,800 | 100% | 2,000 | 2,858 | n/a | 34,476 | 352 | 0.014 | 0.003 | 352 | 0.30 | 0.88 | 353 |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Garden Highway Mutual Water Company
Transfer Volume 7,500 acre feet/year
Location Sutter County

**Table 6. Garden Highway Mutual Water Company GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Garden Highway MWC23 | 23 | Electric | | 110 | 2,000 | 11% | 829 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| Garden Highway MWC17 | 17 | Electric | | 110 | 2,900 | 16% | 1,202 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| Garden Highway MWC4 | 4 | Electric | | 110 | 2,100 | 12% | 870 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| Garden Highway MWC19 | 19 | Electric | | 110 | 2,600 | 14% | 1,077 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| Garden Highway MWC24 | 24 | Electric | | 110 | 3,000 | 17% | 1,243 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| Garden Highway MWC25 | 25 | Electric | | 110 | 3,000 | 17% | 1,243 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| Garden Highway MWC 22 | 22 | Electric | | 110 | 2,500 | 14% | 1,036 | 2,250 | 184,730 | n/a | 33 | 0.002 | 0.001 | 33 | 0.05 | 0.16 | 33 |
| | | | | | **Total** | **100%** | **7,500** | **15,752** | **1,293,113** | **0** | **230** | **0.017** | **0.004** | **230** | **0.36** | **1.12** | **232** |

Legend

Horsepower estimated based on average size engine for fuel type in study area

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution Air Quality Emissions

Agency Goose Club Farms and Teichert Aggregate
Transfer Volume 2,000 acre feet/year
Location Sutter County

**Table 7. Goose Club Farms and Teichert Aggregate Criteria Pollutant Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Goose Club1 | 1 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club2 | 2 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club3 | 3 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club4 | 4 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club5 | 5 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club6 | 6 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club7 | 7 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club8 | 8 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club9 | 9 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club10 | 10 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club11 | 11 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club12 | 12 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| Goose Club13 | 13 | Electric | TBD | 125 | 3,000 | 17% | 333 | 603 | 56,290 | n/a | 10 | 0.001 | 0.000 | 10 | 0.02 | 0.05 | 10 |
| | | | | | **Total** | **100%** | **2,000** | **3,621** | **731,769** | **0** | **130** | **0.010** | **0.002** | **130** | **0.20** | **0.63** | **131** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | |
|---|---|
| 0.4 | lb/hp-hr |
| 0.855 | g/mL |
| 7.13 | lb/gal |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Maxwell Irrigation District
Transfer Volume 4,700 acre feet/year
Location Colusa County

**Table 8. Maxwell Irrigation District GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MID1 | MID1 | Diesel | 2006 | 215 | 3,800 | 20% | 940 | 1,343 | n/a | 16,204 | 165 | 0.007 | 0.001 | 165 | 0.14 | 0.42 | 166 |
| MID2 | MID2 | Diesel | 2006 | 215 | 3,800 | 20% | 940 | 1,343 | n/a | 16,204 | 165 | 0.007 | 0.001 | 165 | 0.14 | 0.42 | 166 |
| MID3 | MID3 | Diesel | 2006 | 215 | 3,800 | 20% | 940 | 1,343 | n/a | 16,204 | 165 | 0.007 | 0.001 | 165 | 0.14 | 0.42 | 166 |
| MID4 | MID4 | Diesel | 2006 | 215 | 3,800 | 20% | 940 | 1,343 | n/a | 16,204 | 165 | 0.007 | 0.001 | 165 | 0.14 | 0.42 | 166 |
| MID5 | MID5 | Diesel | 2006 | 215 | 3,800 | 20% | 940 | 1,343 | n/a | 16,204 | 165 | 0.007 | 0.001 | 165 | 0.14 | 0.42 | 166 |
| | | | | | **Total** | **100%** | **4,700** | **6,717** | **0** | **81,020** | **827** | **0.034** | **0.007** | **827** | **0.70** | **2.08** | **830** |

Legend

Engine information assumed to be equivalent to Eastside MWC because it is the adjacent water district.

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Natomas Central Mutual Water Company
Transfer Volume 30,000 acre feet/year
Location Sacramento County
Sutter County

**Table 9. Natomas Central Mutual Water Company GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 2 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 3 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 4 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 5 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 6 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 7 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 8 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 9 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 10 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 11 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 12 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | 13 | Electric | | 110 | 4,200 | 8% | 2,308 | 2,984 | 244,954 | n/a | 48 | 0.003 | 0.001 | 48 | 0.07 | 0.21 | 48 |
| | | | | | **Total** | **100%** | **30,000** | **38,792** | **3,184,400** | **0** | **620** | **0.042** | **0.009** | **620** | **0.88** | **2.76** | **624** |

Legend

Horsepower estimated based on average size engine for fuel type in study area

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Pelger Mutual Water Company
Transfer Volume 4,000 acre feet/year
Location Sutter County

**Table 10. Pelger Mutual Water Company GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating | Pump Rate | | | Transfer Volume | Operation | | Fuel Consumption | GHG Emissions (tonnes per year) | | | GHG Emissions (MTCO2e per year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (hp) | (AF/month) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Pelger MWC Well 3 Klein | Well 3 Klein | Diesel | | 250 | 338 | 4,700 | 33% | 1,333 | 1,541 | n/a | 21,608 | 221 | 0.009 | 0.002 | 221 | 0.19 | 0.55 | 221 |
| Pelger MWC Well 1 Tucker | Well 1 Tucker | Diesel | | 250 | 338 | 4,700 | 33% | 1,333 | 1,541 | n/a | 21,608 | 221 | 0.009 | 0.002 | 221 | 0.19 | 0.55 | 221 |
| Pelger MWC Well 2 Flopet | Well 2 Flopet | Diesel | | 250 | 338 | 4,700 | 33% | 1,333 | 1,541 | n/a | 21,608 | 221 | 0.009 | 0.002 | 221 | 0.19 | 0.55 | 221 |
| | | | | | | **Total** | **100%** | **4,000** | **4,622** | **0** | **64,825** | **662** | **0.027** | **0.005** | **662** | **0.56** | **1.66** | **664** |

Legend

| | |
|---|---|
| | Pump rate based on Well Development & Test Report (October 13, 1993); maximum test pump rate. |
| | Fuel type assumed to be diesel (worst-case emissions) |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

**Groundwater Substitution GHG Emissions**

Agency Pleasant Grove-Verona Mutual Water Company
Transfer Volume 12,000 acre feet/year
Location Sutter County

**Table 11. Pleasant Grove-Verona Mutual Water Company GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PGVMWC Well #1 | Well #1 | Electric | | 30 | 2,000 | 3% | 315 | 856 | 19,173 | n/a | 3 | 0.0003 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| PGVMWC Well #2 | Well #2 | Electric | | 250 | 5,000 | 7% | 788 | 856 | 159,772 | n/a | 28 | 0.0021 | 0.0004 | 28 | 0.04 | 0.14 | 29 |
| PGVMWC Monster Pump | Monster Pump | Electric | | 60 | 3,100 | 4% | 489 | 856 | 38,345 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| PGVMWC Well #12&17 | Well #12&17 | Electric | | 50 | 1,500 | 2% | 237 | 856 | 31,954 | n/a | 6 | 0.0004 | 0.0001 | 6 | 0.01 | 0.03 | 6 |
| PGVMWC Well #11 | Well #11 | Diesel | 2004 | 250 | 4,200 | 6% | 662 | 856 | n/a | 12,011 | 123 | 0.0050 | 0.0010 | 123 | 0.10 | 0.31 | 123 |
| PGVMWC Well #13&15 | Well #13&15 | Electric | | 240 | 4,800 | 6% | 757 | 856 | 153,381 | n/a | 27 | 0.0020 | 0.0004 | 27 | 0.04 | 0.13 | 28 |
| PGVMWC Well #16 | Well #16 | Electric | | 240 | 1,700 | 2% | 268 | 856 | 153,381 | n/a | 27 | 0.0020 | 0.0004 | 27 | 0.04 | 0.13 | 28 |
| PGVMWC Willey #1 | Willey #1 | Diesel | 2000 | 168 | 3,000 | 4% | 473 | 856 | n/a | 8,071 | 82 | 0.0033 | 0.0007 | 82 | 0.07 | 0.21 | 83 |
| PGVMWC Willey #2 | Willey #2 | Electric | | 159 | 3,000 | 4% | 473 | 856 | 101,615 | n/a | 18 | 0.0013 | 0.0003 | 18 | 0.03 | 0.09 | 18 |
| PGVMWC Willey #3 | Willey #3 | Electric | | 58 | 2,000 | 3% | 315 | 856 | 37,067 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| PGVMWC Willey #4 | Willey #4 | Diesel | 1974 | 150 | 3,000 | 4% | 473 | 856 | n/a | 7,207 | 74 | 0.0030 | 0.0006 | 74 | 0.06 | 0.18 | 74 |
| PGVMWC Well #30 | Well #30 | Diesel | 2000 | 100 | 1,500 | 2% | 237 | 856 | n/a | 4,804 | 49 | 0.0020 | 0.0004 | 49 | 0.04 | 0.12 | 49 |
| PGVMWC Well #31 | Well #31 | Electric | | 99 | 2,500 | 3% | 394 | 856 | 63,270 | n/a | 11 | 0.0008 | 0.0002 | 11 | 0.02 | 0.05 | 11 |
| PGVMWC Well #32 | Well #32 | Electric | | 99 | 2,500 | 3% | 394 | 856 | 63,270 | n/a | 11 | 0.0008 | 0.0002 | 11 | 0.02 | 0.05 | 11 |
| PGVMWC Well #33 | Well #33 | Electric | | 99 | 2,500 | 3% | 394 | 856 | 63,270 | n/a | 11 | 0.0008 | 0.0002 | 11 | 0.02 | 0.05 | 11 |
| PGVMWC Nicholas Sand Field Well | Nicholas Sand Field Well | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Nicholas Filipino Camp #2 | Nicholas Filipino Camp #2 | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Nicholas Filipino Camp South | Nicholas Filipino Camp South | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Nicholas Johnston Field Well #2 | Nicholas Johnston Field Well #2 | Electric | | 58 | 2,000 | 3% | 315 | 856 | 37,067 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| PGVMWC Nicholas Johnston Well | Nicholas Johnston Well | Electric | | 58 | 2,000 | 3% | 315 | 856 | 37,067 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| PGVMWC Nicholas 72-Acre Field South | Nicholas 72-Acre Field South | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Nicholas 72-Acre Field North | Nicholas 72-Acre Field North | Electric | | 58 | 2,000 | 3% | 315 | 856 | 37,067 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| PGVMWC Nicholas BBC Well | Nicholas BBC Well | Electric | | 58 | 2,000 | 3% | 315 | 856 | 37,067 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| PGVMWC Kelly 190 Field Well #2 | Kelly 190 Field Well #2 | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Kelly Windmill Field Well #2 | Kelly Windmill Field Well #2 | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Kelly Windmill North Field Well | Kelly Windmill North Field Well | Diesel | 2002 | 62 | 2,000 | 3% | 315 | 856 | n/a | 2,984 | 30 | 0.0012 | 0.0002 | 30 | 0.03 | 0.08 | 31 |
| PGVMWC Kelly 306 Well | Kelly 306 Well | Electric | | 111 | 2,600 | 3% | 410 | 856 | 70,939 | n/a | 13 | 0.0009 | 0.0002 | 13 | 0.02 | 0.06 | 13 |
| PGVMWC Scheidel & Osterli #16 | Scheidel & Osterli #16 | Diesel | 1997 | 234 | 3,400 | 4% | 536 | 856 | n/a | 11,242 | 115 | 0.0047 | 0.0009 | 115 | 0.10 | 0.29 | 115 |
| PGVMWC Scheidel & Osterli #17 | Scheidel & Osterli #17 | Diesel | 1999 | 101 | 1,500 | 2% | 237 | 856 | n/a | 4,852 | 50 | 0.0020 | 0.0004 | 50 | 0.04 | 0.12 | 50 |
| PGVMWC Scheidel & Osterli #18A | Scheidel & Osterli #18A | Diesel | 1999 | 101 | 1,800 | 2% | 284 | 856 | n/a | 4,852 | 50 | 0.0020 | 0.0004 | 50 | 0.04 | 0.12 | 50 |
| PGVMWC River Ranch #19 | River Ranch #19 | Diesel | 2008 | 99 | 2,500 | 3% | 394 | 856 | n/a | 4,756 | 49 | 0.0020 | 0.0004 | 49 | 0.04 | 0.12 | 49 |
| | | | | | **Total** | **100%** | **12,000** | **26,548** | **1,103,702** | **78,681** | **1,000** | **0.0471** | **0.0096** | **1,000** | **0.99** | **2.98** | **1,004** |

Legend

| | |
|---|---|
| | Average HP estimated from pump rates |
| | HP interpolated from other pumps |

Conversion Factors

| | | | |
|---|---|---|---|
| 1 lb | = | 453.6 | g |
| 1 tonne | = | 1,000 | kg |
| 1 tonne | = | 1,000,000 | g |
| 1 MWh | = | 1,000 | kWh |
| 1 GWh | = | 1,000,000 | kWh |
| 1 kW | = | 1.34 | hp |
| 1 hour | = | 60 | minutes |
| 1 acre-foot | = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Reclamation District 108
Transfer Volume 7,500 acre feet/year
Location Colusa County
Yolo County

**Table 12. Reclamation District 108 GHG Emissions**

| | | | | | | | | | | | GHG Emissions | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | (tonnes per year) | | | (MTCO2e per year) | | | |
| Description | Well | Fuel Type | Model Year | (hp) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| RD-108 Well 1 | Well 1 | Electric | | 100 | 3,300 | 18% | 1,367 | 2,250 | 167,937 | n/a | 30 | 0.002 | 0.000 | 30 | 0.05 | 0.15 | 30 |
| RD-108 Well 5 | Well 5 | Electric | | 150 | 1,500 | 8% | 622 | 2,250 | 251,905 | n/a | 45 | 0.003 | 0.001 | 45 | 0.07 | 0.22 | 45 |
| RD-108 Well 6 | Well 6 | Electric | | 250 | 5,700 | 31% | 2,362 | 2,250 | 419,842 | n/a | 75 | 0.006 | 0.001 | 75 | 0.12 | 0.36 | 75 |
| RD-108 Well 7 | Well 7 | Electric | | 250 | 3,800 | 21% | 1,575 | 2,250 | 419,842 | n/a | 75 | 0.006 | 0.001 | 75 | 0.12 | 0.36 | 75 |
| RD-108 Well 8 | Well 8 | Electric | | 250 | 3,800 | 21% | 1,575 | 2,250 | 419,842 | n/a | 75 | 0.006 | 0.001 | 75 | 0.12 | 0.36 | 75 |
| | | | | **Total** | **18,100** | **100%** | **7,500** | **11,252** | **1,679,367** | **0** | **299** | **0.022** | **0.005** | **299** | **0.46** | **1.46** | **301** |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

**Groundwater Substitution GHG Emissions**

| | | |
|---|---|---|
| Agency | Reclamation District 1004 | |
| Transfer Volume | 5,400 | acre feet/year |
| Location | Colusa | County |
| | Glenn | County |
| | Sutter | County |

**Table 13. Reclamation District 1004 GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RD-1004Behring Ranch Club House No. 496461 | Behring Ranch Club House No. 496461 | Electric | | 202 | 3,400 | 6% | 330 | 527 | 79,512 | n/a | 14 | 0.0010 | 0.0002 | 14 | 0.02 | 0.07 | 14 |
| RD-1004Behring Ranch Nursery Well No. 17N1W10H1 | Behring Ranch Nursery Well No. 17N1W10H1 | Diesel | TBD | 40 | 1,000 | 2% | 97 | 527 | n/a | 1,184 | 12 | 0.0005 | 0.0001 | 12 | 0.01 | 0.03 | 12 |
| RD-1004Gardener No. 498178 | Gardener No. 498178 | Diesel | 2009 | 215 | 3,500 | 6% | 340 | 527 | n/a | 6,362 | 65 | 0.0026 | 0.0005 | 65 | 0.06 | 0.16 | 65 |
| RD-1004Drumheller Well #7 | Drumheller Well #7 | Diesel | TBD | 162 | 4,000 | 7% | 388 | 527 | n/a | 4,794 | 49 | 0.0020 | 0.0004 | 49 | 0.04 | 0.12 | 49 |
| RD-1004Myers Well #2 No. 340884 | Myers Well #2 No. 340884 | Electric | 1982 | 100 | 4,100 | 7% | 398 | 527 | 39,362 | n/a | 7 | 0.0005 | 0.0001 | 7 | 0.01 | 0.03 | 7 |
| RD-1004Stonewell #6 No. 11334 | Stonewell #6 No. 11334 | Electric | 2006 | 40 | 1,800 | 3% | 175 | 527 | 15,745 | n/a | 3 | 0.0002 | 0.0000 | 3 | 0.00 | 0.01 | 3 |
| RD-1004Myers Well #1 No. 3457 | Myers Well #1 No. 3457 | Electric | 2006 | 40 | 2,200 | 4% | 214 | 527 | 15,745 | n/a | 3 | 0.0002 | 0.0000 | 3 | 0.00 | 0.01 | 3 |
| RD-1004Hall Well No. 369428 | Hall Well No. 369428 | Electric | 2011 | 125 | 4,500 | 8% | 437 | 527 | 49,203 | n/a | 9 | 0.0006 | 0.0001 | 9 | 0.01 | 0.04 | 9 |
| RD-1004Hall Well No. X | Hall Well No. X | Electric | TBD | 148 | 4,500 | 8% | 437 | 527 | 58,256 | n/a | 10 | 0.0008 | 0.0002 | 10 | 0.02 | 0.05 | 10 |
| RD-1004Gardener No. 374672 | Gardener No. 374672 | Diesel | 2008 | 215 | 3,500 | 6% | 340 | 527 | n/a | 6,362 | 65 | 0.0026 | 0.0005 | 65 | 0.06 | 0.16 | 65 |
| RD-1004Behring Ranch West Well No. 97863 | Behring Ranch West Well No. 97863 | Electric | | 53 | 2,300 | 4% | 223 | 527 | 20,862 | n/a | 4 | 0.0003 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| RD-1004Behring Ranch 10 Field Well No. 496441 | Behring Ranch 10 Field Well No. 496441 | Diesel | 2008 | 225 | 5,800 | 10% | 563 | 527 | n/a | 6,658 | 68 | 0.0028 | 0.0006 | 68 | 0.06 | 0.17 | 68 |
| RD-1004Behring Ranch Pearl 20094 | Behring Ranch Pearl 20094 | Diesel | TBD | 80 | 2,500 | 4% | 243 | 527 | n/a | 2,367 | 24 | 0.0010 | 0.0002 | 24 | 0.02 | 0.06 | 24 |
| RD-1004Sikes & Parachini #2 No. 374682 | Sikes & Parachini #2 No. 374682 | Diesel | 2008 | 150 | 4,000 | 7% | 388 | 527 | n/a | 4,439 | 45 | 0.0018 | 0.0004 | 45 | 0.04 | 0.11 | 45 |
| RD-1004Sikes & Parachini #1 No. 93124 | Sikes & Parachini #1 No. 93124 | Diesel | 2006 | 173 | 4,000 | 7% | 388 | 527 | n/a | 5,119 | 52 | 0.0021 | 0.0004 | 52 | 0.04 | 0.13 | 52 |
| RD-1004Rancho Valeta No. 726883 | Rancho Valeta No. 726883 | Diesel | 2004 | 170 | 4,500 | 8% | 437 | 527 | n/a | 5,030 | 51 | 0.0021 | 0.0004 | 51 | 0.04 | 0.13 | 52 |
| | | | | | **Total** | **100%** | **5,400** | **8,439** | **278,686** | **42,315** | **482** | **0.0212** | **0.0043** | **482** | **0.44** | **1.33** | **483** |

Legend

| | |
|---|---|
| | Average HP estimated from pump rates |
| | HP interpolated from other pumps |
| | Power rating equal to pump with closest equivalent pump rate |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency River Garden Farms
Transfer Volume 6,000 acre feet/year
Location Yolo County

**Table 14. River Garden Farms GHG Emissions**

| | | | | | | | | | | | GHG Emissions | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | (tonnes per year) | | | (MTCO2e per year) | | | |
| Description | Well | Fuel Type | Model Year | (hp) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| RG Field 65 PW | Field 65 PW | Electric | 2008 | 110 | 2,500 | 14% | 862 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| RG Field 71 PW | Field 71 PW | Electric | 2001 | 110 | 1,700 | 10% | 586 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| RG Field 98 PW | Field 98 PW | Electric | 1963 | 110 | 2,900 | 17% | 1,000 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| RG Field 104 PW | Field 104 PW | Electric | 2008 | 110 | 2,500 | 14% | 862 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| RG Field 104-09 PW | Field 104-09 PW | Electric | 2009 | 110 | 2,990 | 17% | 1,031 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| RG Field 91-09 PW | Field 91-09 PW | Electric | 2009 | 110 | 2,840 | 16% | 980 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| RG Field 117 PW | Field 117 PW | Electric | 2009 | 110 | 1,965 | 11% | 678 | 1,873 | 153,774 | n/a | 27 | 0.002 | 0.000 | 27 | 0.04 | 0.13 | 28 |
| | | | | | **Total** | **100%** | **6,000** | **13,113** | **1,076,417** | **0** | **192** | **0.014** | **0.003** | **192** | **0.30** | **0.93** | **193** |

Legend

Horsepower estimated based on average size engine for fuel type in study area

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Sycamore Mutual Water Company
Transfer Volume 8,000 acre feet/year
Location Colusa County

**Table 15. Sycamore Mutual Water Company GHG Emissions**

| Sycamore Family Trust1 | | | | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | GHG Emissions (tonnes per year) | | | GHG Emissions (MTCO2e per year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Well | Fuel Type | Model Year | (hp) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Sycamore Family Trust11 | 11 | Electric | | 100 | 2,500 | 7% | 571 | 1,241 | 92,637 | n/a | 17 | 0.001 | 0.000 | 17 | 0.03 | 0.08 | 17 |
| Sycamore Family Trust15 | 15 | Electric | | 75 | 2,500 | 7% | 571 | 1,241 | 69,478 | n/a | 12 | 0.001 | 0.000 | 12 | 0.02 | 0.06 | 12 |
| Sycamore Family Trust14 | 14 | Electric | | 100 | 2,500 | 7% | 571 | 1,241 | 92,637 | n/a | 17 | 0.001 | 0.000 | 17 | 0.03 | 0.08 | 17 |
| Sycamore Family Trust17 | 17 | Electric | | 125 | 3,500 | 10% | 800 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust1 | 1 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust2 | 2 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust3 | 3 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust4 | 4 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust5 | 5 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust6 | 6 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust7 | 7 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| Sycamore Family Trust8 | 8 | Electric | | 125 | 3,000 | 9% | 686 | 1,241 | 115,796 | n/a | 21 | 0.002 | 0.000 | 21 | 0.03 | 0.10 | 21 |
| | | | | | **Total** | **100%** | **8,000** | **14,896** | **1,296,919** | **0** | **231** | **0.017** | **0.004** | **231** | **0.36** | **1.13** | **233** |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Te Velde Revocable Family Trust
Transfer Volume 5,344 acre feet/year
Location Yolo County

**Table 16. Te Velde Revocable Family Trust GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | GHG Emissions (tonnes per year) | | | GHG Emissions (MTCO2e per year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (hp) | (gpm) | (% of Total) | (acre feet/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Sacramento River Ranch123448 | 123448 | elec | | 127 | 4656 | 35% | 1,856 | 2,165 | 205,210 | n/a | 37 | 0.003 | 0.001 | 37 | 0.06 | 0.18 | 37 |
| Sacramento River Ranch123447 | 123447 | elec | | 104 | 2200 | 16% | 877 | 2,165 | 168,046 | n/a | 30 | 0.002 | 0.000 | 30 | 0.05 | 0.15 | 30 |
| Sacramento River Ranch33839 | 33839 | elec | | 143 | 2833 | 21% | 1,129 | 2,165 | 231,063 | n/a | 41 | 0.003 | 0.001 | 41 | 0.06 | 0.20 | 41 |
| Sacramento River Ranch33838 | 33838 | elec | | 125 | 3715 | 28% | 1,481 | 2,165 | 201,978 | n/a | 36 | 0.003 | 0.001 | 36 | 0.06 | 0.18 | 36 |
| | | | | | **Total** | **100%** | **5,344** | **8,661** | **806,298** | **0** | **144** | **0.011** | **0.002** | **144** | **0.22** | **0.70** | **145** |

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Groundwater Substitution GHG Emissions

Agency Tule Basin Farms
Transfer Volume 6,400 acre feet/year
Location Sutter County

**Table 17. Tule Basin Farms GHG Emissions**

| Description | Well | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (acre feet/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (MMBtu/hr) | Fuel Consumption (MMBtu/yr) | GHG Emissions (tonnes per year) CO2 | (tonnes per year) CH4 | (tonnes per year) N2O | (MTCO2e per year) CO2 | (MTCO2e per year) CH4 | (MTCO2e per year) N2O | (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tule Basin Farms1 | 1 | Electric | | 125 | 3,750 | 31% | 2,000 | 2,896 | 270,192 | n/a | n/a | 48 | 0.004 | 0.001 | 48 | 0.07 | 0.23 | 48 |
| Tule Basin Farms2 | 2 | Natural Gas | 1985 | 190 | 3,750 | 31% | 2,000 | 2,896 | n/a | 1.33 | 3,852 | 204 | 0.004 | 0.0004 | 204 | 0.08 | 0.12 | 204 |
| Tule Basin Farms3 | 3 | Electric | | 125 | 4,500 | 38% | 2,400 | 2,896 | 270,192 | n/a | n/a | 48 | 0.004 | 0.001 | 48 | 0.07 | 0.23 | 48 |
| | | | | | **Total** | **100%** | **6,400** | **8,689** | **540,383** | **1.33** | **3,852** | **301** | **0.011** | **0.002** | **301** | **0.23** | **0.59** | **301** |

Conversion Factors

| | | |
|---|---|---|
| 1 MMBtu = | 1,000,000 | Btu |
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

| | | | |
|---|---|---|---|
| Estimated BSFC = | 7000 | Btu/bhp-hr | (Estimated from Waukesha engine specifications) |
| Higher Heating Value | 1,020 | Btu/scf | (AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines) |

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 21 |
| N2O | 310 |

## Engine Size Summary

**Table 18**
**Engine Power Rating Summary by Fuel Type**

| Fuel Type | No. Engines | Avg. HP | Max HP | Min HP |
|---|---|---|---|---|
| Diesel | 26 | 140 | 250 | 62.1 |
| Electric | 38 | 110 | 250 | 30 |
| Natural Gas | 1 | 190 | 190 | 190 |

## GHG Emission Factors

**Table 19**
**GHG Emission Factors for Electric Pumps**

| County | Utility Company | Emission Factors | | |
|---|---|---|---|---|
| | | CO2 (lbs/MWh) | CH4 (lbs/GWh) | N2O (lbs/GWh) |
| Colusa | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Glenn | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Merced | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Placer | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Sacramento | Sacramento Municipal Utility District | 429.29 | 28.94 | 6.17 |
| San Joaquin | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Shasta | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Solano | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Sutter | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Yolo | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |
| Yuba | Pacific Gas & Electric | 392.87 | 28.94 | 6.17 |

**Table 20**
**Utility-Specific CO2 Emission Factors**

| 2009 Emission Rates | | |
|---|---|---|
| Utility | Factor Type | Emission Factor (lbs $CO_2$/MWh) |
| Modesto Irrigation District | Retail Power | 1,036.17 |
| | Special Power | 0 |
| | Wholesale Power | 2,048.09 |
| Pacific Gas & Electric | System Average | 575.38 |
| Bonneville Power Authority | System Average | 93.17 |
| **2010 Emission Rates** | | |
| Utility | Factor Type | Emission Factor (lbs $CO_2$/MWh) |
| Sacramento Municipal Utility District | Retail Power | 526.47 |
| | Special Power | 0.00 |
| | Wholesale Power | 828.58 |
| Newmont Nevada Energy Investment | Wholesale Power | 2,055.79 |
| Pacific Gas & Electric | System Average | 444.64 |
| City of Vernon, Light and Power | System Average | 775.83 |
| Modesto Irrigation District | Retail Power | 942.99 |
| | Special Power | 0.00 |
| | Wholesale Power | 2,026.12 |
| Northern States Power Company (Xcel Energy) | System Average | 1,047.20 |
| Public Service Company of Colorado (Xcel Energy) | System Average | 1,675.51 |
| Southwestern Public Service Company (Xcel Energy) | System Average | 1,552.05 |
| Seattle City Light | Retail Power | 45.57 |
| | Special Power | 0.00 |
| | Wholesale Power | 537.64 |
| Bonneville Power Authority | System Average | 134.70 |

| 2011 Emission Rates | | |
|---|---|---|
| **Utility** | **Factor Type** | **Emission Factor (lbs $CO_2$/MWh)** |
| Pacific Gas & Electric | System Average | 392.87 |
| Bonneville Power Authority | System Average | 47.86 |
| Seattle City Light | Retail Power | 13.77 |
| | Special Power | 0.00 |
| | Wholesale Power | 218.75 |
| Sacramento Municipal Utility District | Retail Power | 429.29 |
| | Special Power | 0.00 |
| | Wholesale Power | 795.14 |
| City of Vernon, Light and Power | System Average | 731.49 |
| Northern States Power Company (Xcel Energy) | System Average | 1,071.45 |
| Public Service Company of Colorado (Xcel Energy) | System Average | 1,618.19 |
| Southwestern Public Service Company (Xcel Energy) | System Average | 1,472.69 |
| **2012 Emission Rates** | | |
| **Utility** | **Factor Type** | **Emission Factor (lbs $CO_2$/MWh)** |
| City of Vernon, Light and Power | System Average | 765.97 |

*Source:*

*The Climate Registry. 2013. Utility-Specific Emission Factors. Accessed on: January 2, 2014. Available at: http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/.*

**Table 21**
**eGRID GHG Emission Factors**

| eGRID 2012 Subregion | eGRID 2012 Subregion Name | 2009 Emission Rates (lbs CO2/MWh) | (lbs CH4/GWh) | (lbs N2O/GWh) |
|---|---|---|---|---|
| AKGD | ASCC Alaska Grid | 1,280.86 | 27.74 | 7.69 |
| AKMS | ASCC Miscellaneous | 521.26 | 21.78 | 4.28 |
| AZNM | WECC Southwest | 1,191.35 | 19.13 | 15.58 |
| CAMX | WECC California | 658.68 | 28.94 | 6.17 |
| ERCT | ERCOT All | 1,181.73 | 16.7 | 13.1 |
| FRCC | FRCC All | 1,176.61 | 39.24 | 13.53 |
| HIMS | HICC Miscellaneous | 1,351.66 | 72.4 | 13.8 |
| HIOA | HICC Oahu | 1,593.35 | 101.74 | 21.98 |
| MROE | MRO East | 1,591.65 | 23.98 | 27.04 |
| MROW | MRO West | 1,628.60 | 28.8 | 27.79 |
| NEWE | NPCC New England | 728.41 | 75.68 | 13.86 |
| NWPP | WECC Northwest | 819.21 | 15.29 | 12.5 |
| NYCW | NPCC NYC/Westchester | 610.67 | 23.75 | 2.81 |
| NYLI | NPCC Long Island | 1,347.99 | 96.86 | 12.37 |
| NYUP | NPCC Upstate NY | 497.92 | 15.94 | 6.77 |
| RFCE | RFC East | 947.42 | 26.84 | 14.96 |
| RFCM | RFC Michigan | 1,659.46 | 31.41 | 27.89 |
| RFCW | RFC West | 1,520.59 | 18.12 | 25.13 |
| RMPA | WECC Rockies | 1,824.51 | 22.25 | 27.19 |
| SPNO | SPP North | 1,815.76 | 21.01 | 28.89 |
| SPSO | SPP South | 1,599.02 | 23.25 | 21.79 |
| SRMV | SERC Mississippi Valley | 1,002.41 | 19.45 | 10.65 |
| SRMW | SERC Midwest | 1,749.75 | 19.57 | 28.98 |
| SRSO | SERC South | 1,325.68 | 22.27 | 20.78 |
| SRTV | SERC Tennessee Valley | 1,357.71 | 17.28 | 22.09 |
| SRVC | SERC Virginia/Carolina | 1,035.87 | 21.51 | 17.45 |
| US Territories (not an eGRID Region)* | n/a | 1,891.57 | 75.91 | 17.13 |

*2014. Available at: http://www.theclimateregistry.org/downloads/2013/04/2013-Climate-Registry-Default-Emissions-Factors.pdf.*

**Table 22**
**Diesel Emission Factors**

| Pollutant | Emission Factor | Unit | Emission Factor Description |
|---|---|---|---|
| CO2 | 10.21 | kg/gallon | Table 12.1, Distillate Fuel Oil No. 2 |
| CH4 | 0.003 | kg/MMBtu | Table 12.9, Petroleum Products, Industrial |
| N2O | 0.0006 | kg/MMBtu | Table 12.9, Petroleum Products, Industrial |
| Heat Content | 0.138 | MMBtu/gallon | Table 12.1, Distillate Fuel Oil No. 2 |

*Source: The Climate Registry. 2013. 2013 Climate Registry Default Emission Factors. Accessed on: January 2, 2014. Available at: http://www.theclimateregistry.org/downloads/2013/04/2013-Climate-Registry-Default-Emissions-Factors.pdf.*

**Table 23**
**Natural Gas Emission Factors**

| Pollutant | Emission Factor | Unit | Emission Factor Description |
|---|---|---|---|
| CO2 | 53.02 | kg/MMBtu | Table 12.1, US Weighted Average |
| CH4 | 0.001 | kg/MMBtu | Table 12.9, Natural Gas, Industrial |
| N2O | 0.0001 | kg/MMBtu | Table 12.9, Natural Gas, Industrial |
| Heat Content | 1,028 | Btu/scf | Table 12.1, US Weighted Average |

*Source: The Climate Registry. 2013. 2013 Climate Registry Default Emission Factors. Accessed on: January 2, 2014. Available at: http://www.theclimateregistry.org/downloads/2013/04/2013-Climate-Registry-Default-Emissions-Factors.pdf.*

**Table 24. Reduced Exhaust Emissions from Cropland Idling**

| Water Agency | Groundwater Substitution | Cropland Idling/ Crop Shifting | GW Pumping Equivalent | Annual Emission (MT/year) | | | Annual Emissions (MTCO2e/year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (acre-feet/year) | (acre-feet/year) | (acre-feet/year) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Biggs-West Gridley Water District | 0 | 32,190 | 7,574 | 1,253 | 1.07 | 3.15 | 1,253 | 1.07 | 3.15 | 1,257 |
| Conaway Preservation Group | 26,639 | 16,014 | 3,768 | 623 | 0.53 | 1.57 | 623 | 0.53 | 1.57 | 626 |
| Glenn-Colusa Irrigation District | 0 | 16,500 | 3,882 | 642 | 0.55 | 1.61 | 642 | 0.55 | 1.61 | 644 |
| Goose Club Farms and Teichert Aggregate | 2,000 | 6,000 | 1,412 | 234 | 0.20 | 0.59 | 234 | 0.20 | 0.59 | 234 |
| Maxwell Irrigation District | 4,700 | 7,500 | 1,765 | 292 | 0.25 | 0.73 | 292 | 0.25 | 0.73 | 293 |
| Pelger Mutual Water Company | 4,000 | 1,903 | 448 | 74 | 0.06 | 0.19 | 74 | 0.06 | 0.19 | 74 |
| Pleasant Grove-Verona Mutual Water Company | 12,000 | 9,000 | 2,118 | 350 | 0.30 | 0.88 | 350 | 0.30 | 0.88 | 352 |
| Princeton-Codora-Glenn Irrigation District | 0 | 3,000 | 706 | 117 | 0.10 | 0.29 | 117 | 0.10 | 0.29 | 117 |
| Provident Irrigation District | 0 | 3,000 | 706 | 117 | 0.10 | 0.29 | 117 | 0.10 | 0.29 | 117 |
| Reclamation District 108 | 7,500 | 20,000 | 4,706 | 779 | 0.66 | 1.96 | 779 | 0.66 | 1.96 | 781 |
| Reclamation District 1004 | 5,400 | 7,500 | 1,765 | 292 | 0.25 | 0.73 | 292 | 0.25 | 0.73 | 293 |
| Sycamore Mutual Water Company | 8,000 | 10,000 | 2,353 | 389 | 0.33 | 0.98 | 389 | 0.33 | 0.98 | 391 |
| Te Velde Revocable Family Trust | 5,344 | 5,387 | 1,268 | 210 | 0.18 | 0.53 | 210 | 0.18 | 0.53 | 211 |
| **Total** | **75,583** | **137,994** | **32,471** | **5,373** | **4.58** | **13.51** | **5,373** | **4.58** | **13.51** | **5,391** |

Notes:
Pelger Mutual Water Company used to estimate emissions for other water agencies.
Engine power rating equal to 250 hp for Pelger Mutual Water Company engines.
The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).
Pelger Mutual Water Company engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing

*Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."*

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# Appendix F

# Groundwater Modeling Results

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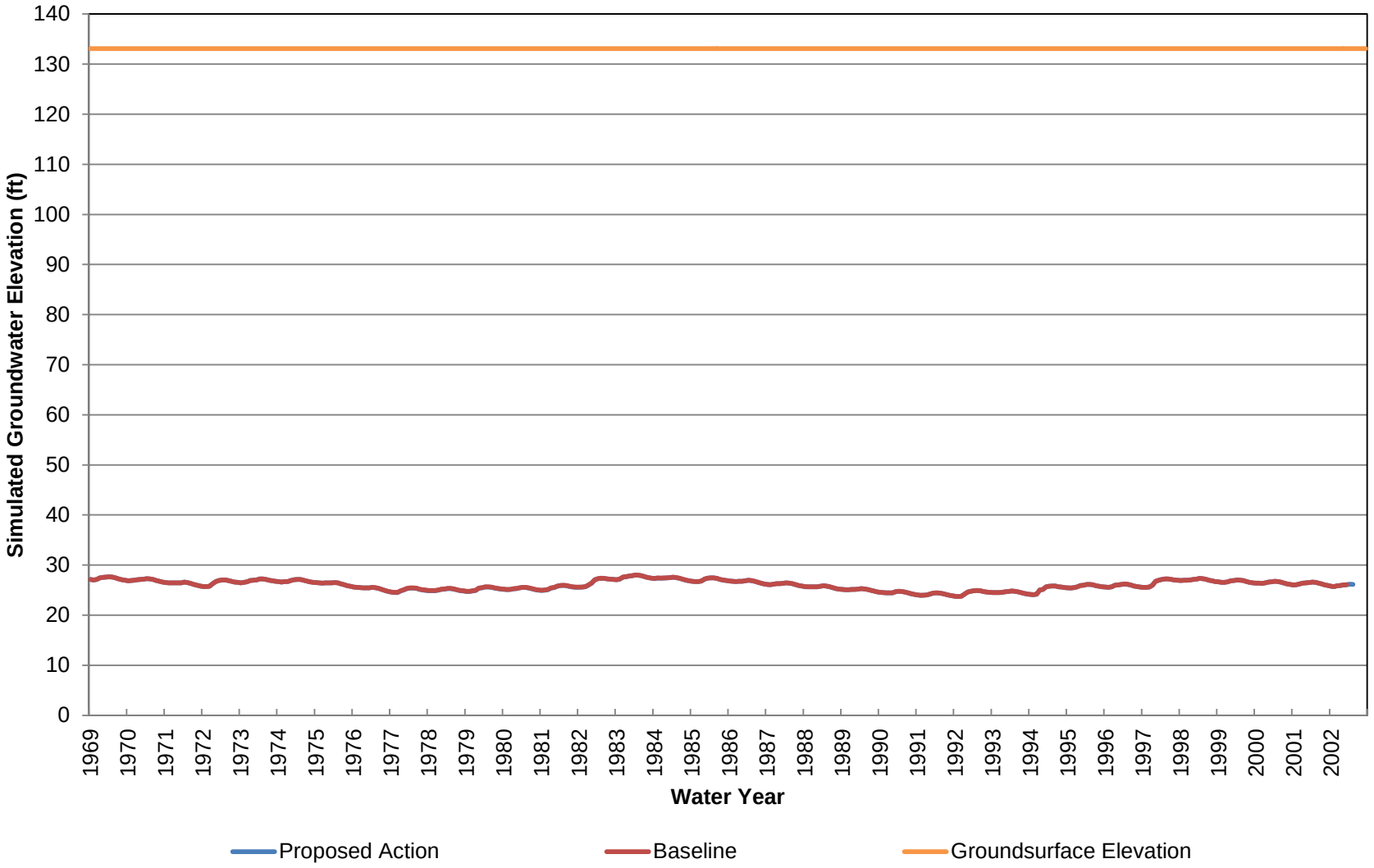
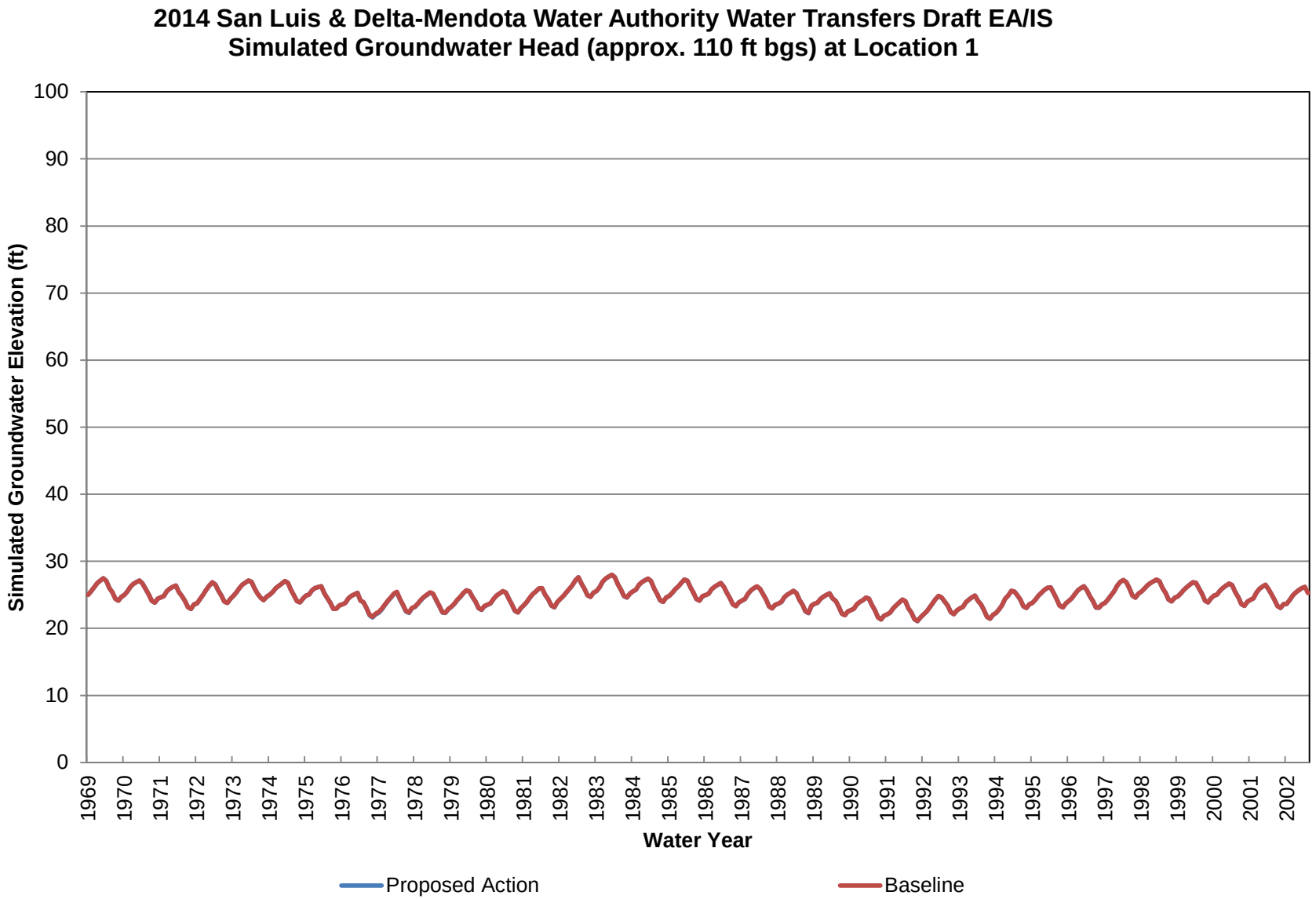
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 1




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 1
Simulated Groundwater Elevation (ft)
100
90
80
70
60
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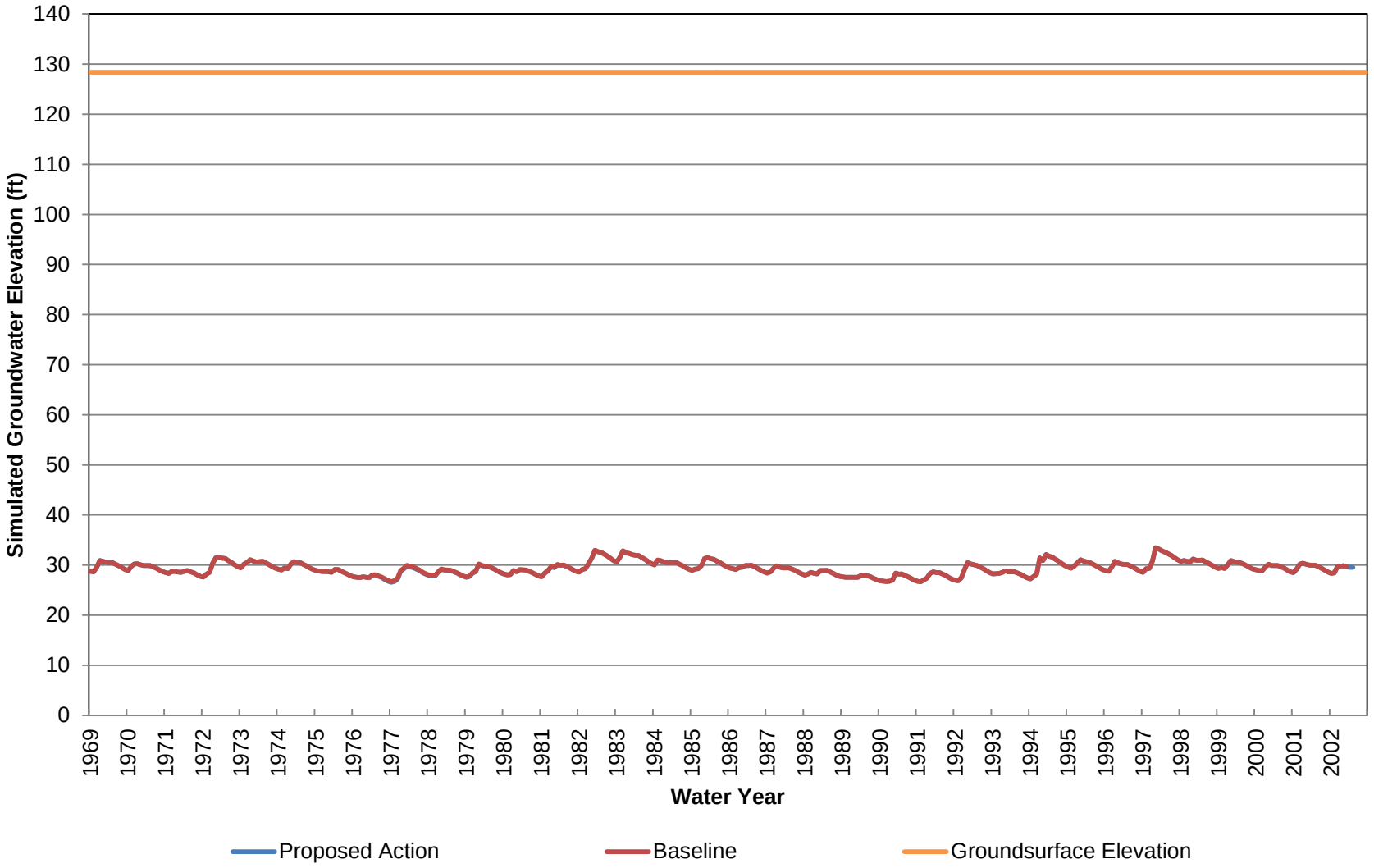
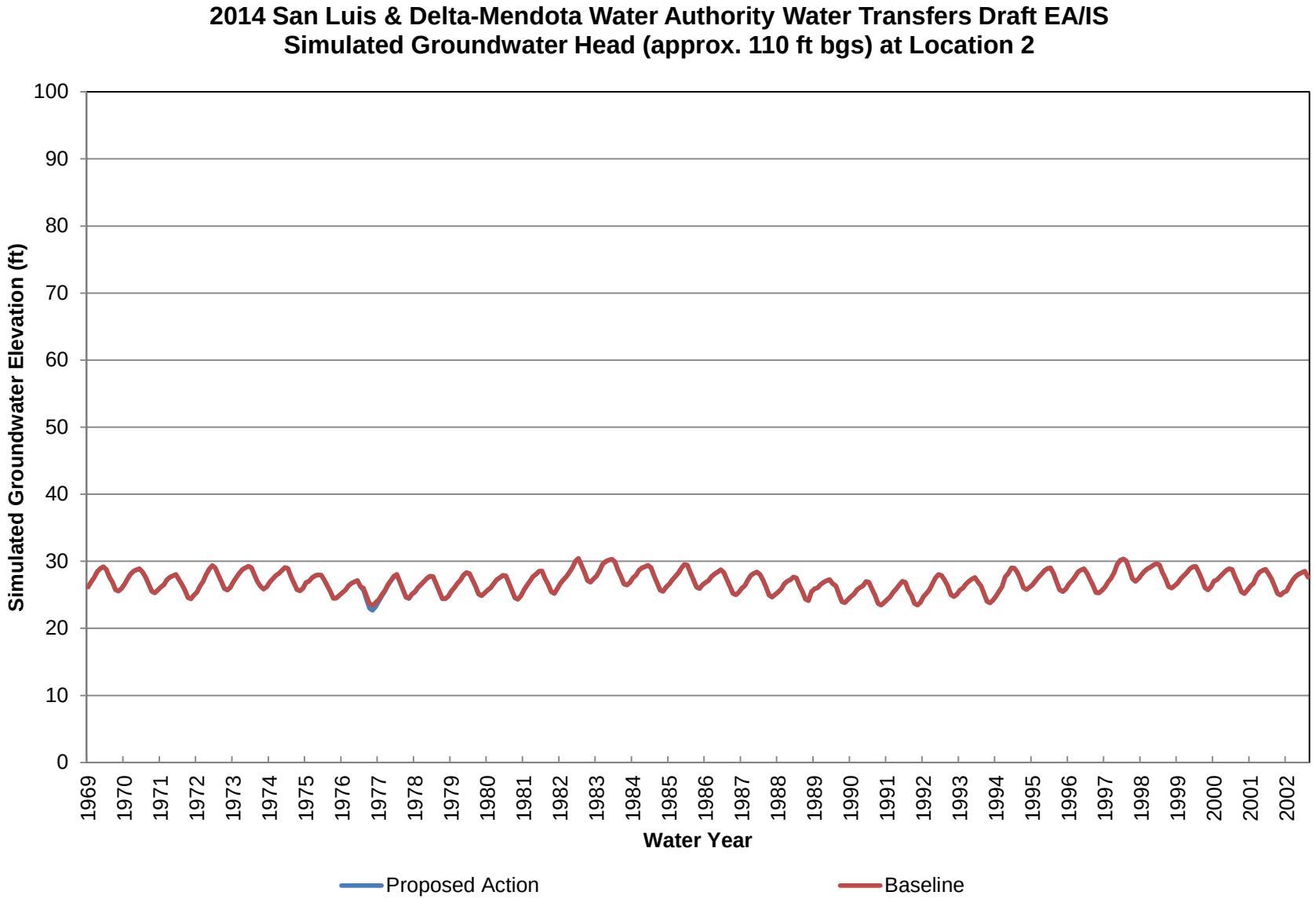
2002
Water Year
Proposed Action
Baseline

## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 2




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 2
Simulated Groundwater Elevation (ft)
100
90
80
70
60
50
40
30
20
10
0
1969
1970
1971
1972
1973
1974
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1976
1977
1978
1979
1980
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1982
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1992
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1994
1995
1996
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1998
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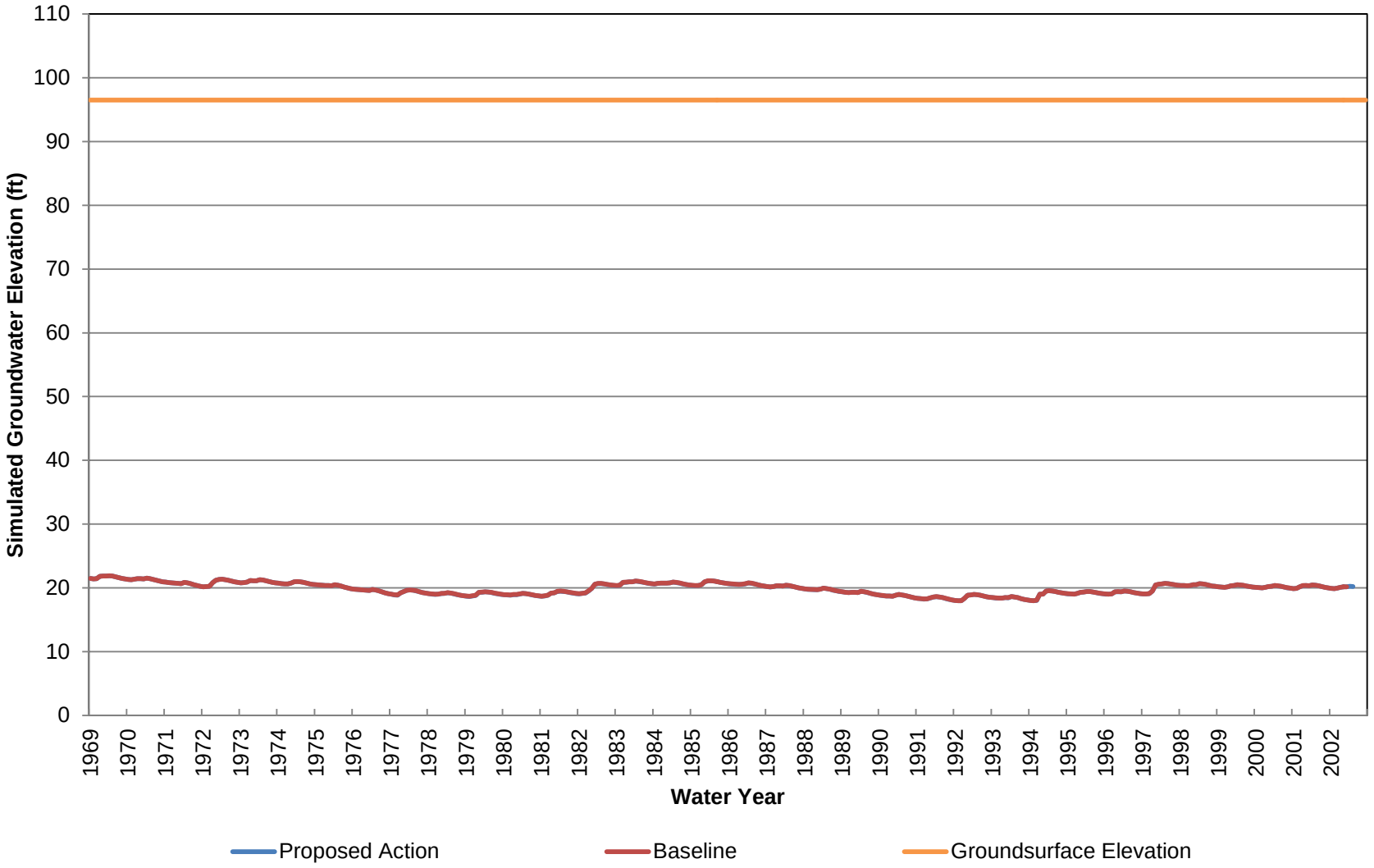
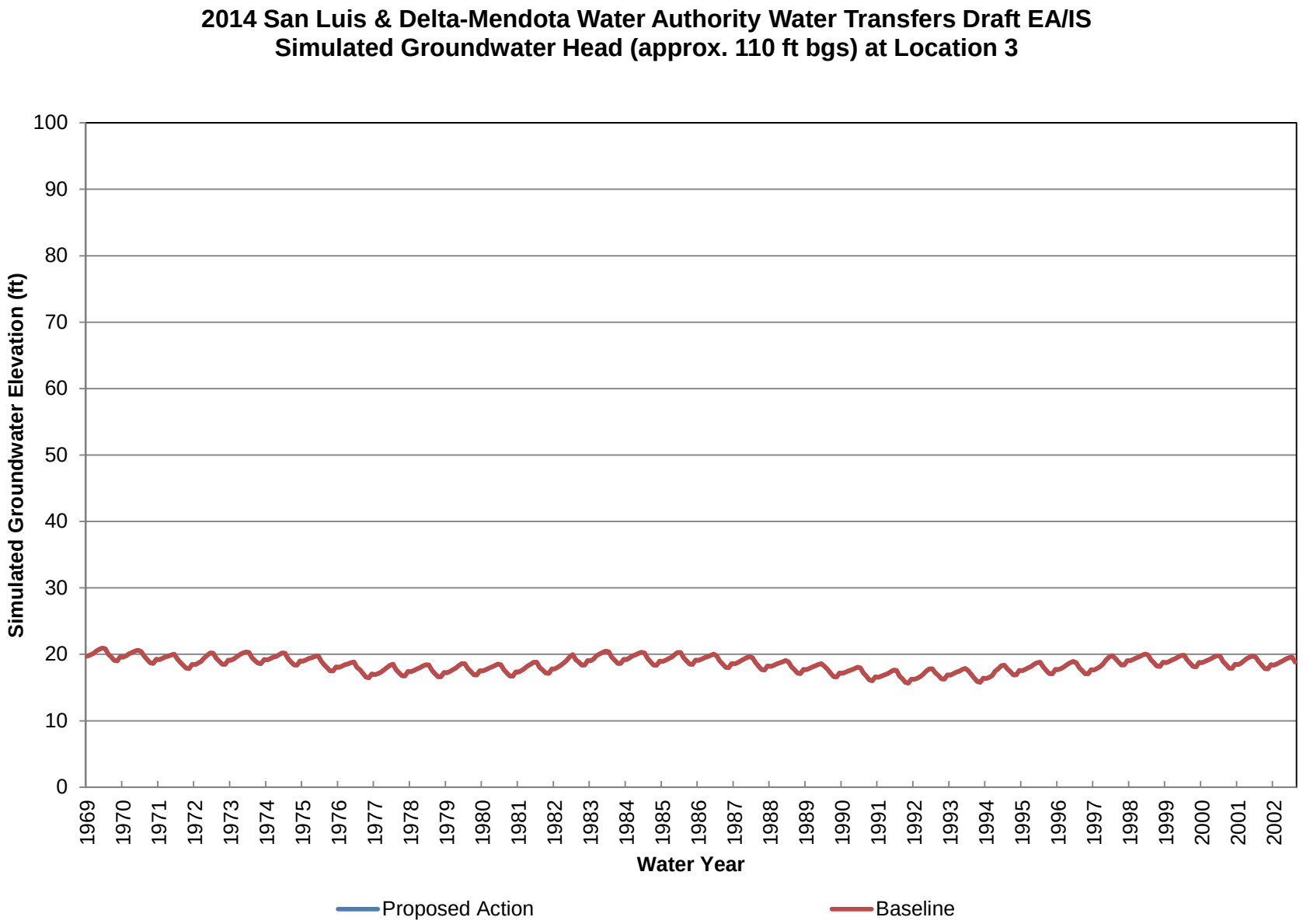
2000
2001
2002
Water Year
Proposed Action
Baseline

## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 3




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 3
Simulated Groundwater Elevation (ft)
100
90
80
70
60
50
40
30
20
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1969
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1974
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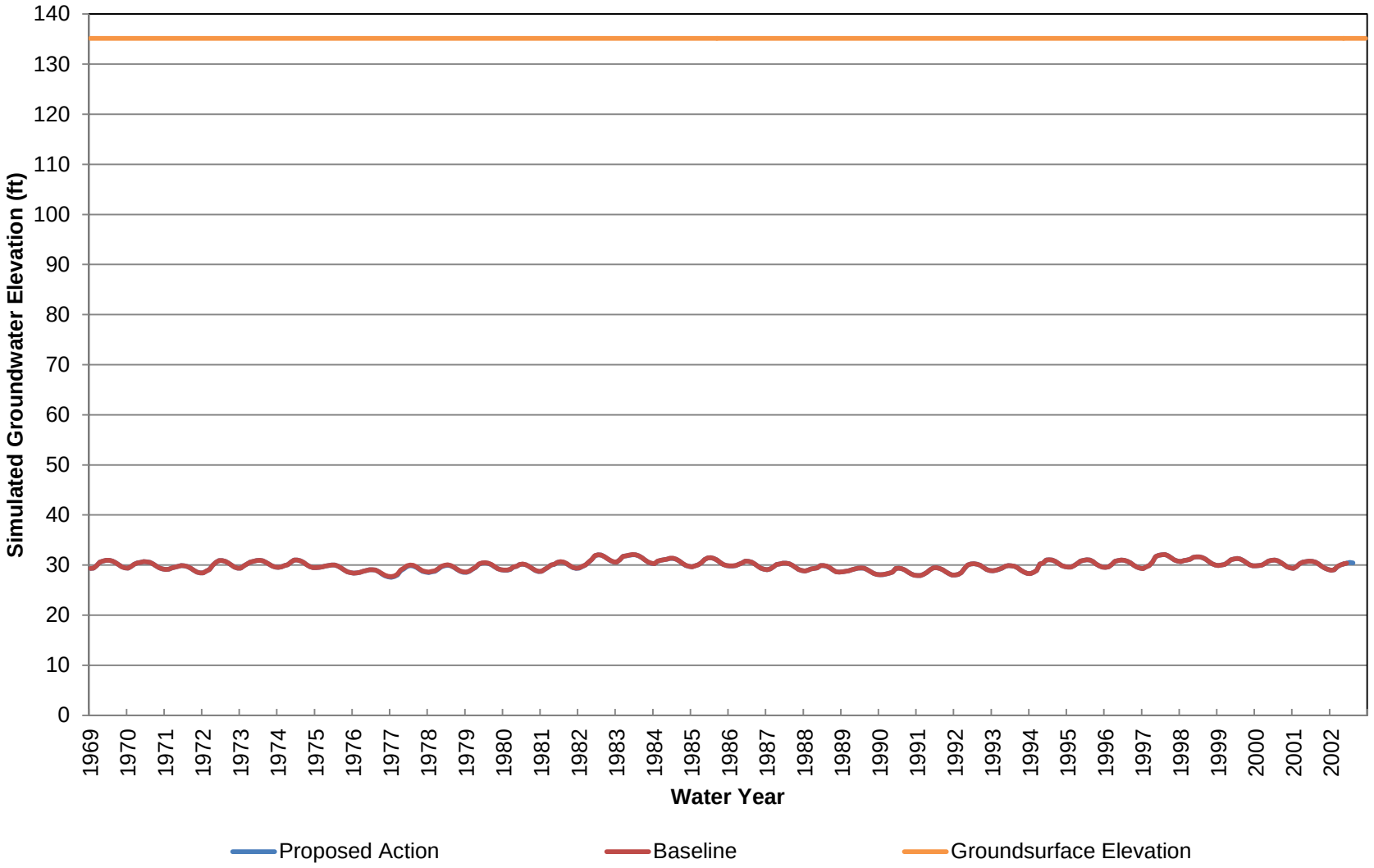
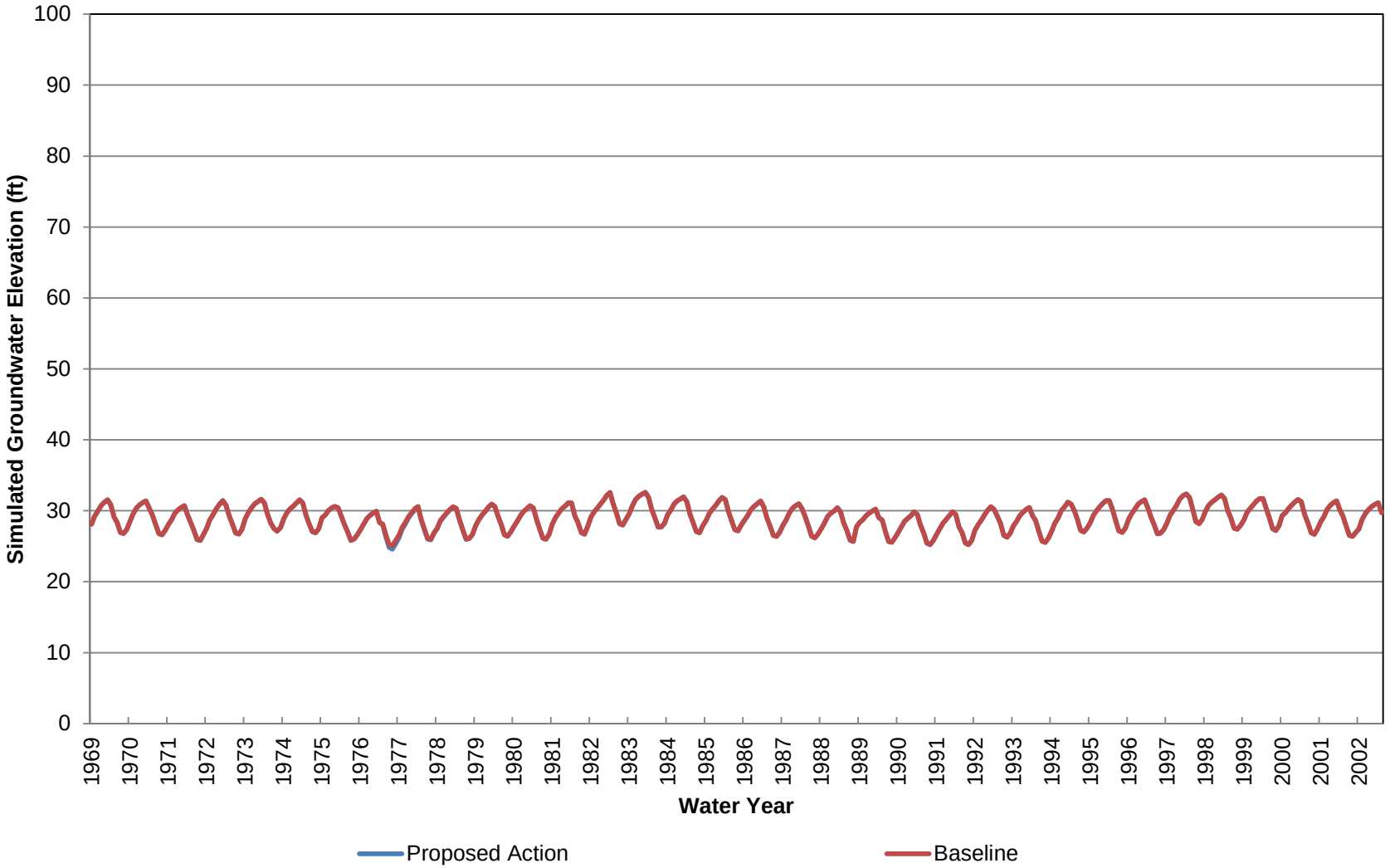
1998
1999
2000
2001
2002
Water Year
Proposed Action
Baseline

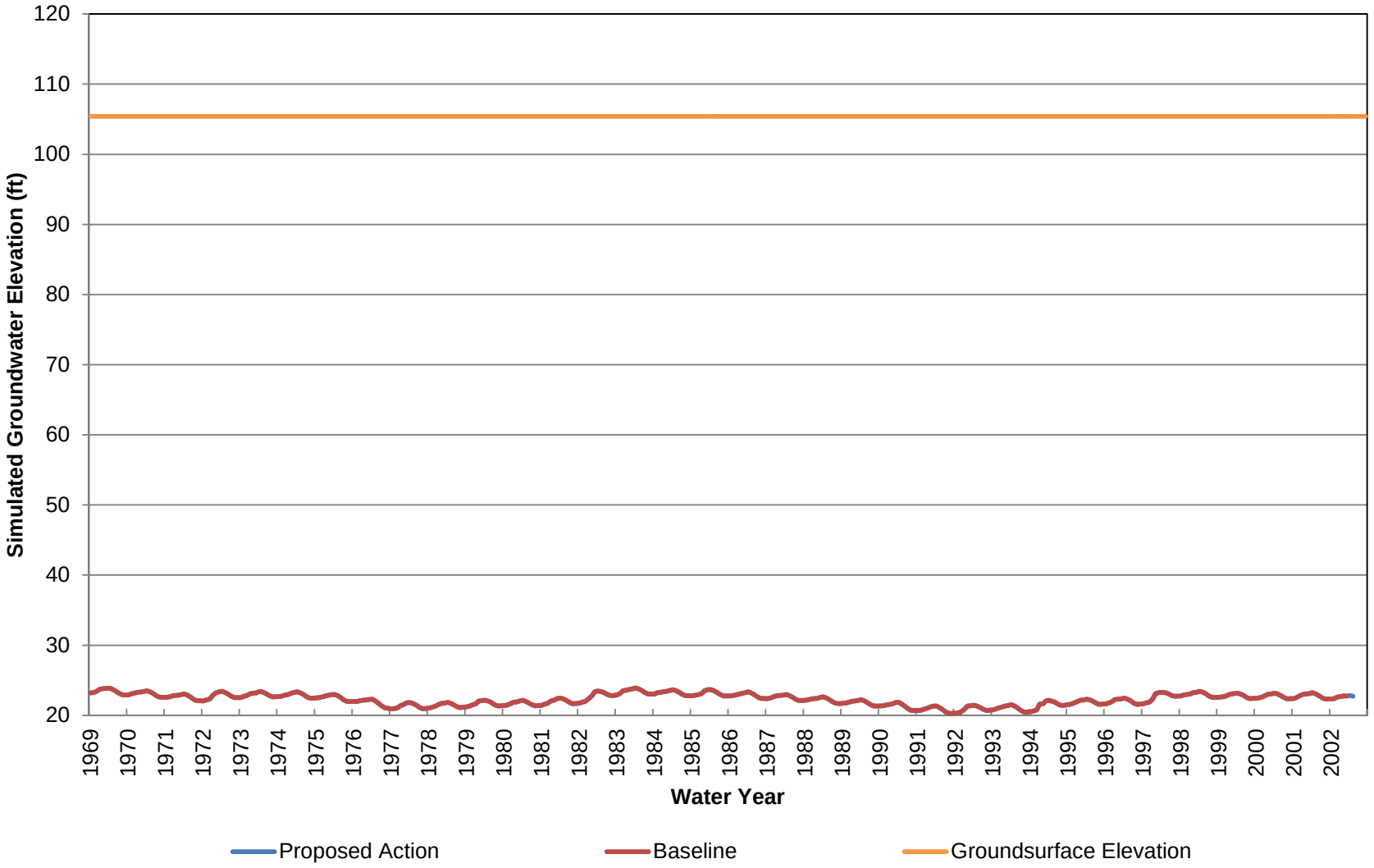
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 4



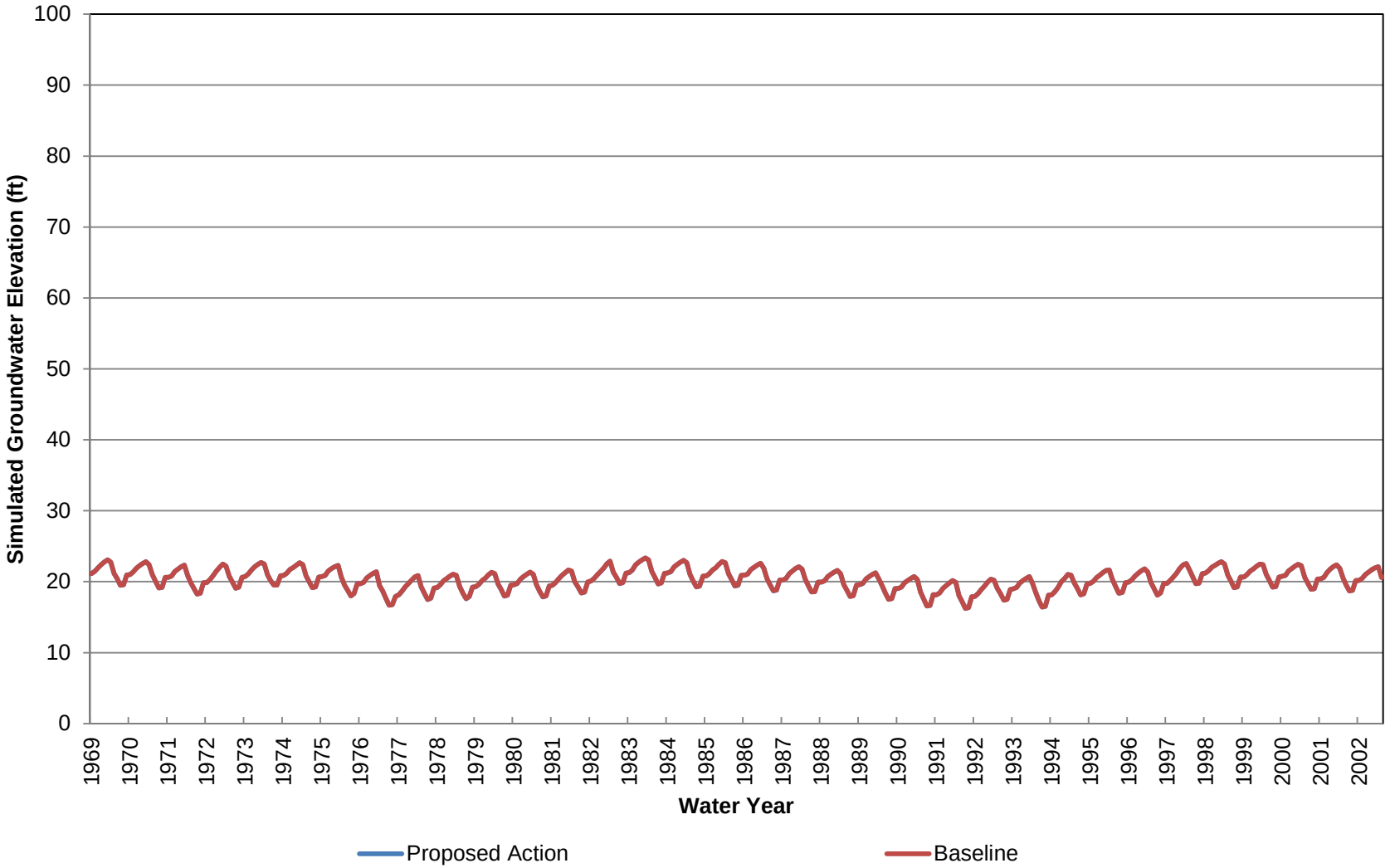
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 4



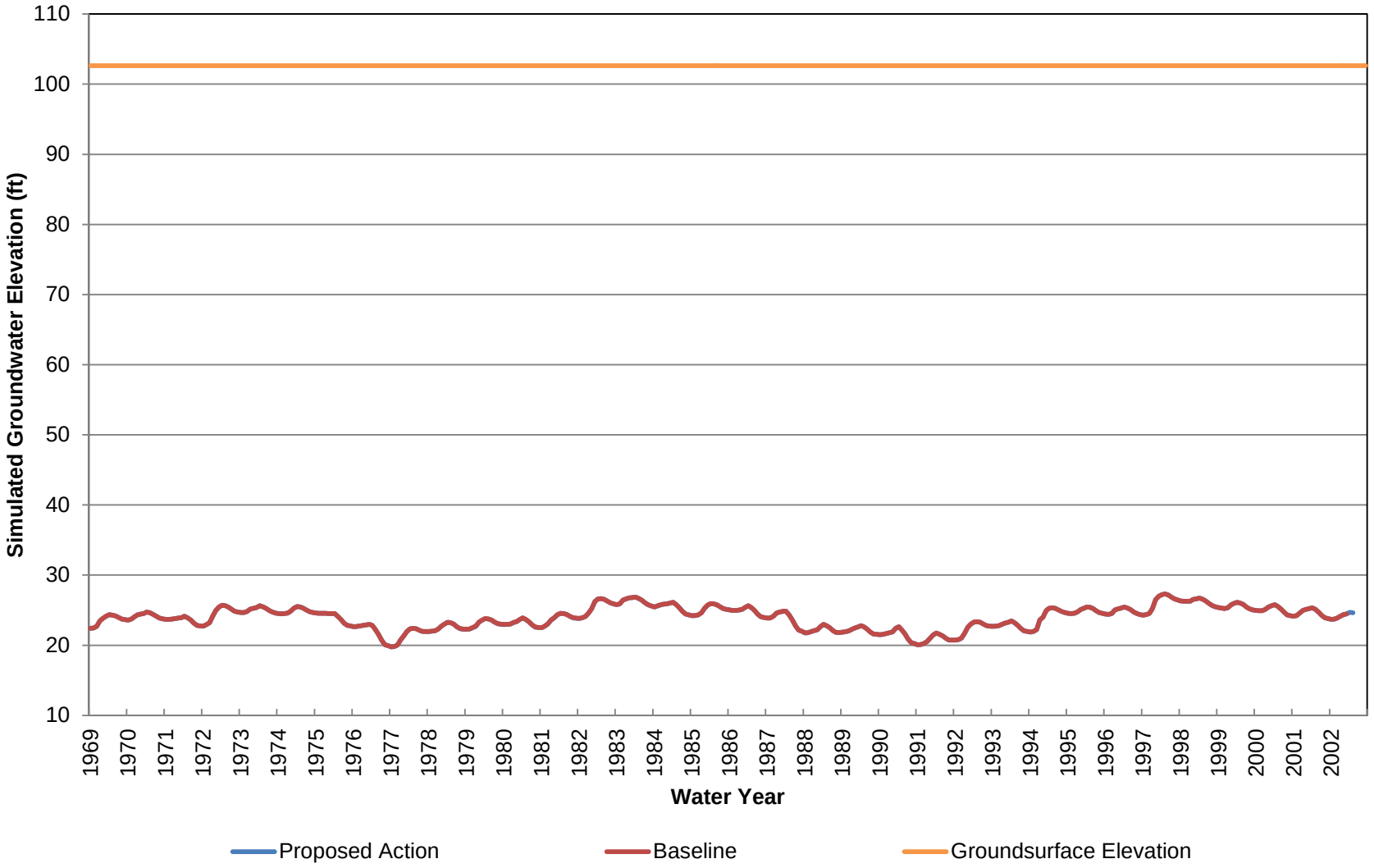
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 5



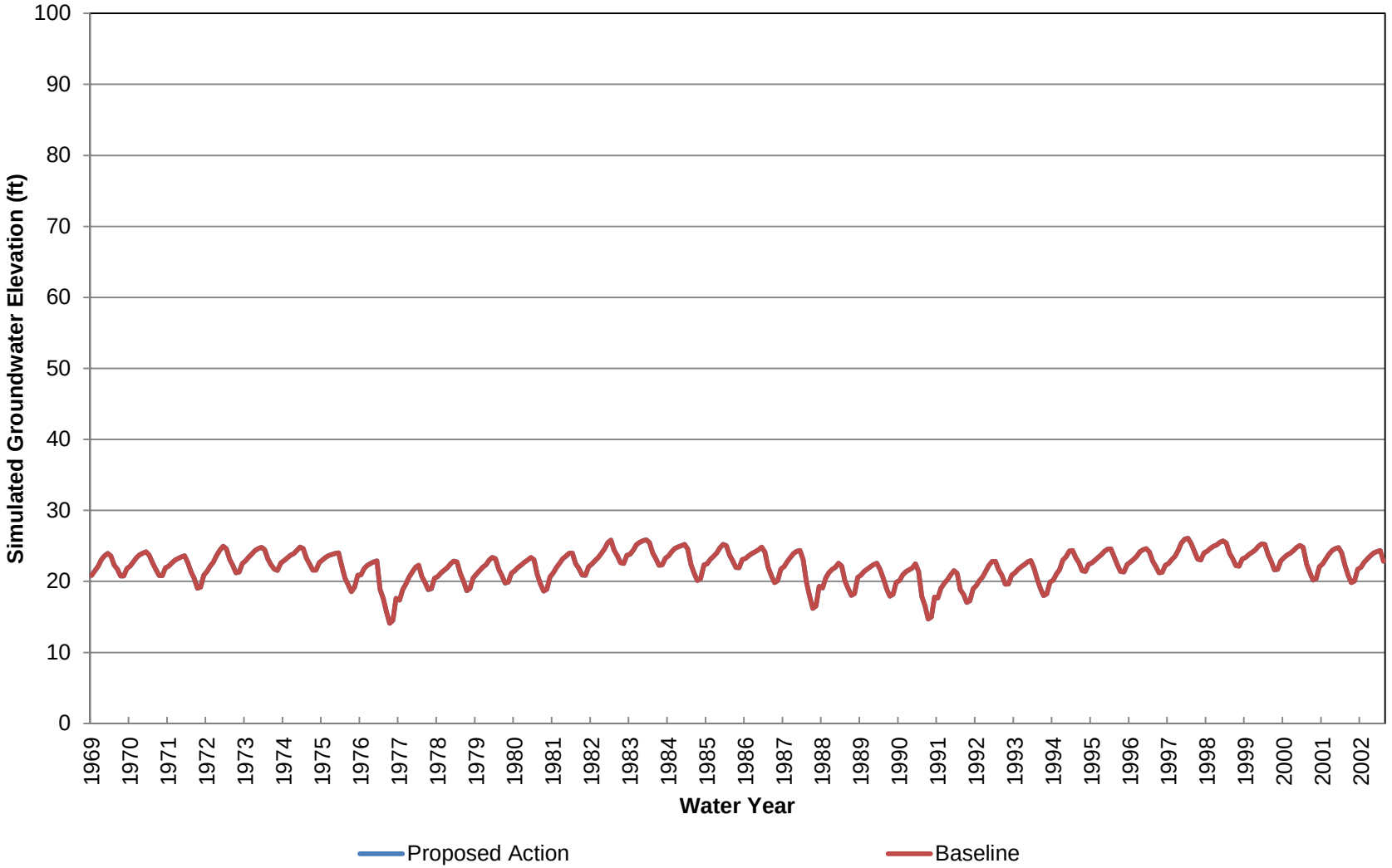
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 5



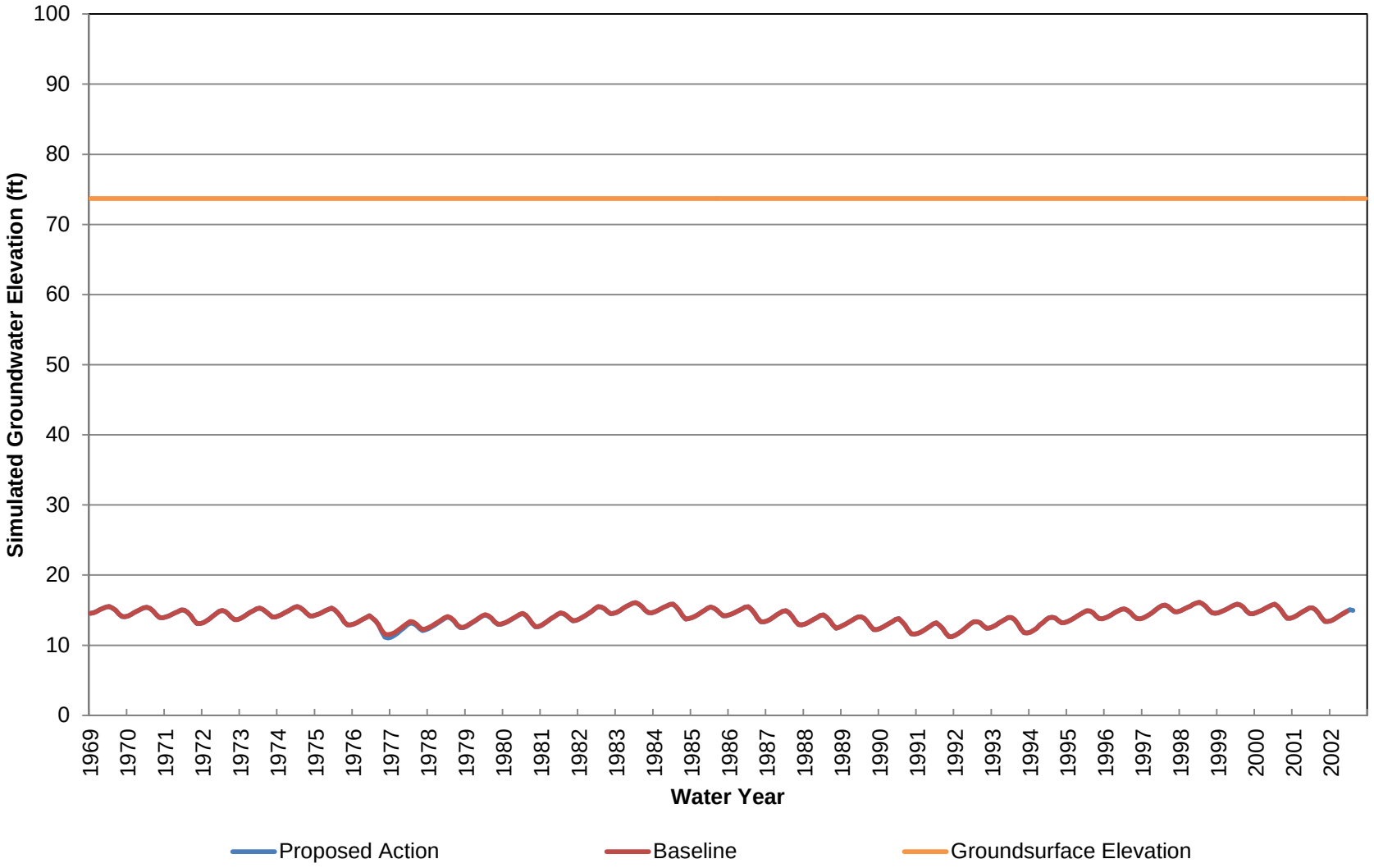
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 6

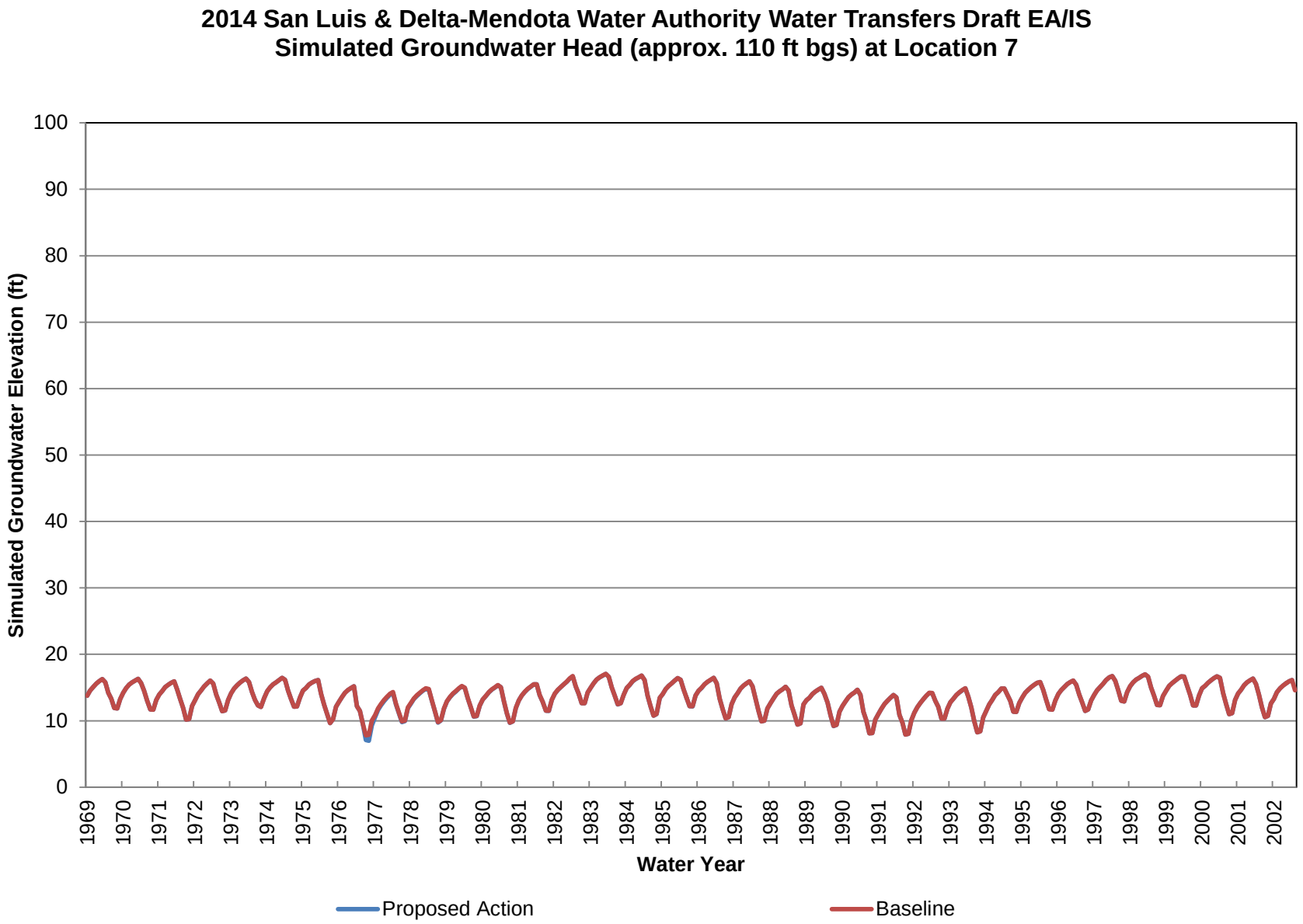


**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 6**



## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 7




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 7
Simulated Groundwater Elevation (ft)
100
90
80
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1997
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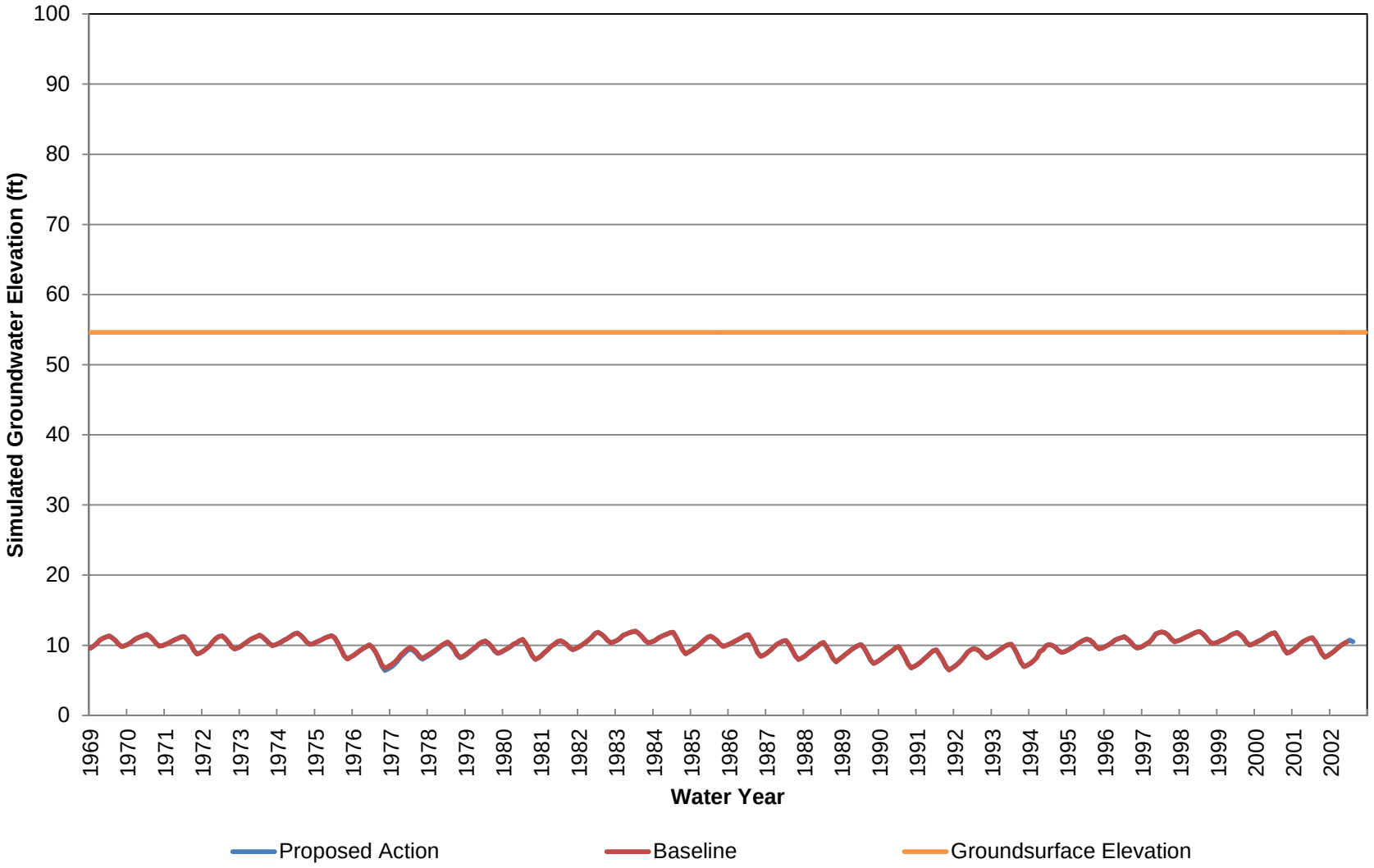
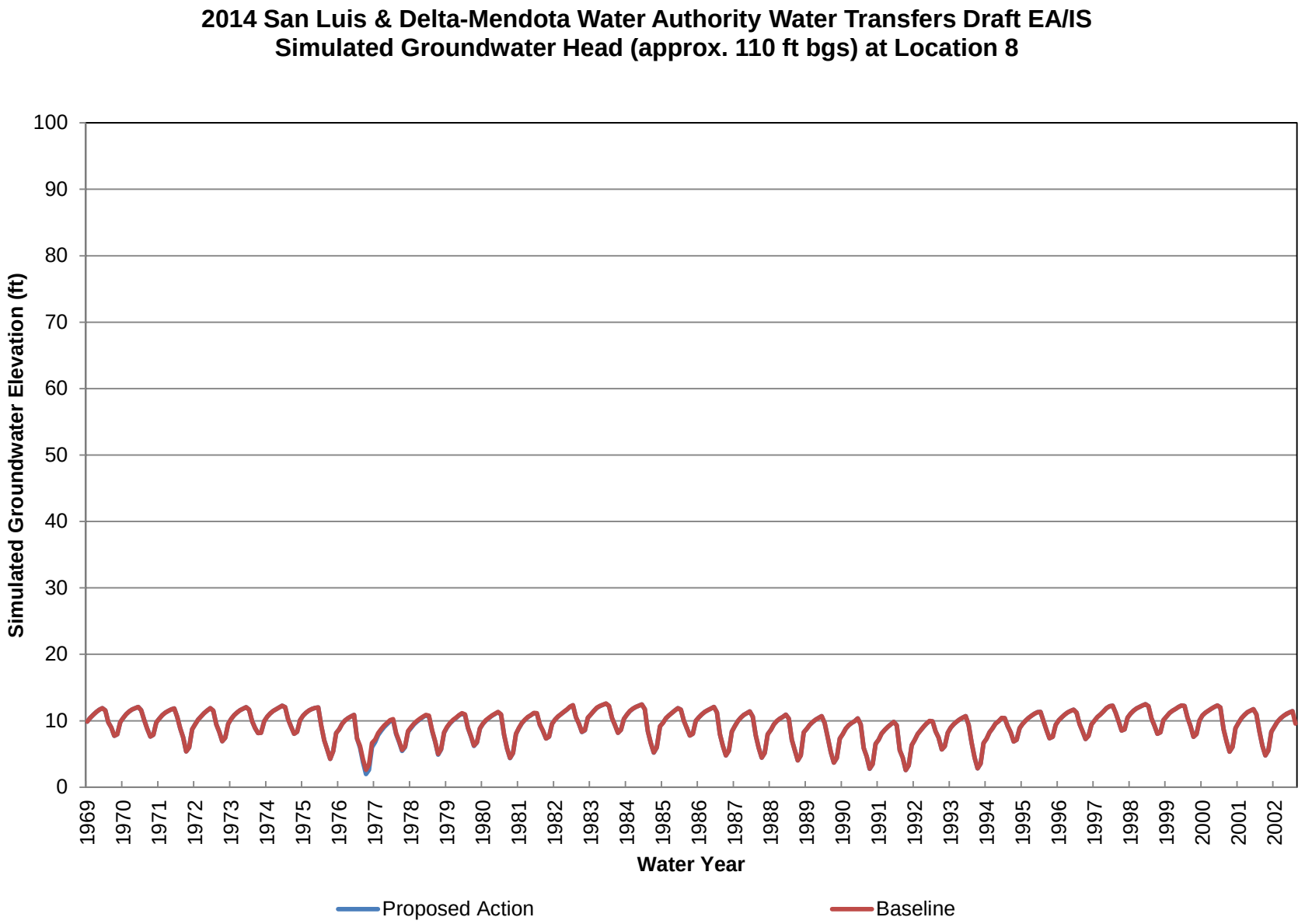
2000
2001
2002
Water Year
Proposed Action
Baseline

## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 8




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 8
Simulated Groundwater Elevation (ft)
100
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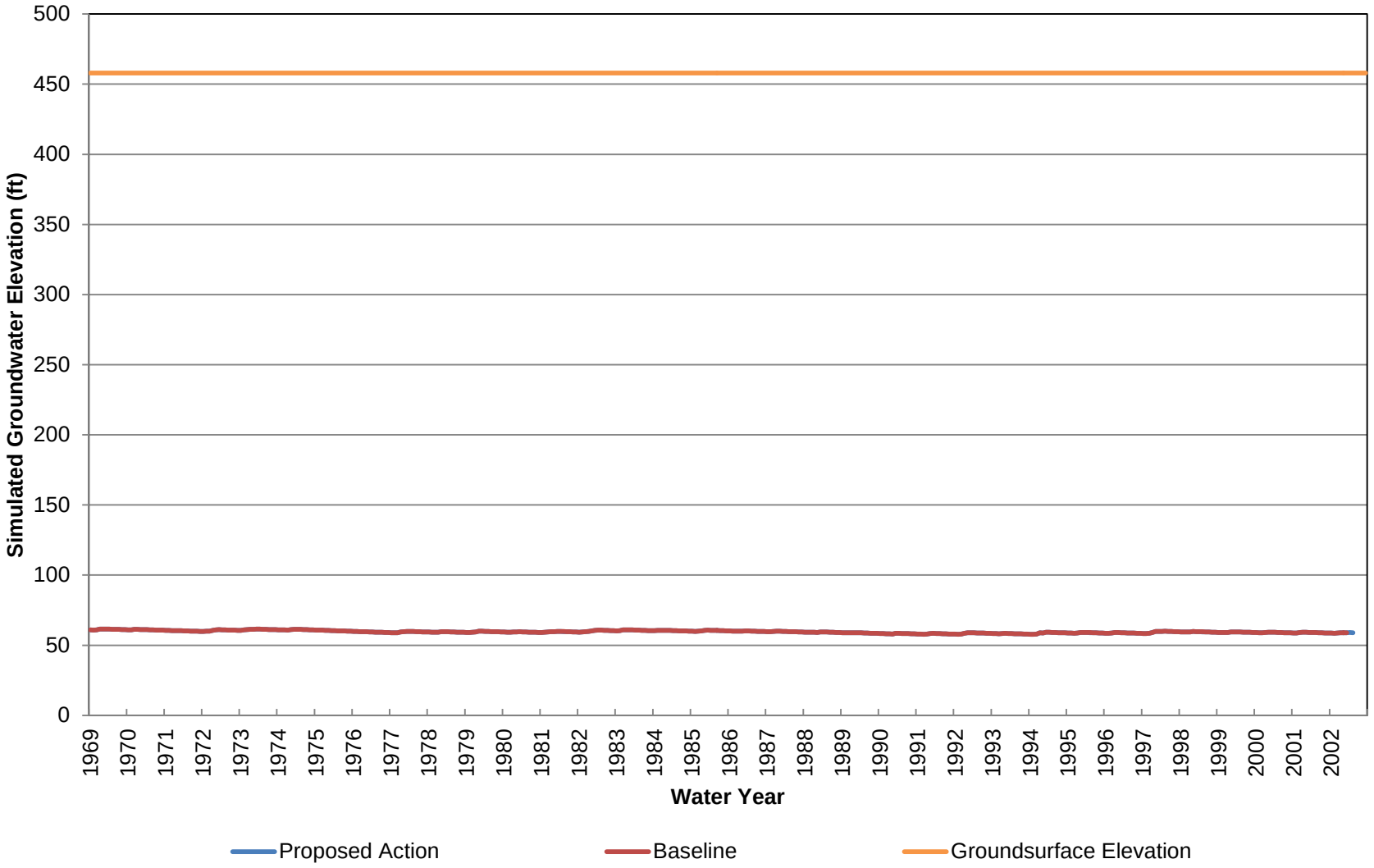
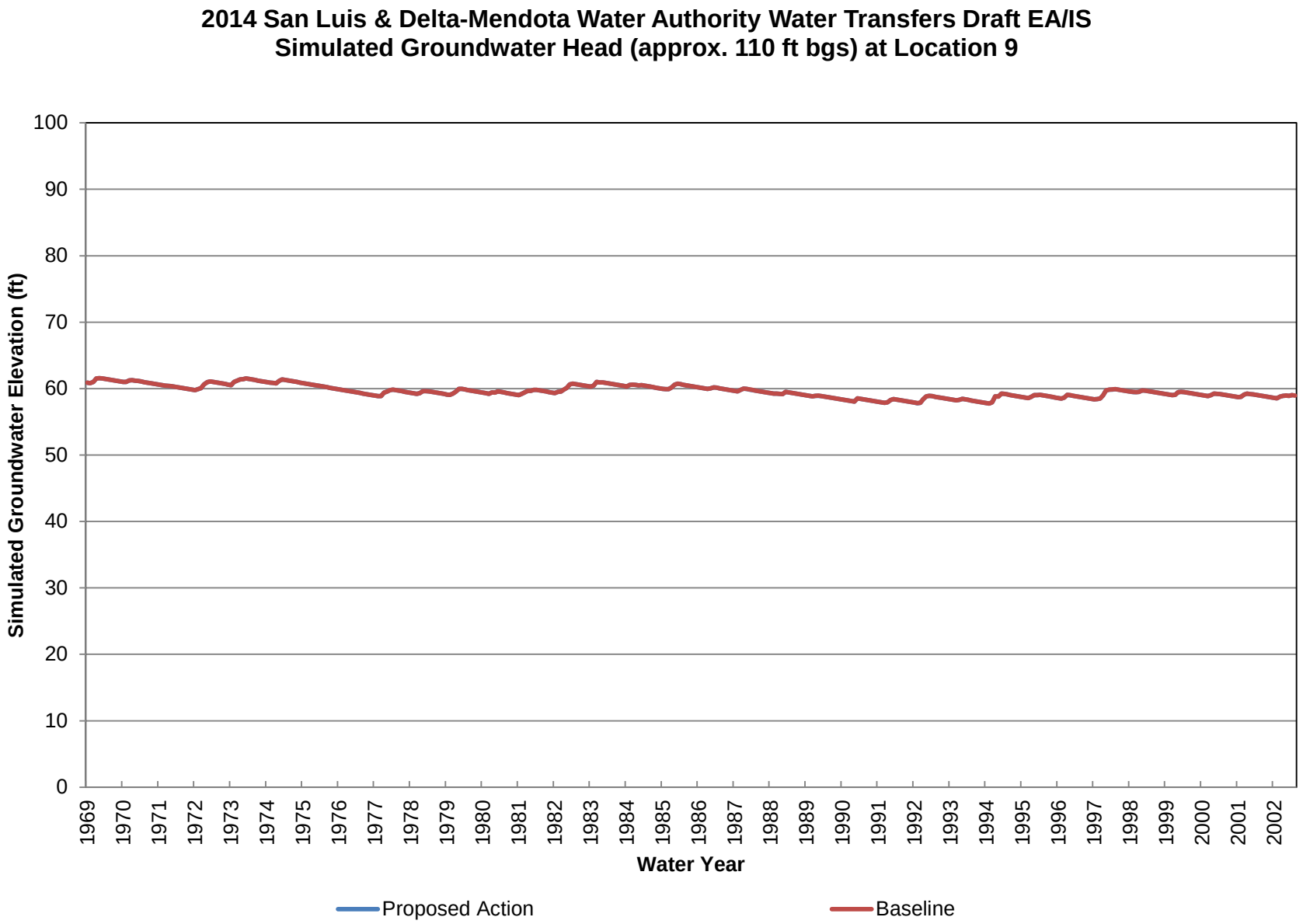
2001
2002
Water Year
Proposed Action
Baseline

## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 9




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 9
Simulated Groundwater Elevation (ft)
100
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1999
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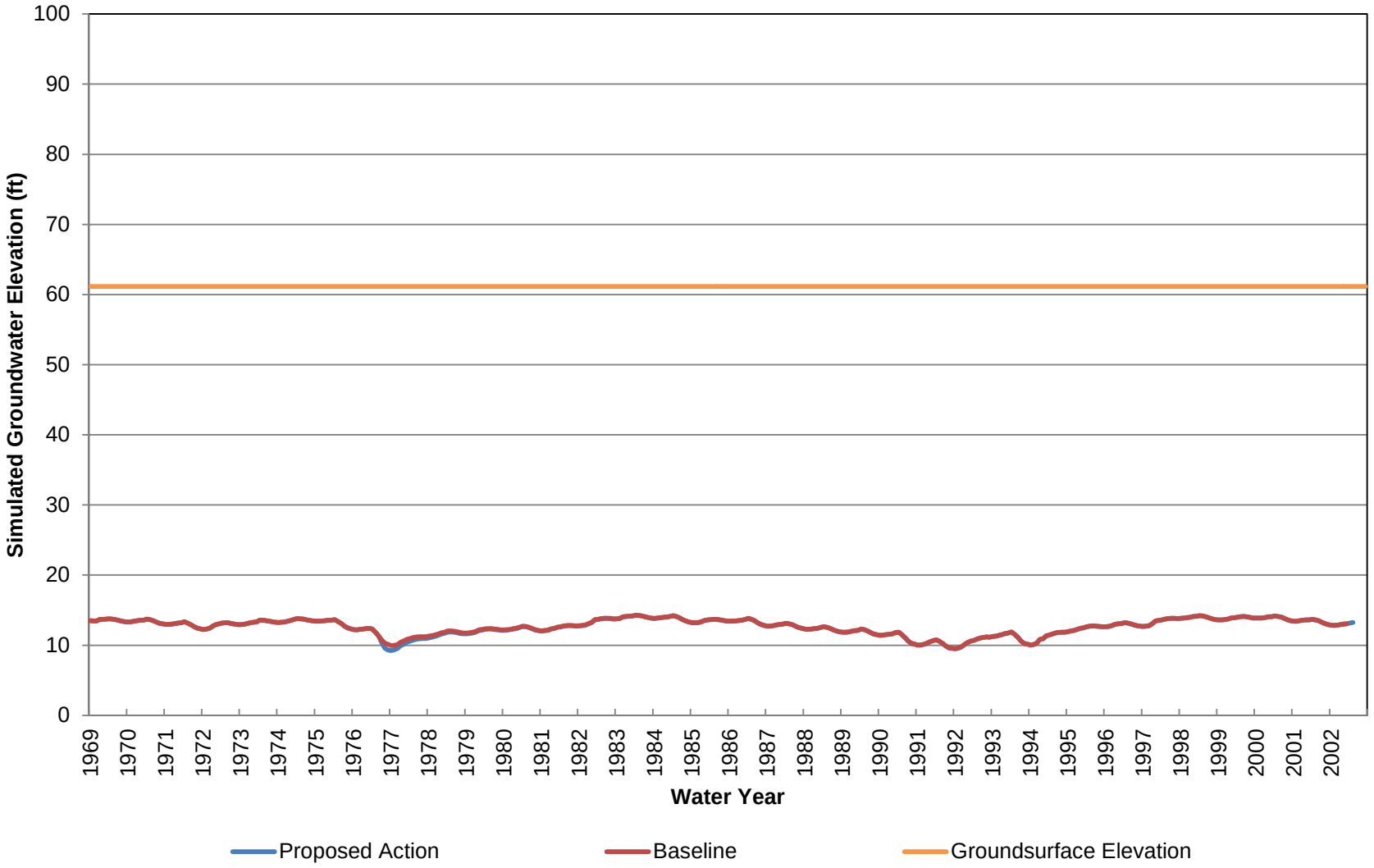
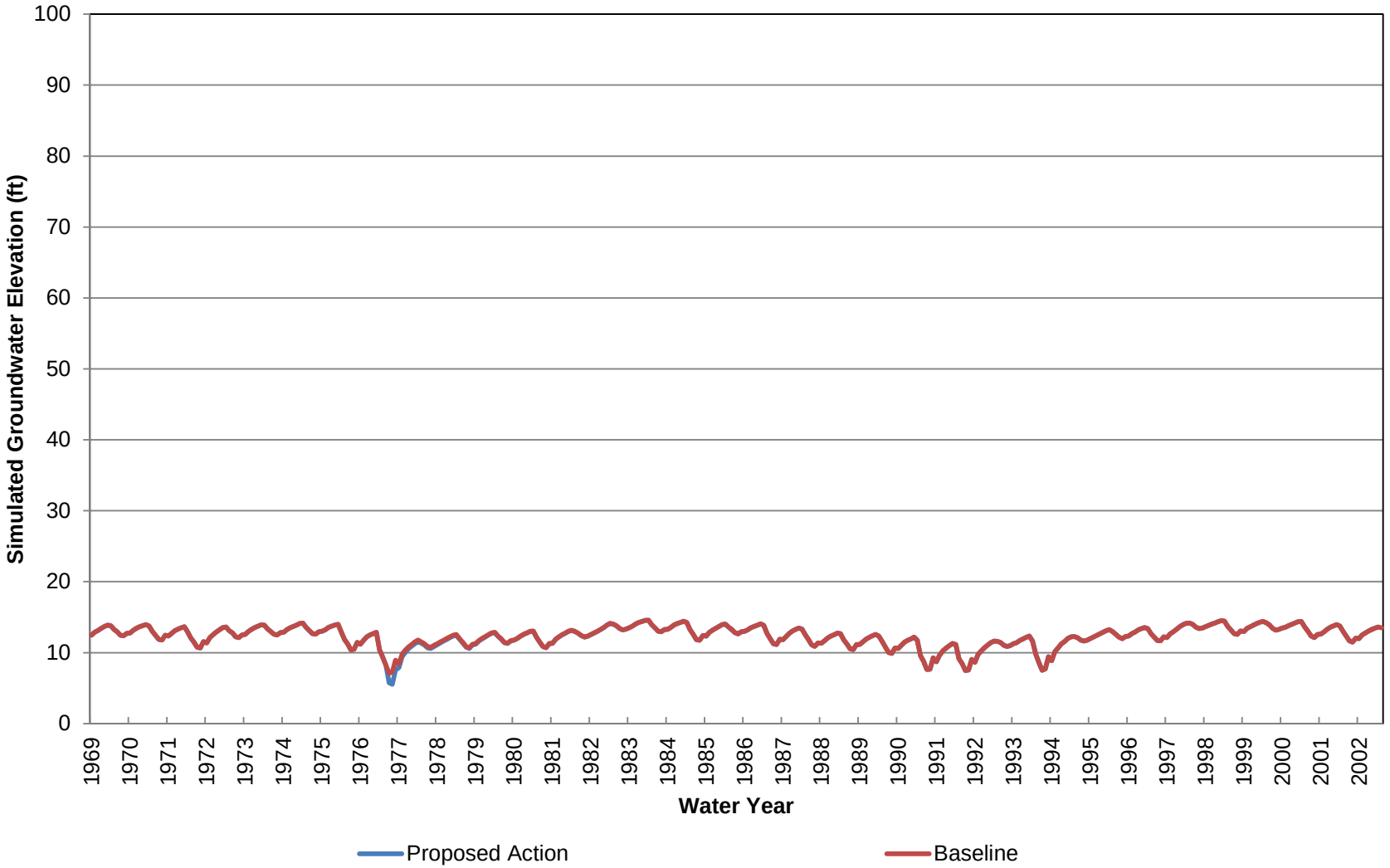
2001
2002
Water Year
Proposed Action
Baseline

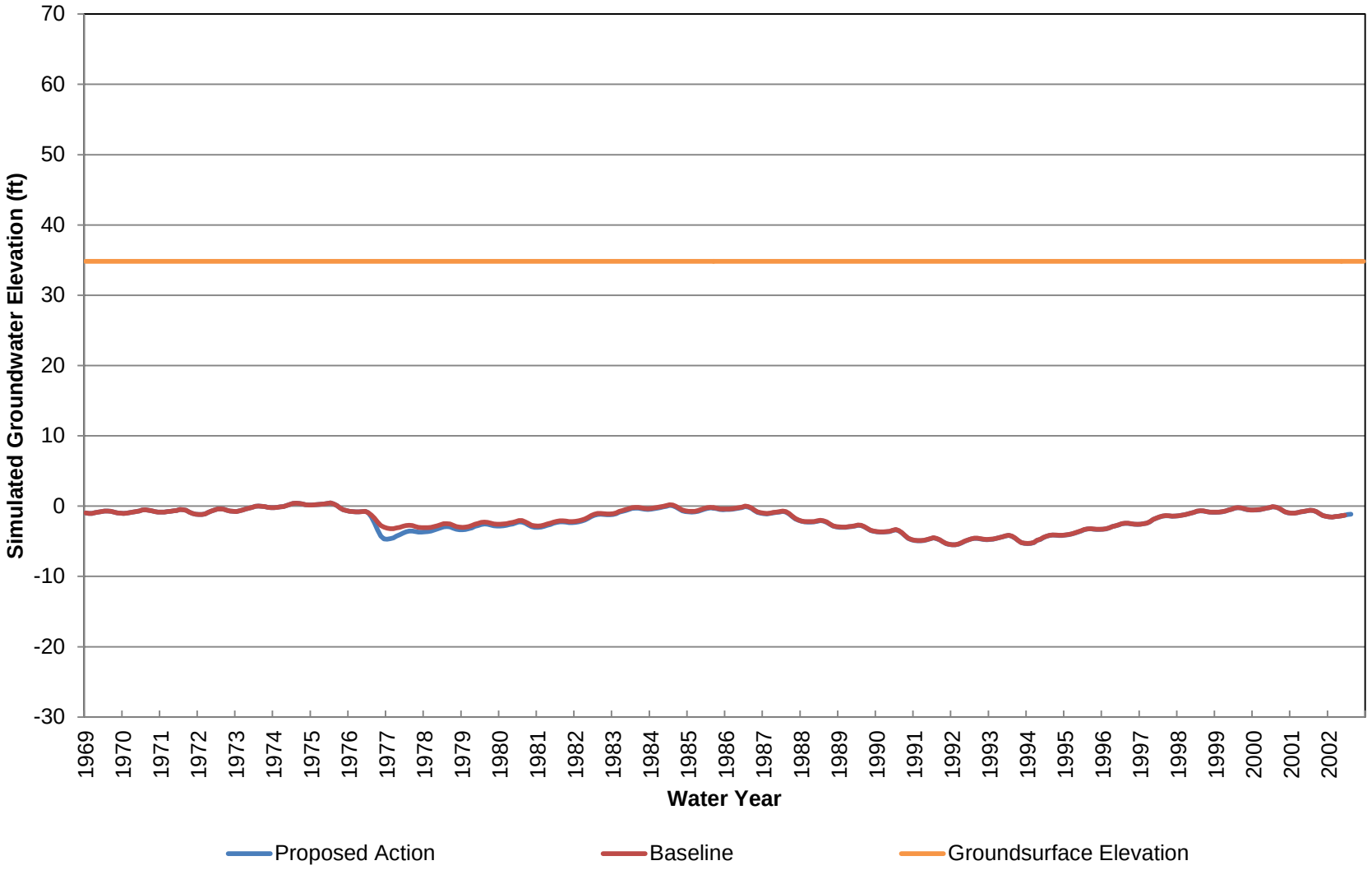
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 10



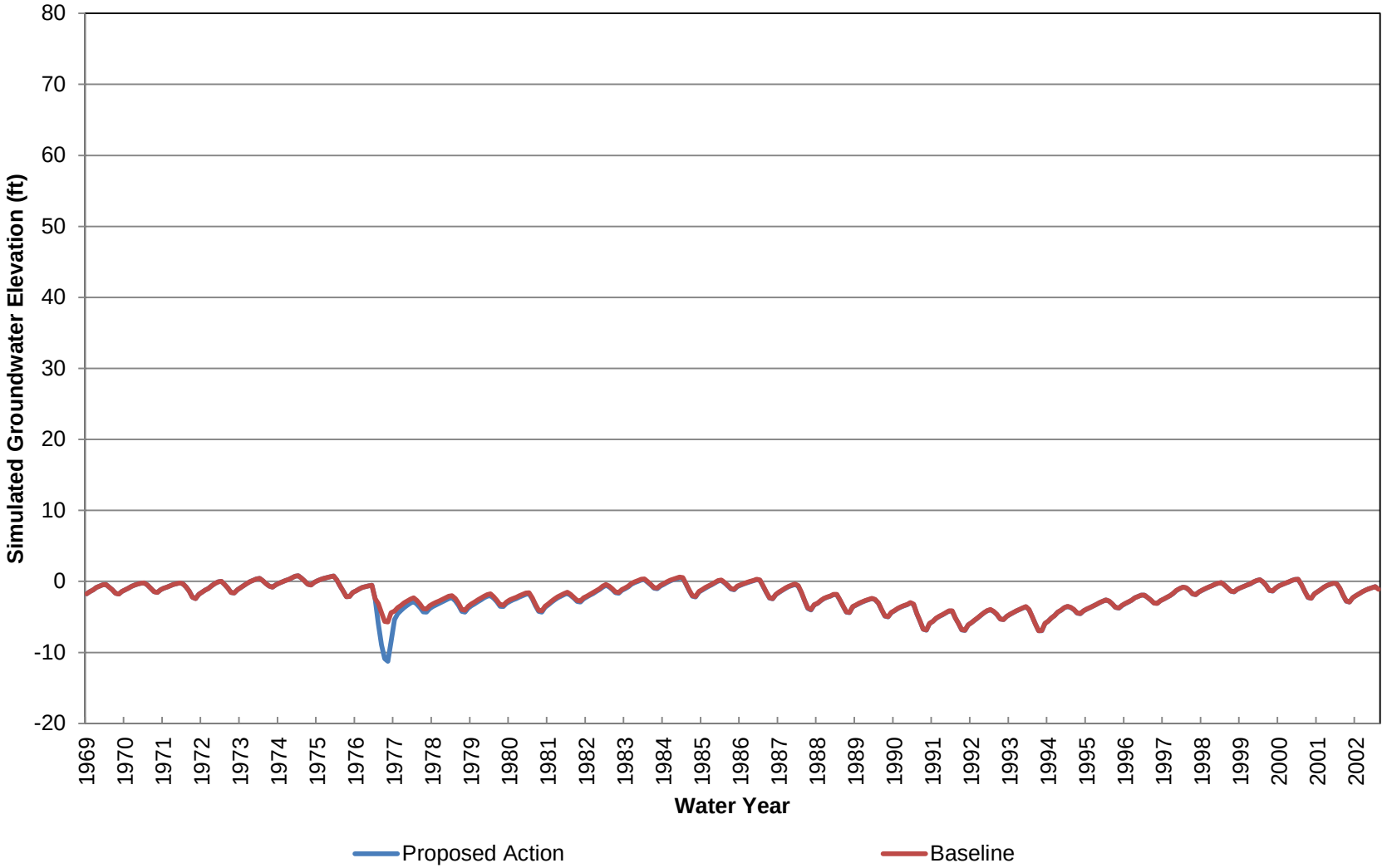
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 10



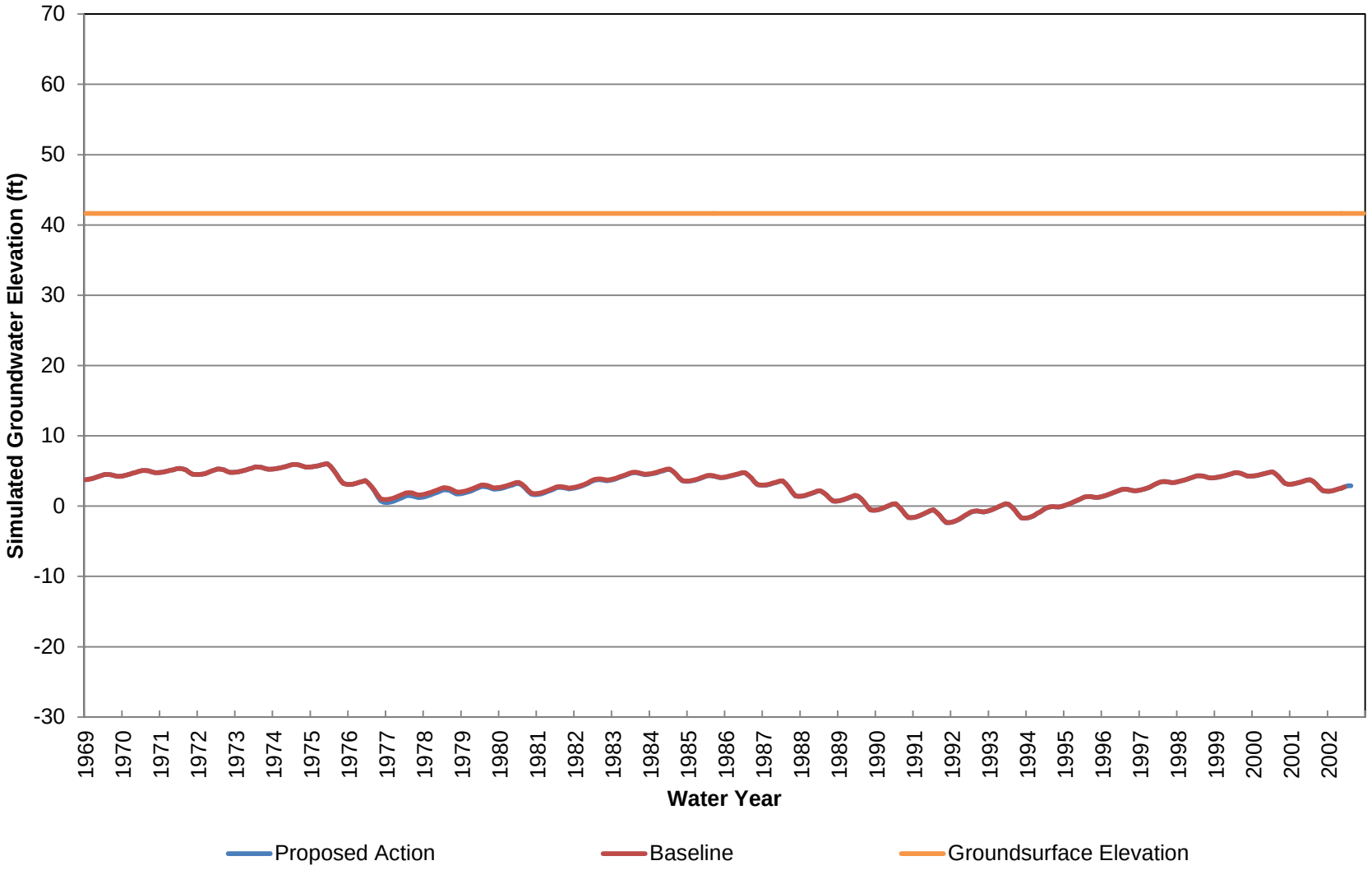
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Table Elevations at Location 11**



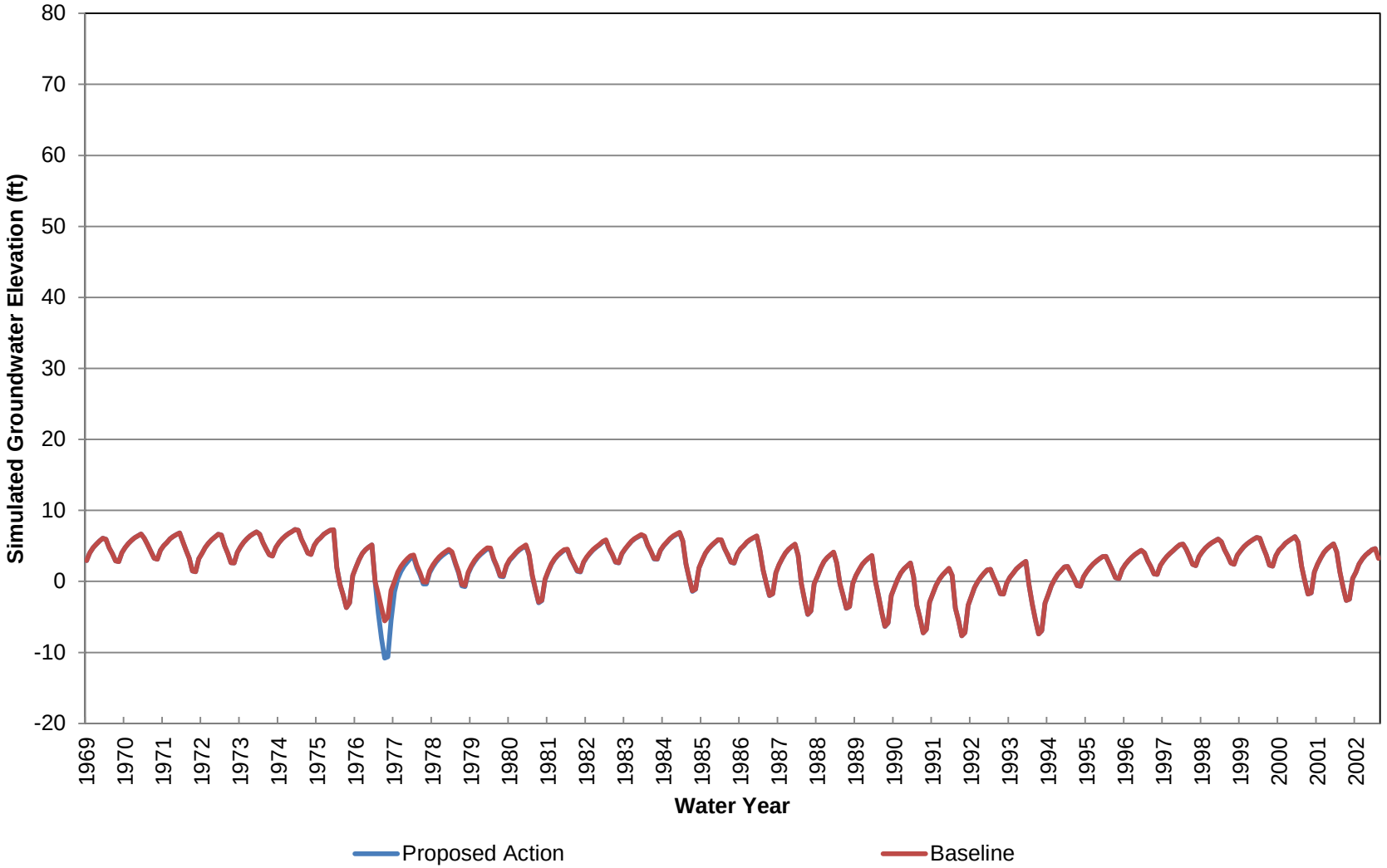
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 11



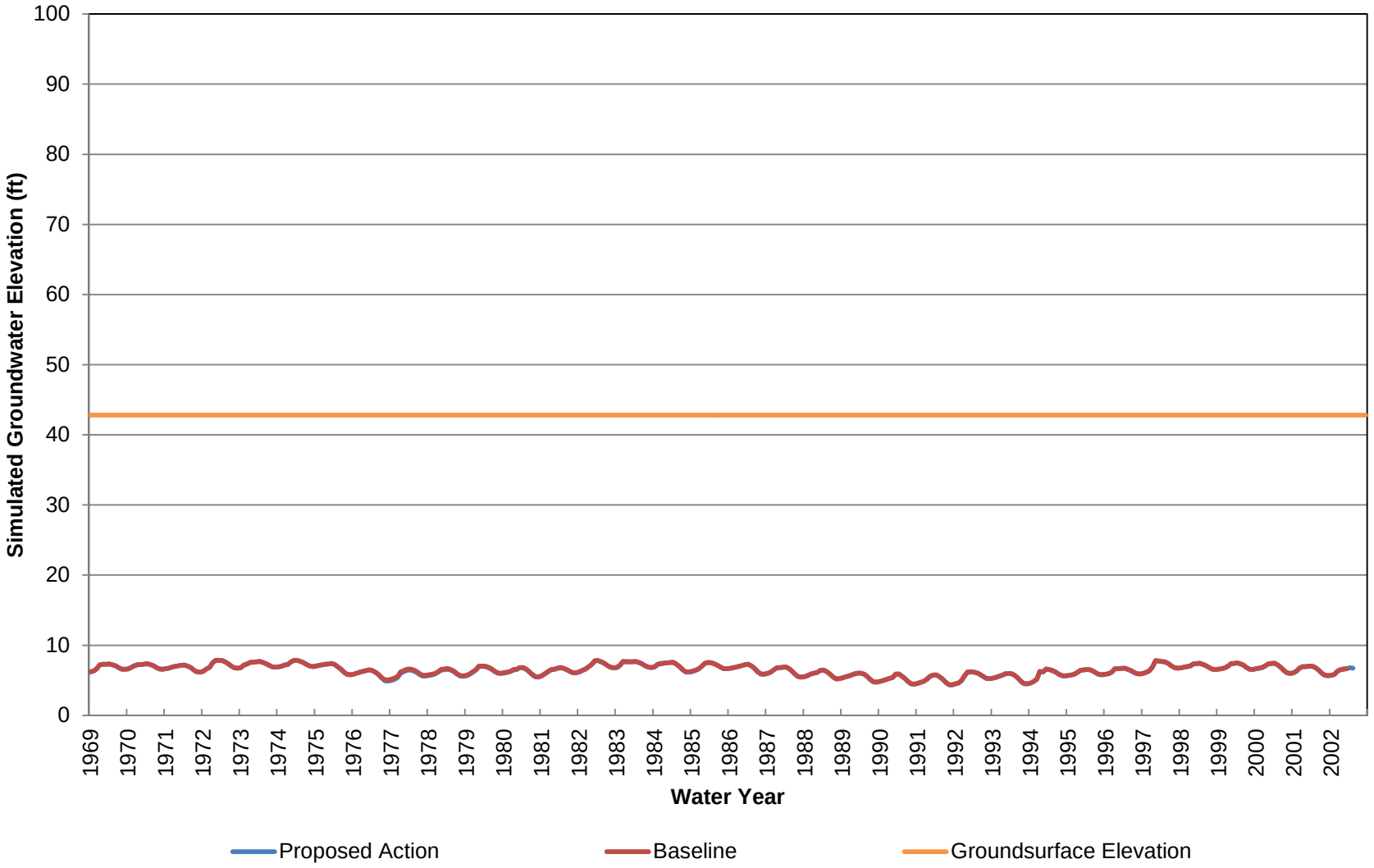
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 12



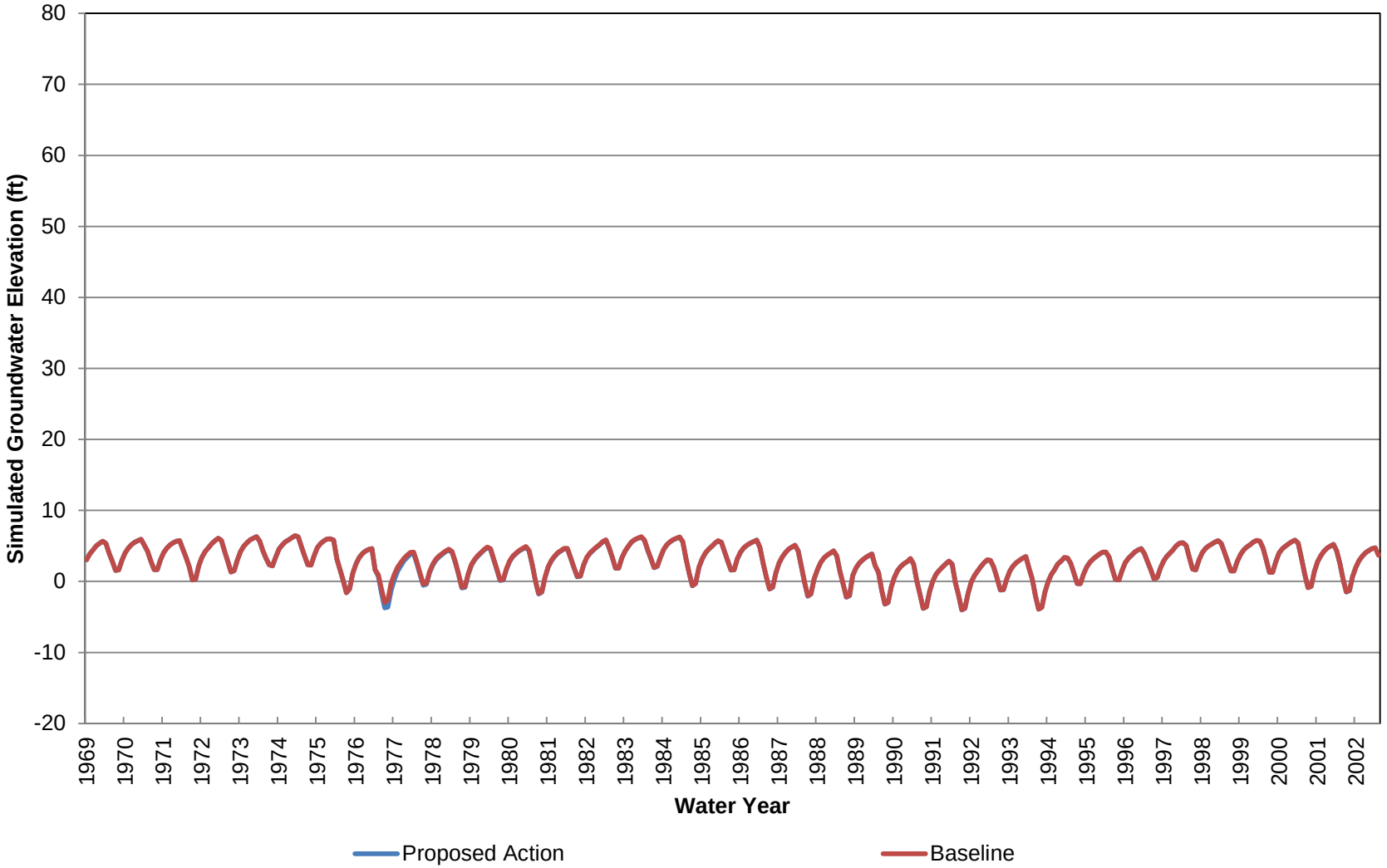
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 12



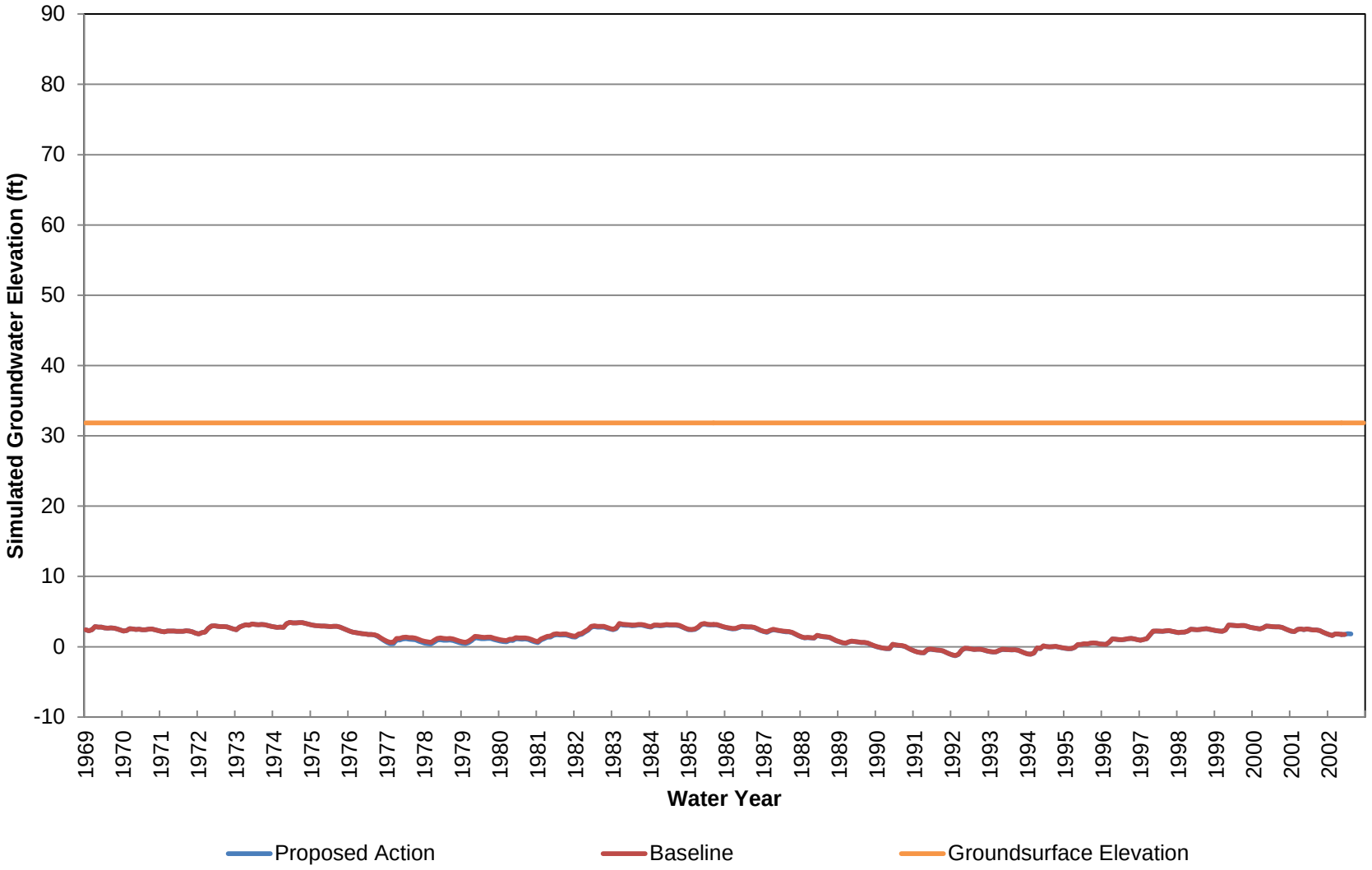
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 13



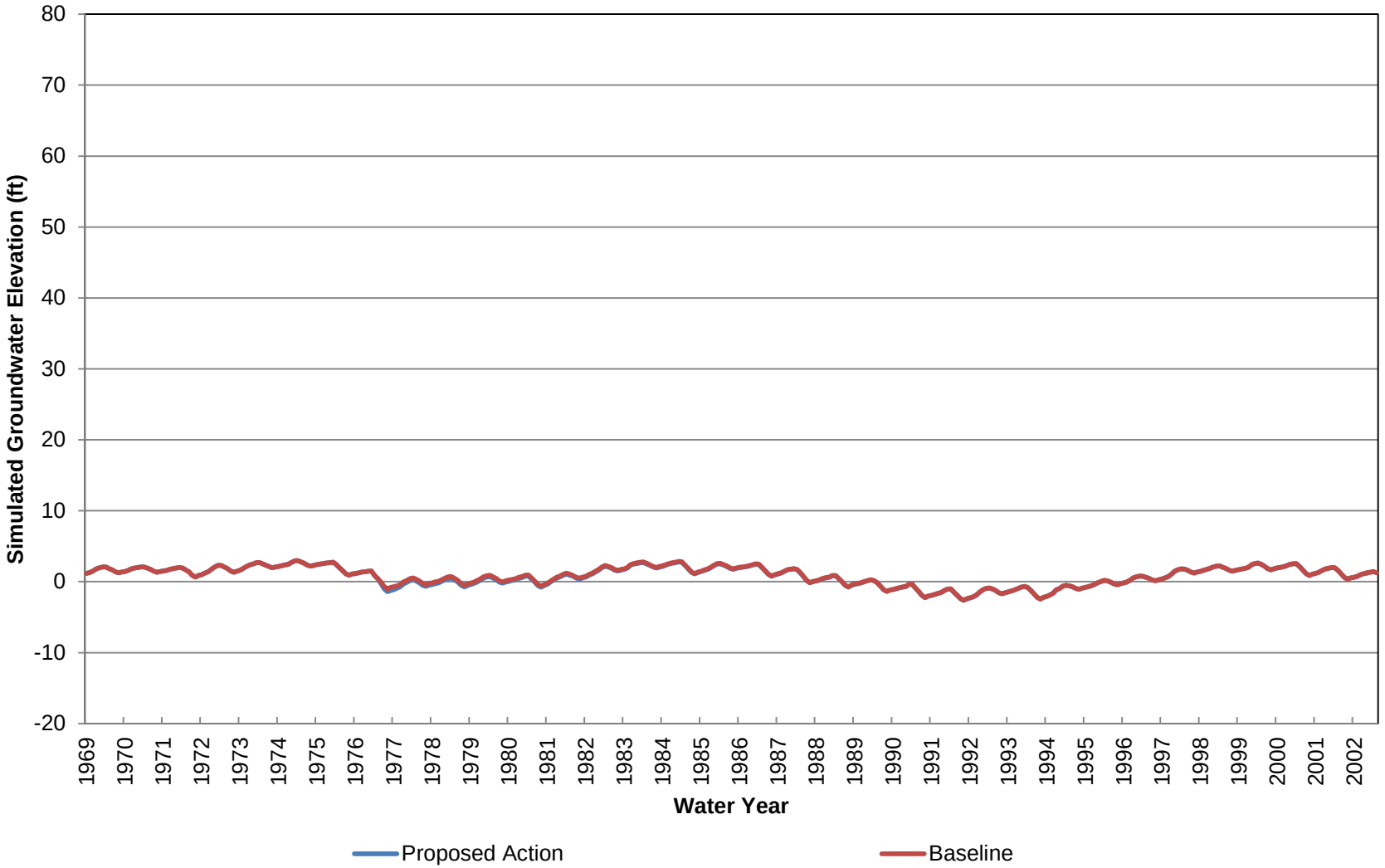
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 13**



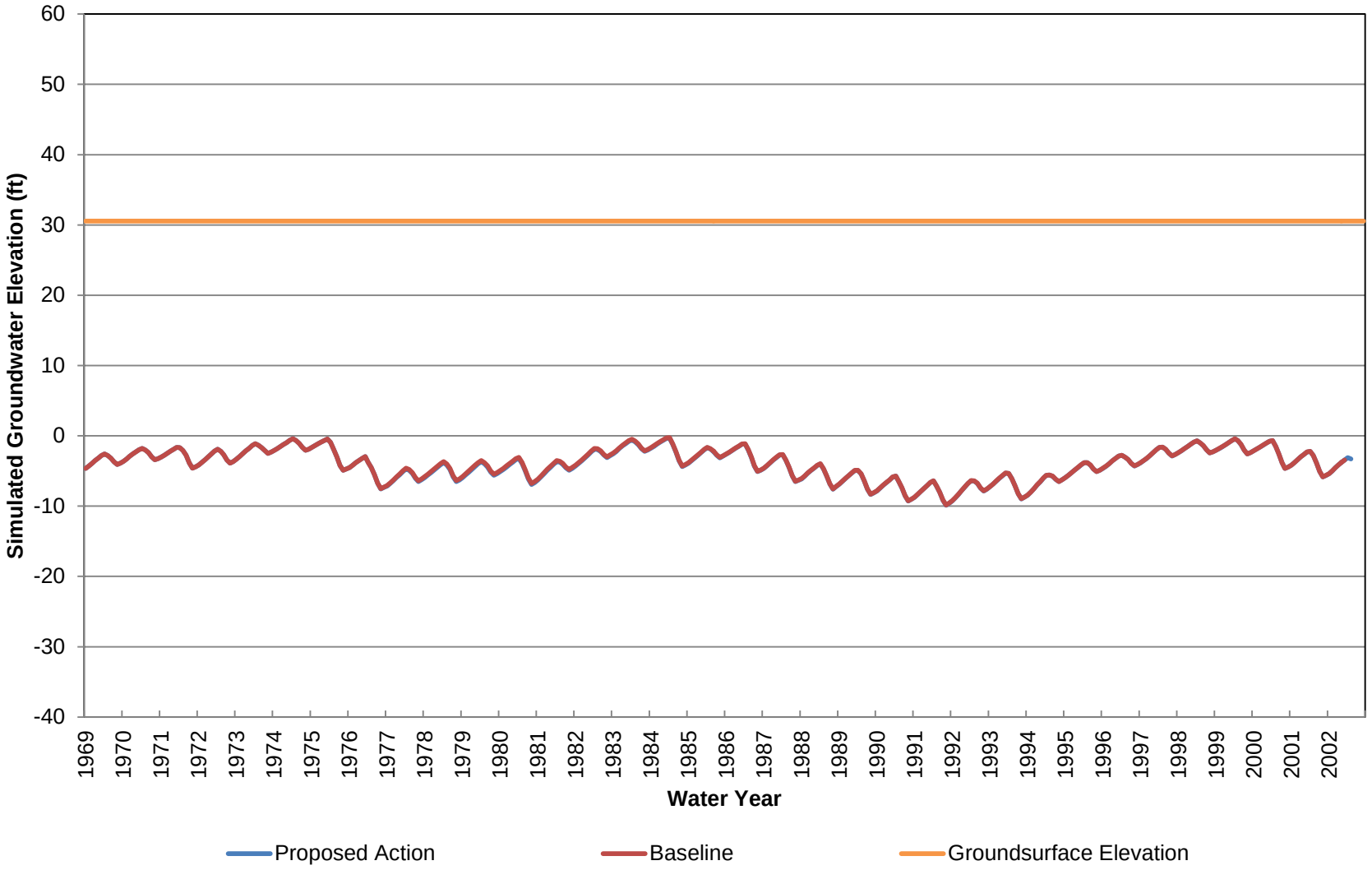
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 14



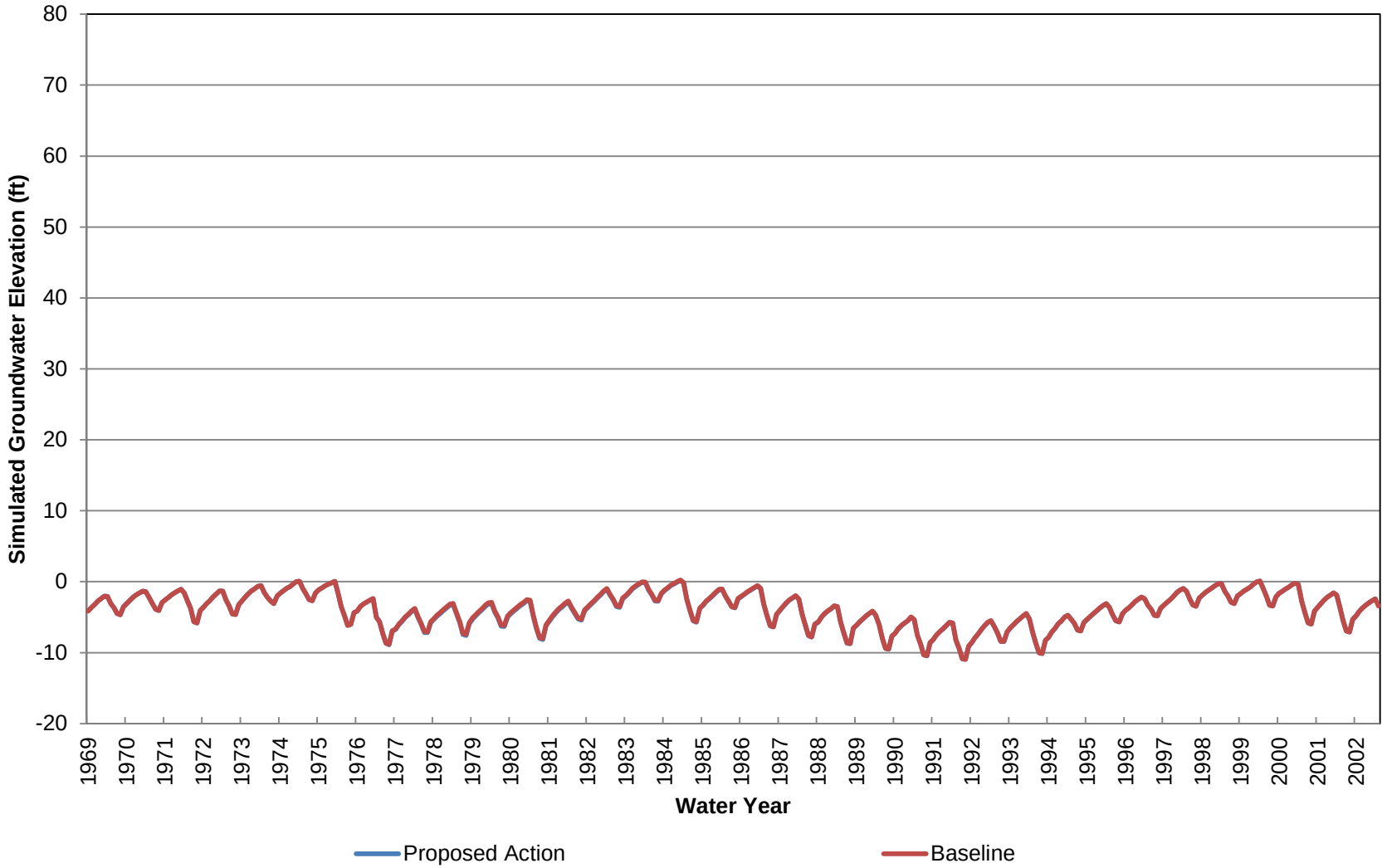
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 14



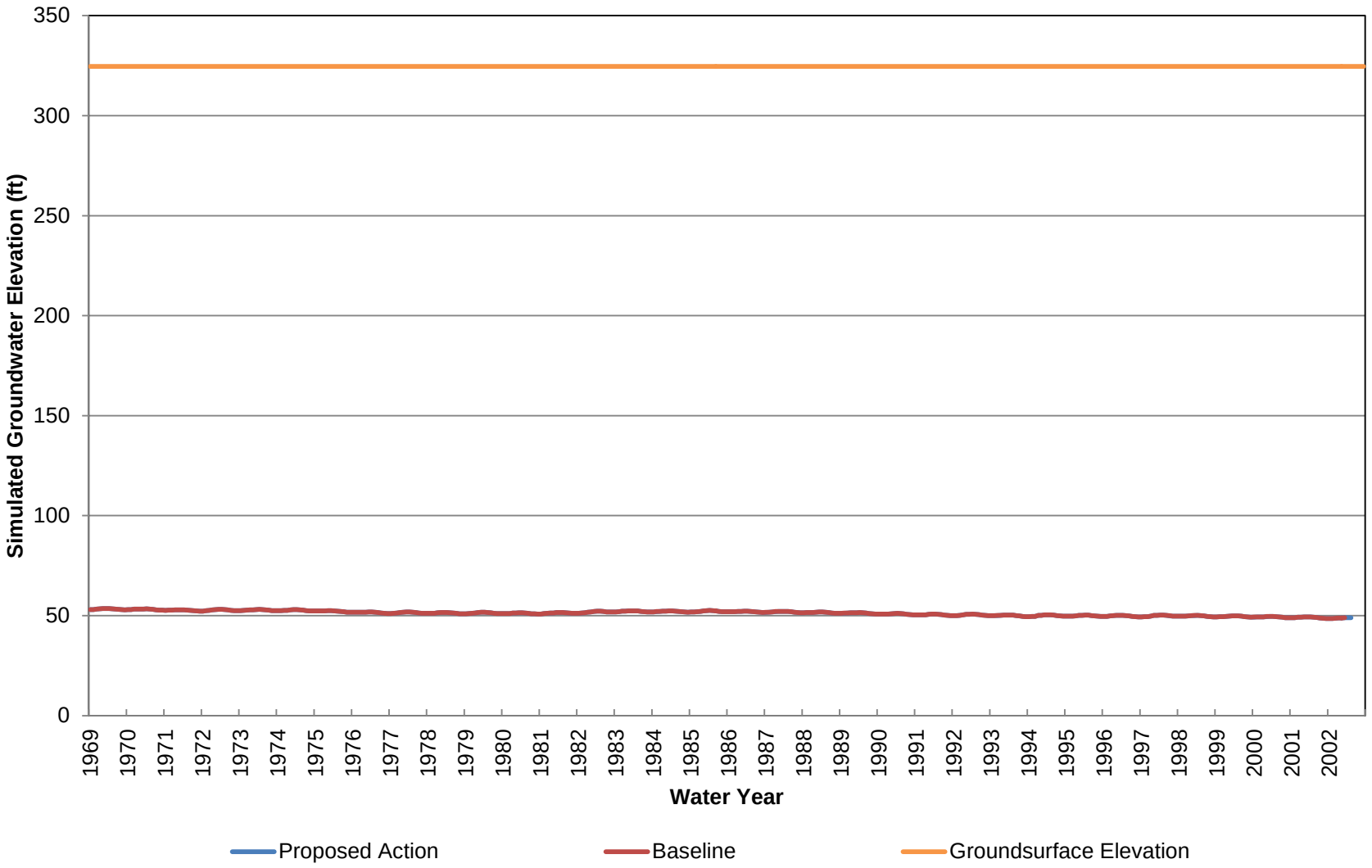
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 15



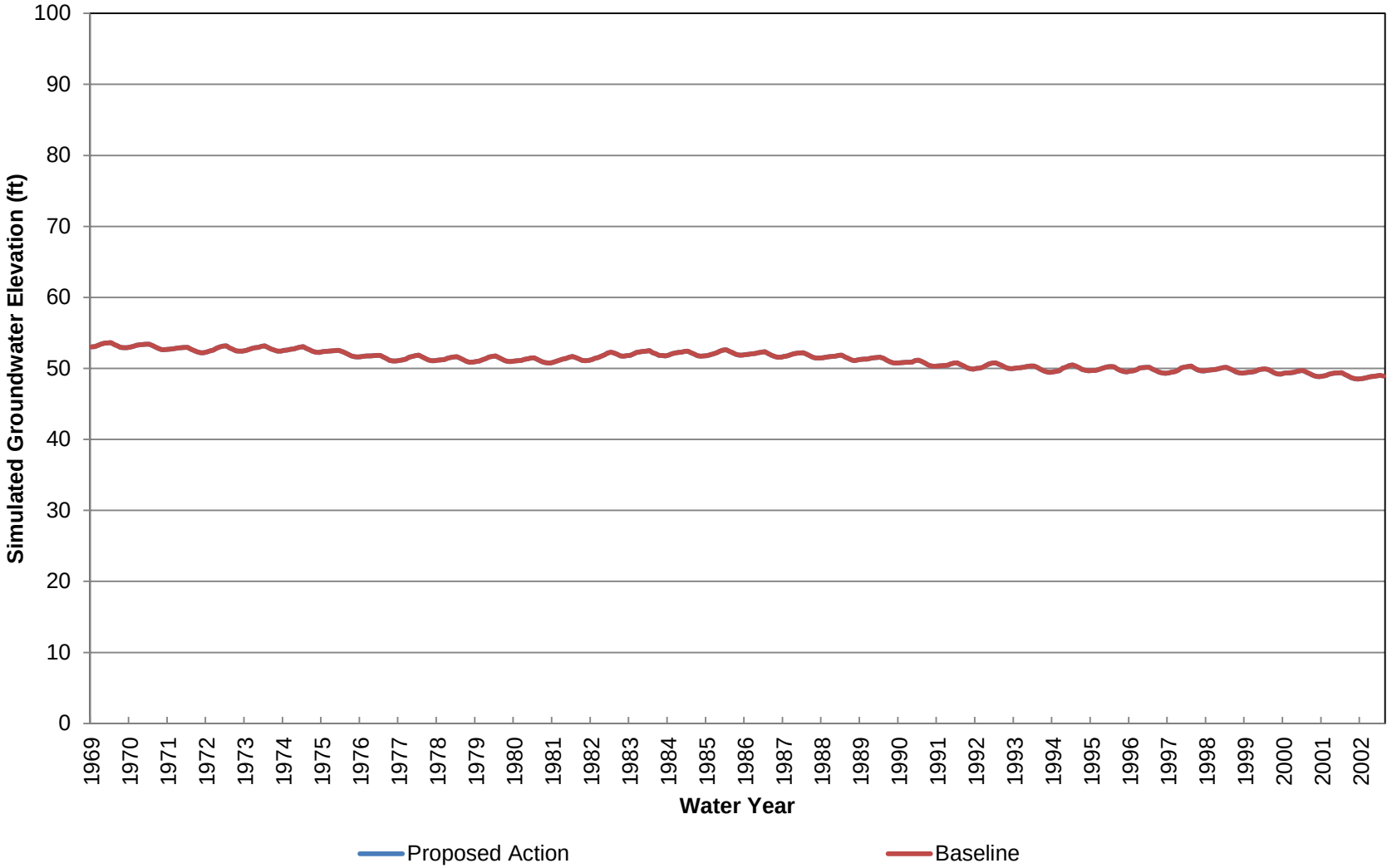
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 15



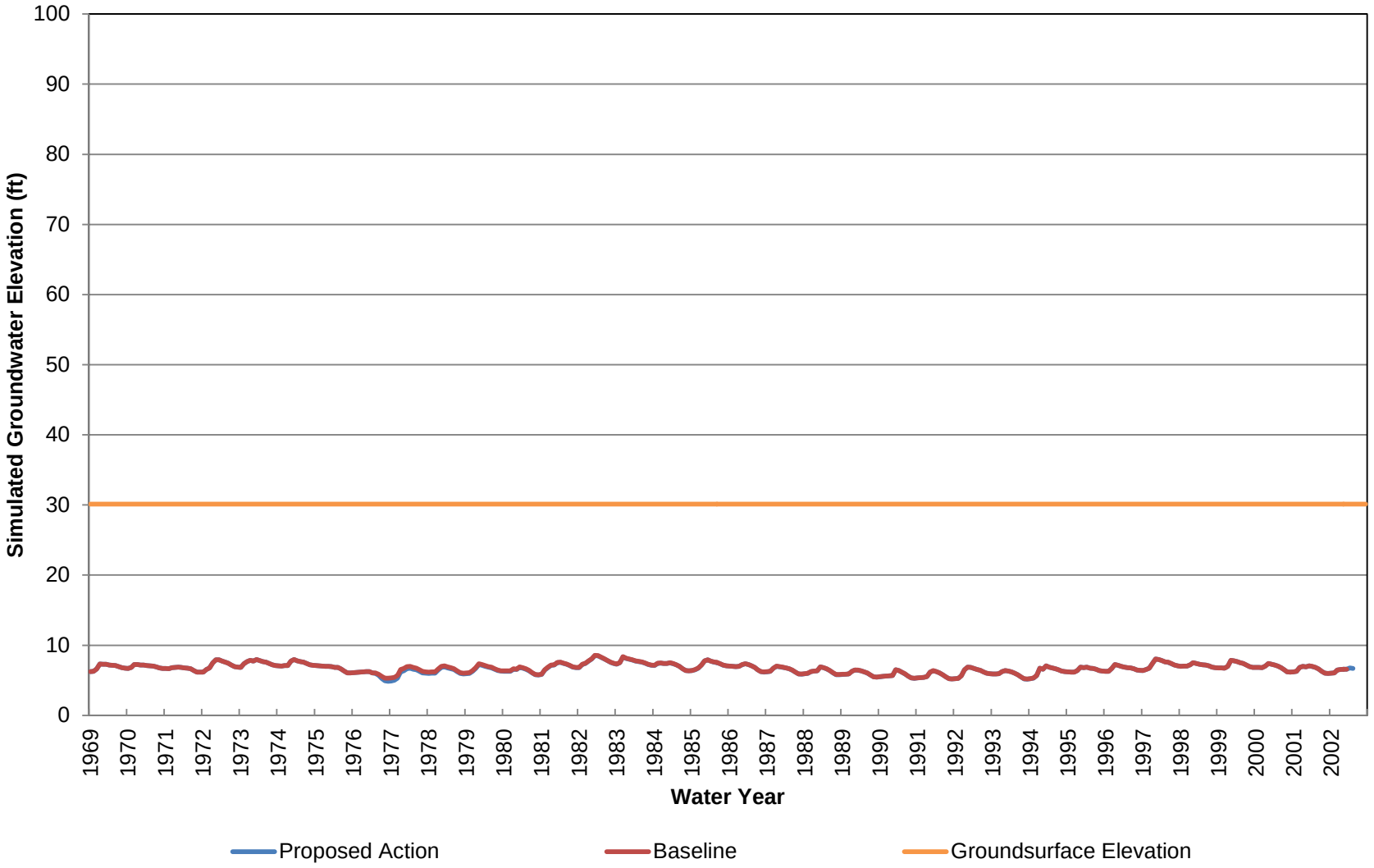
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Table Elevations at Location 16**



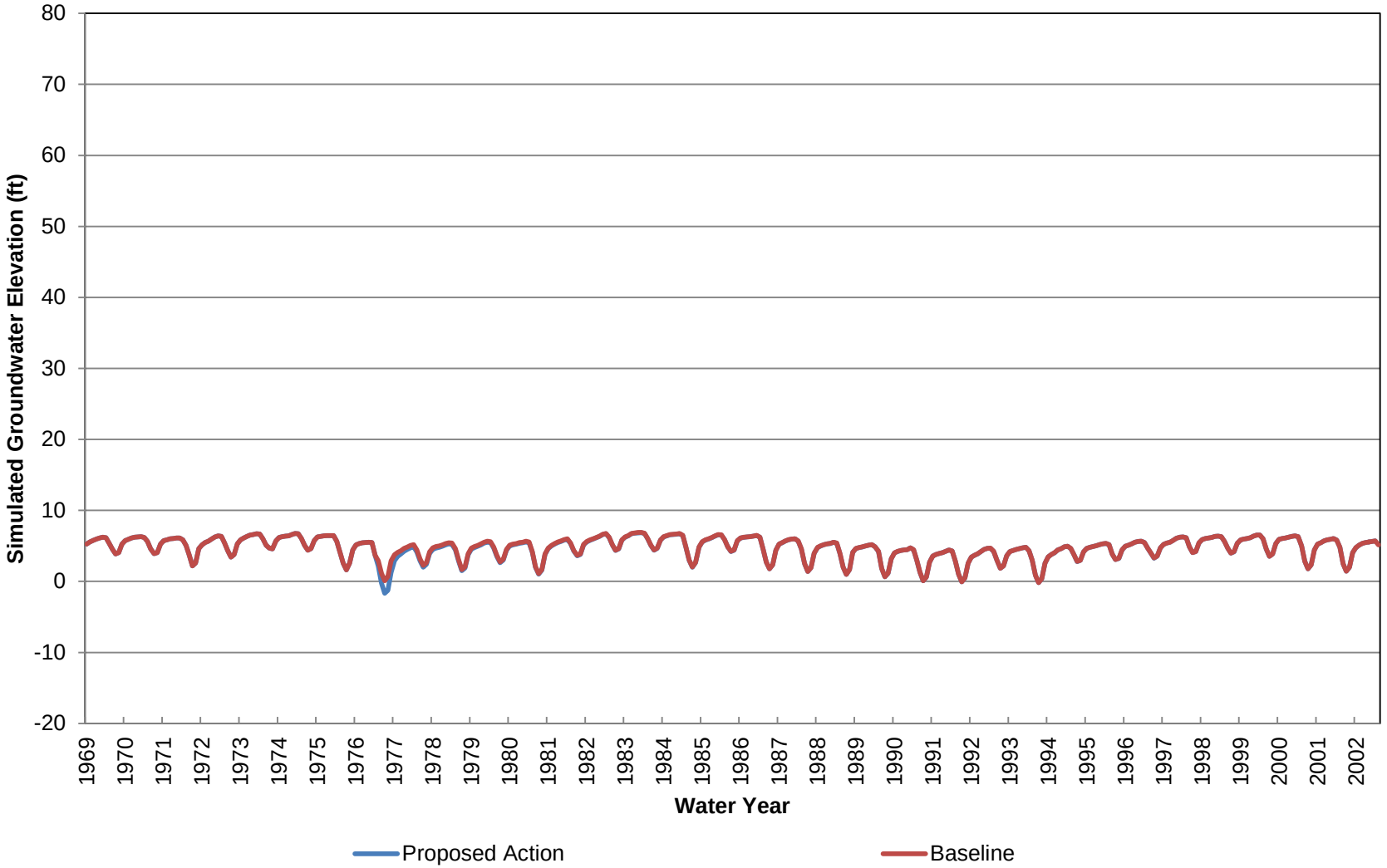
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 16**



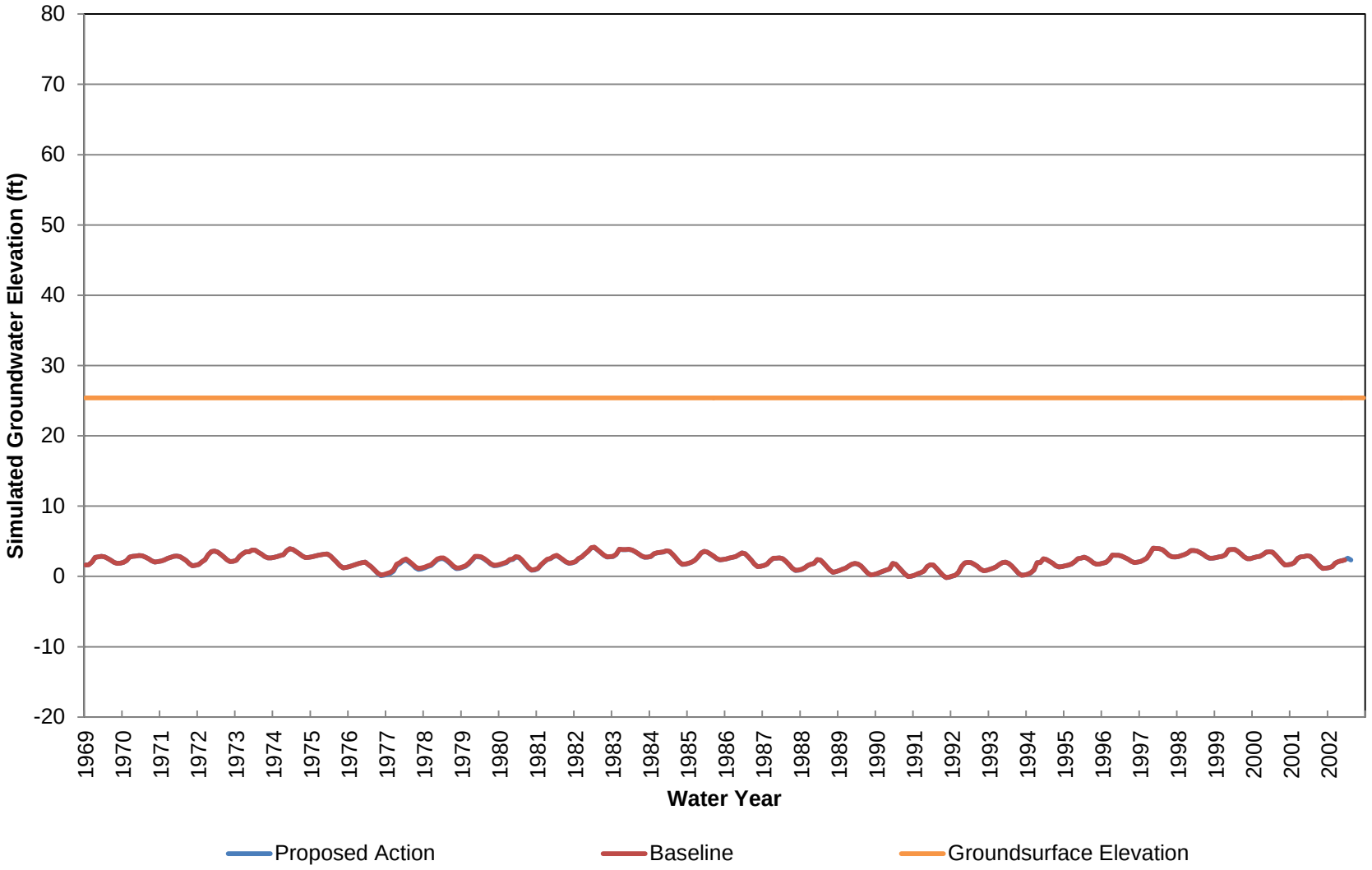
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 17



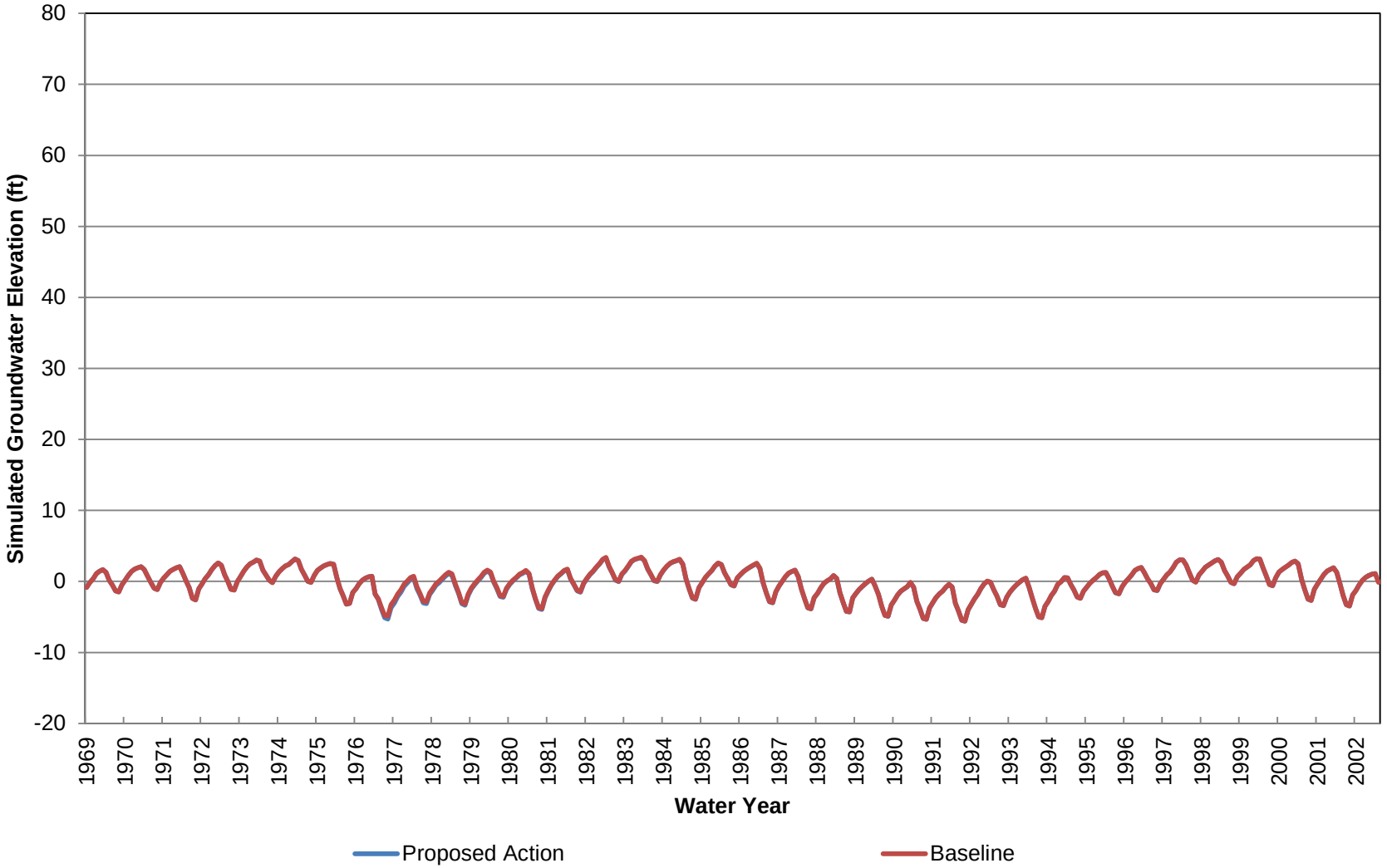
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 17**



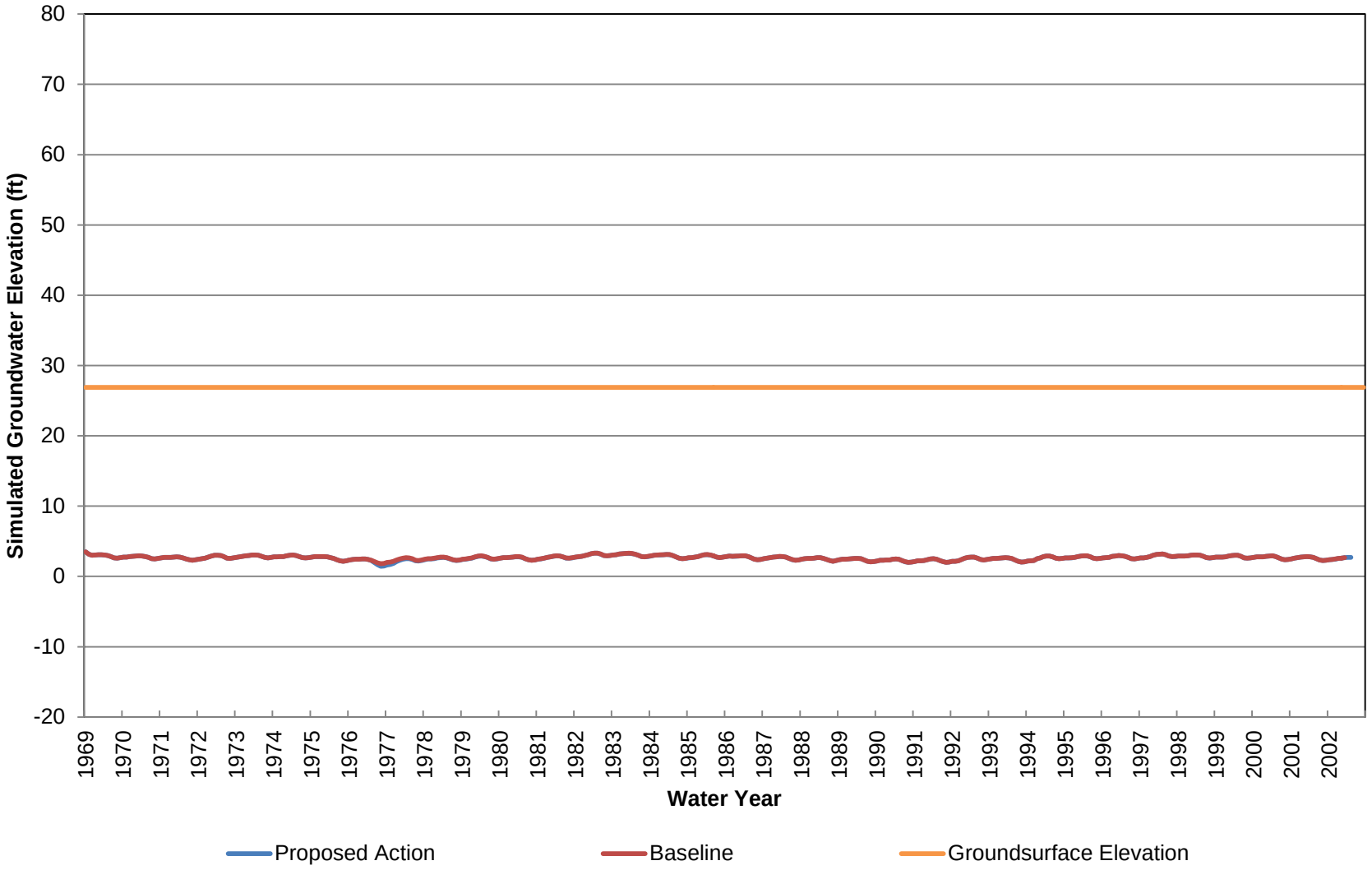
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 18



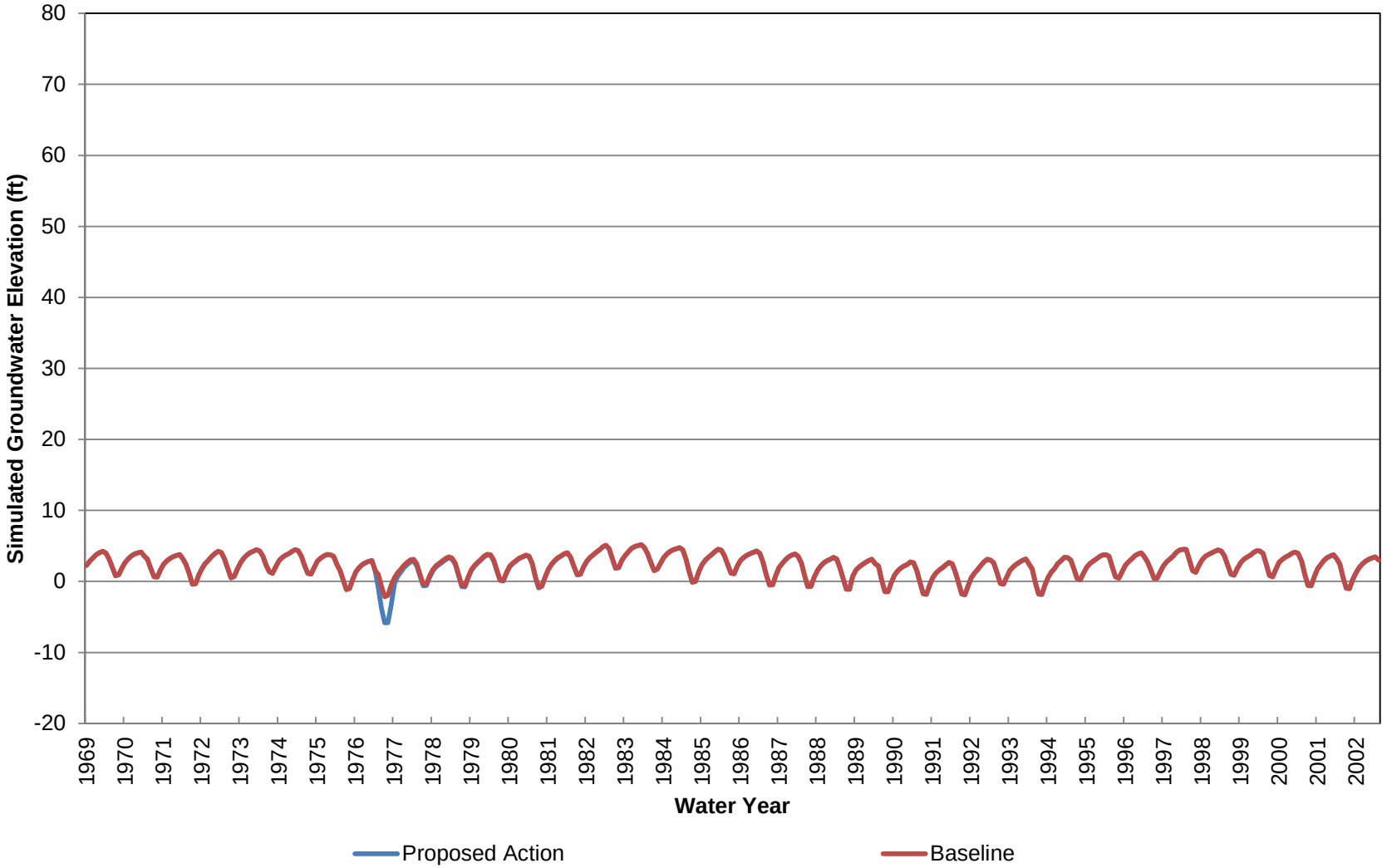
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 18**



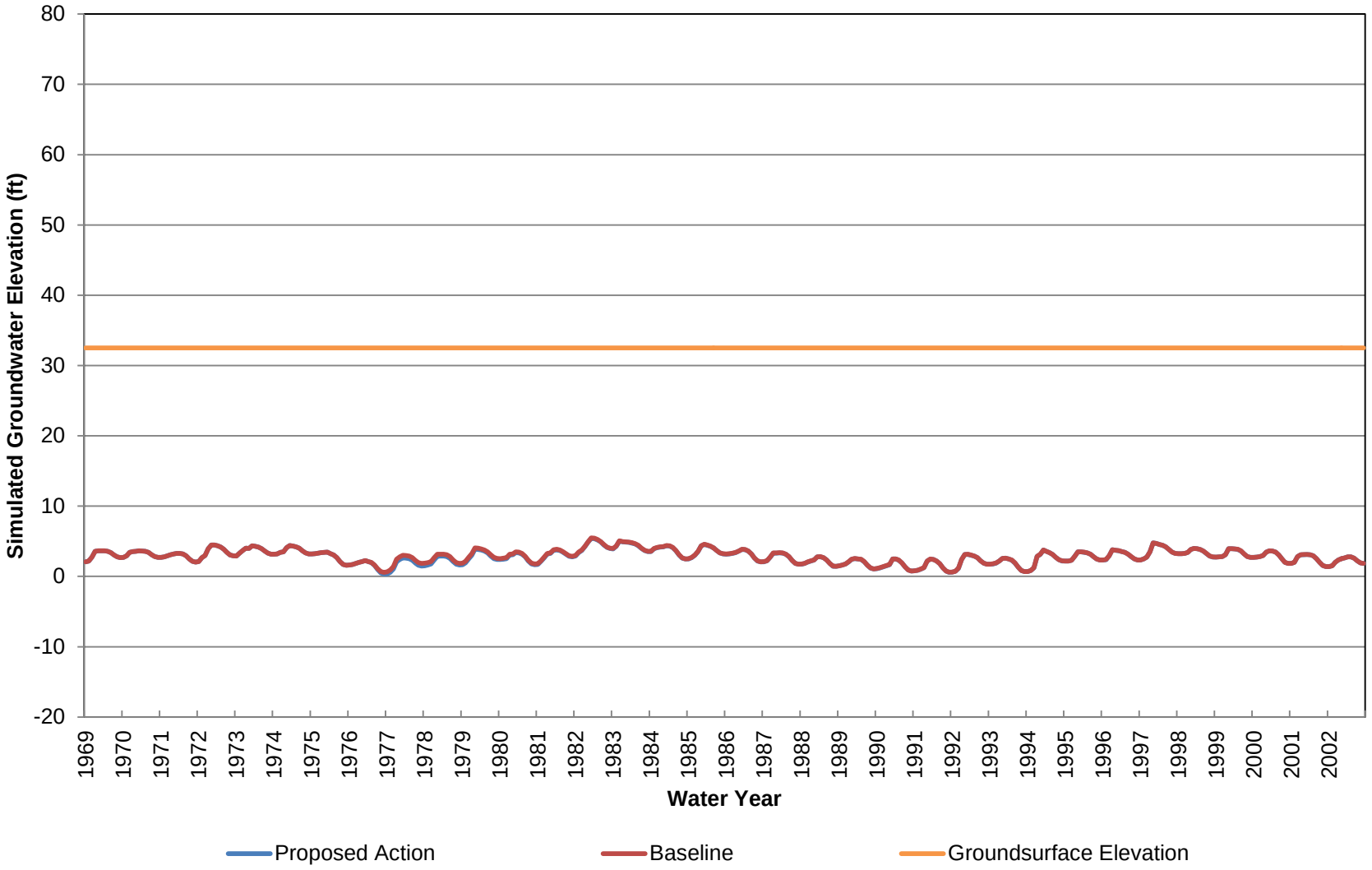
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 19



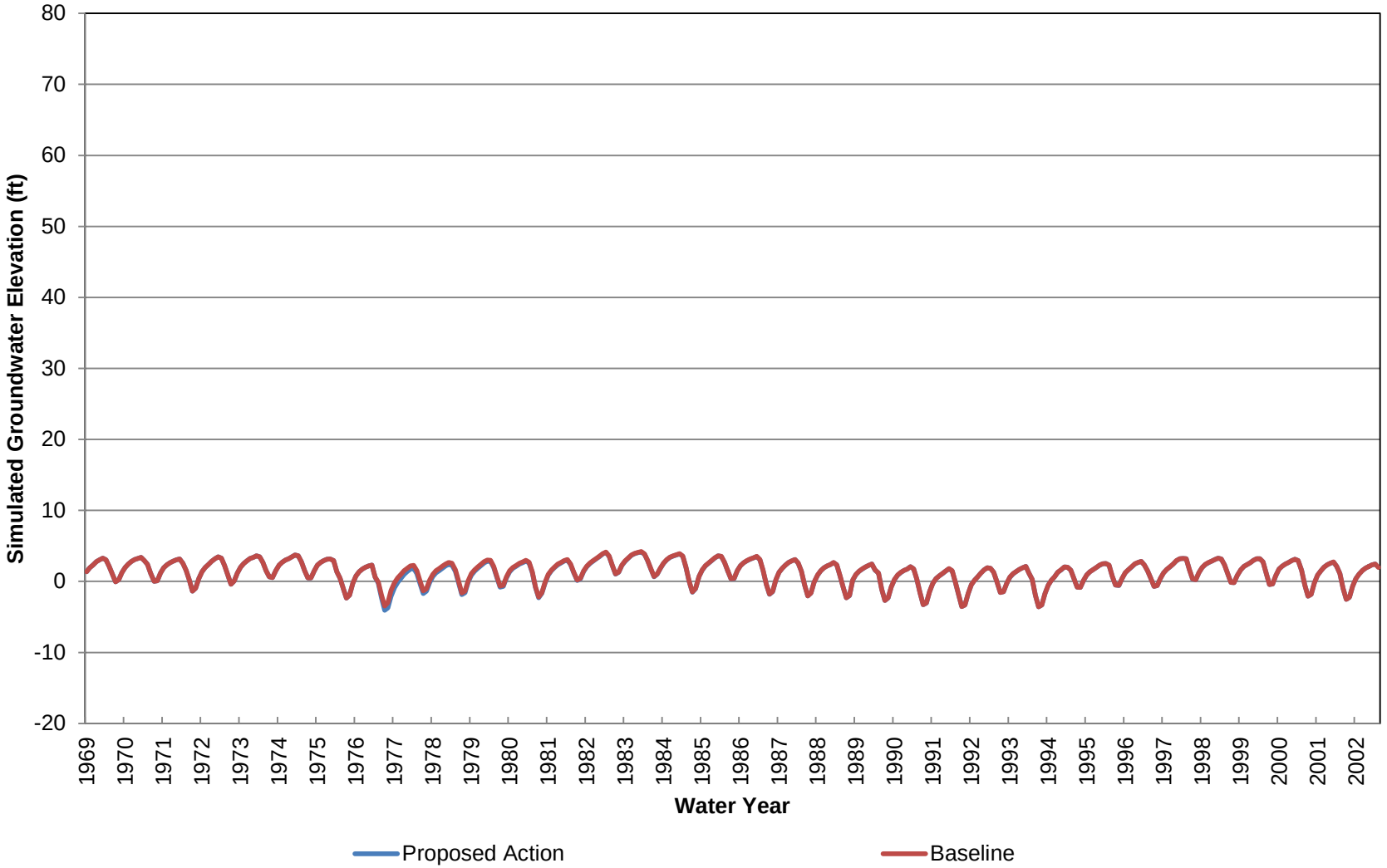
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 19**



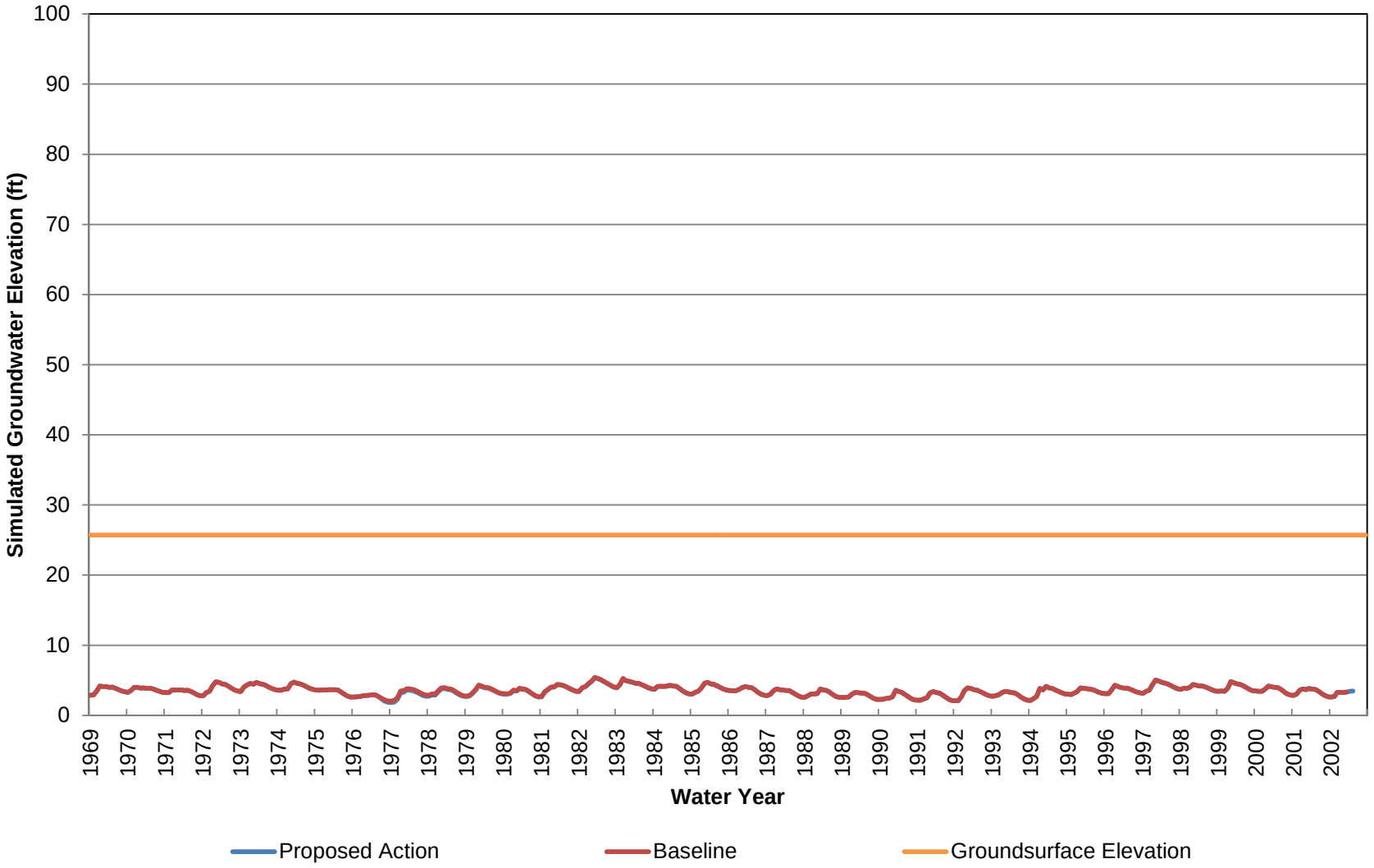
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Table Elevations at Location 20**

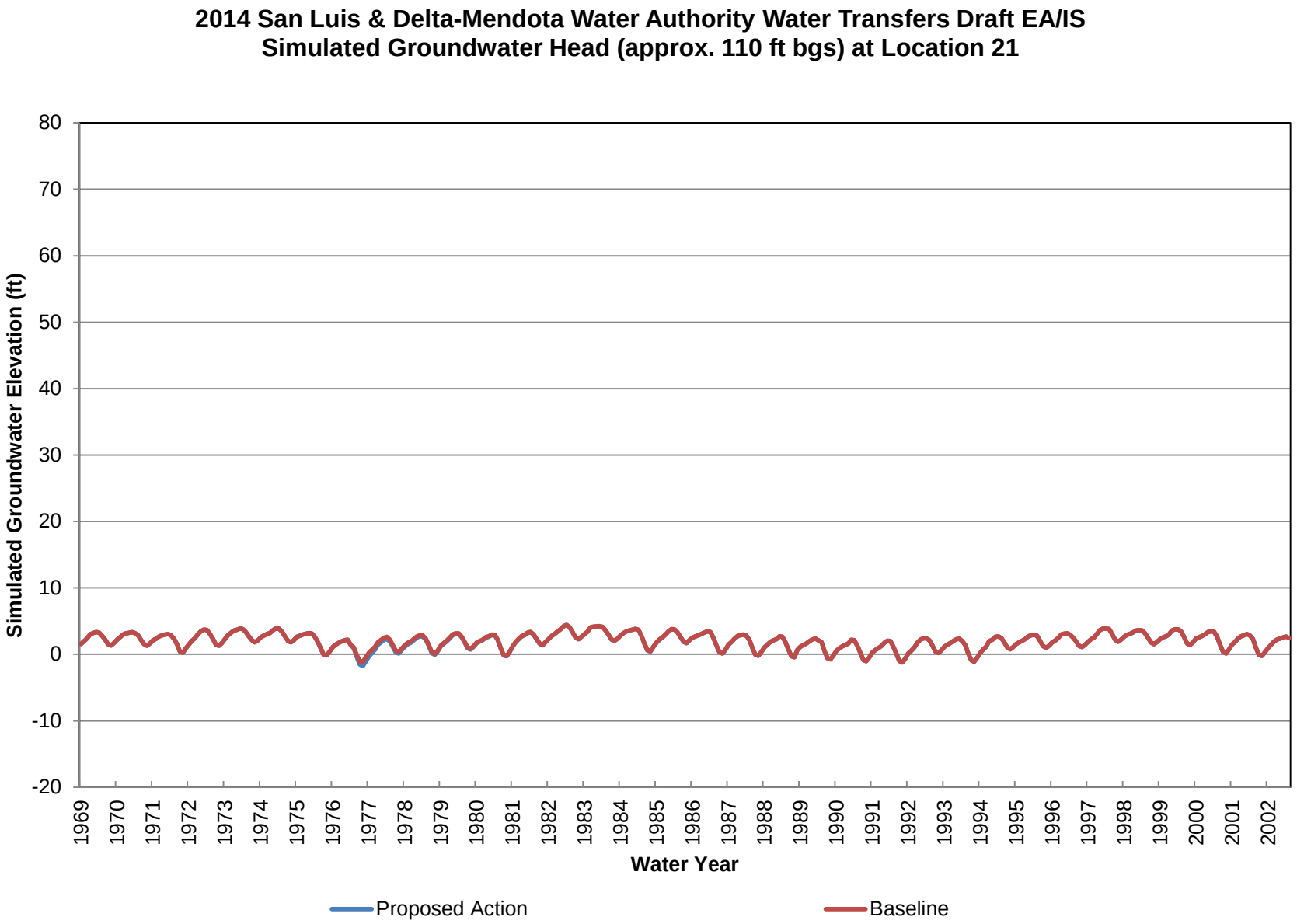


**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 20**

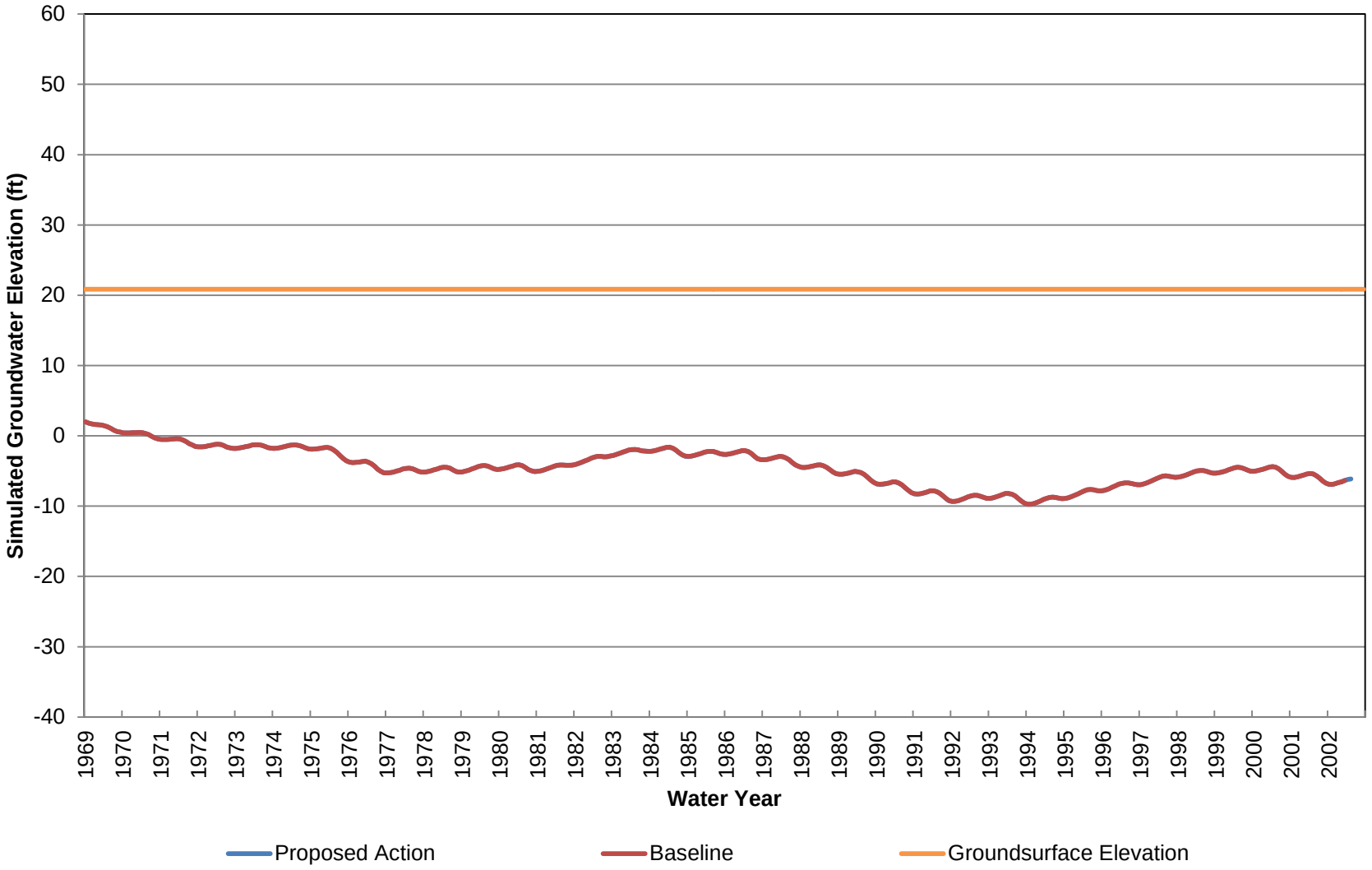


## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 21

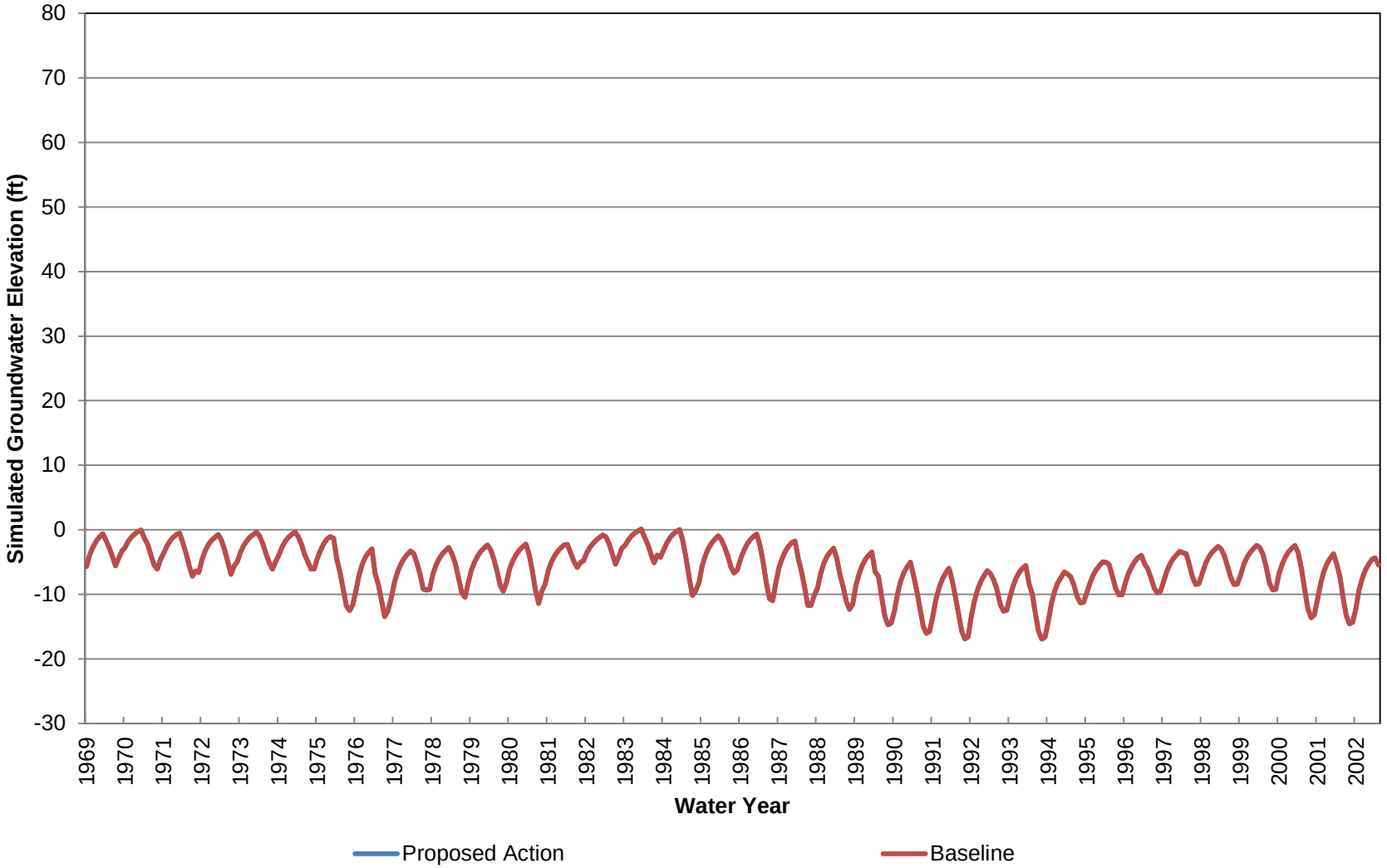



2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 21
Simulated Groundwater Elevation (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Water Year
Proposed Action
Baseline

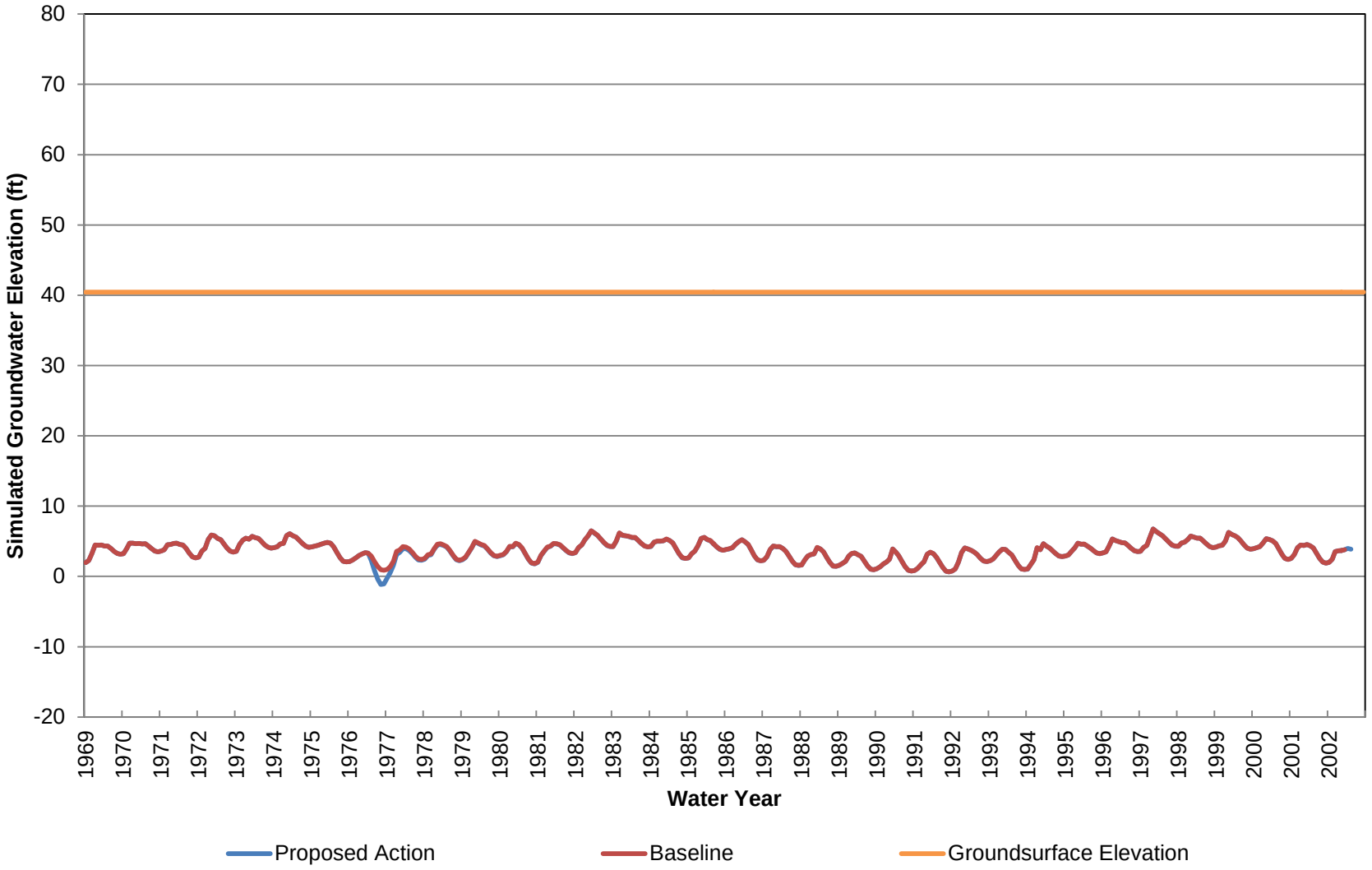
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 22



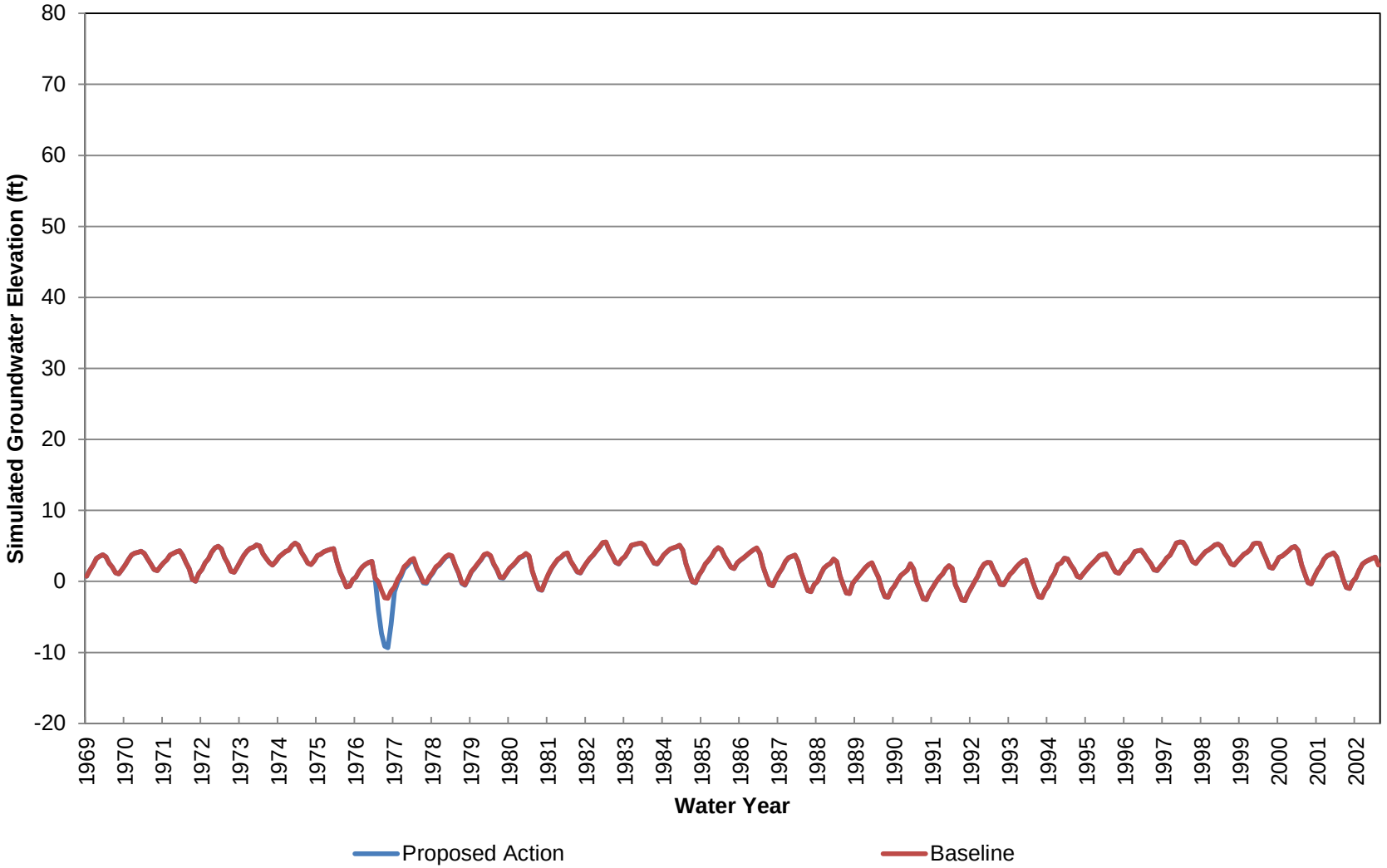
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 22



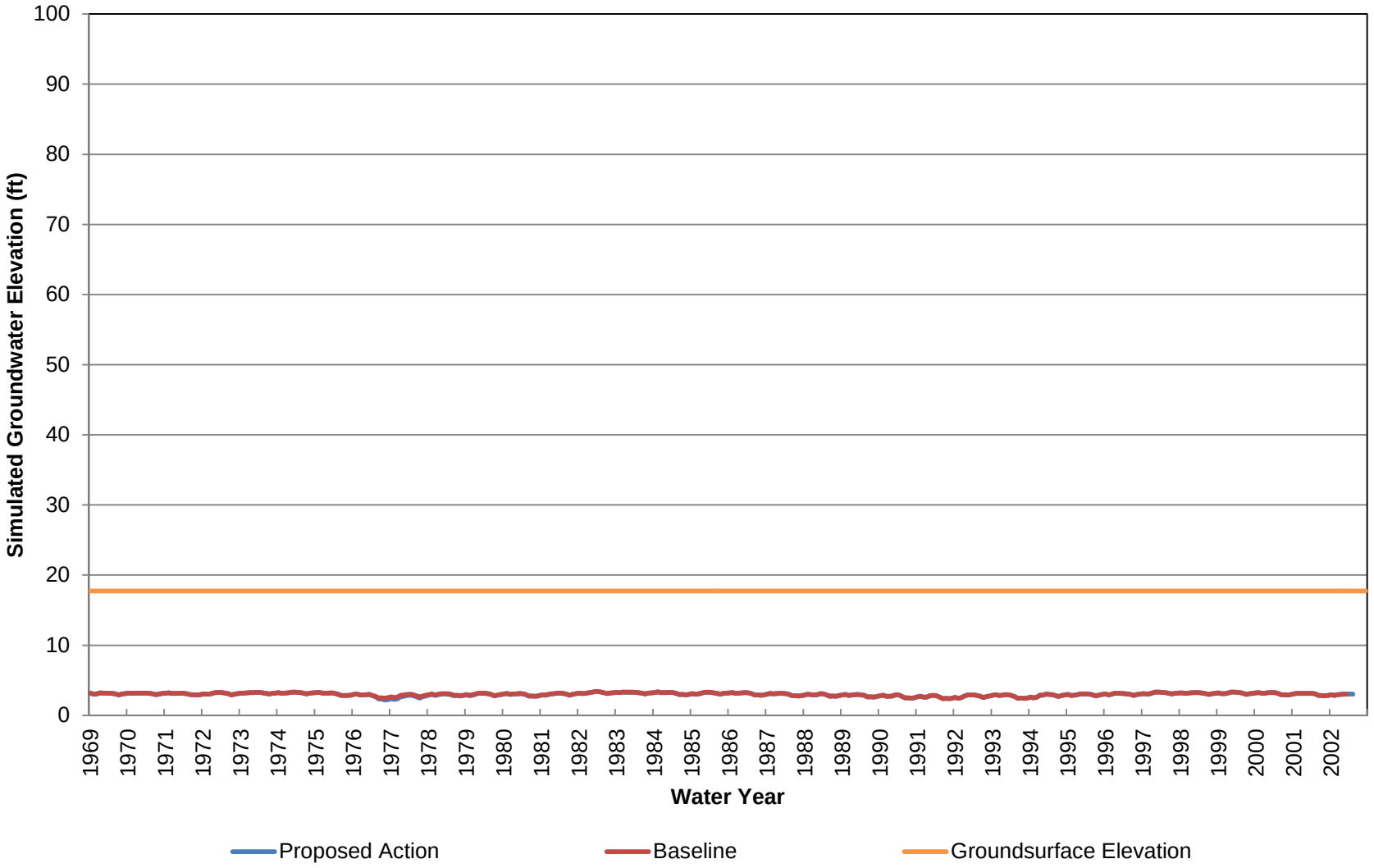
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Table Elevations at Location 23**

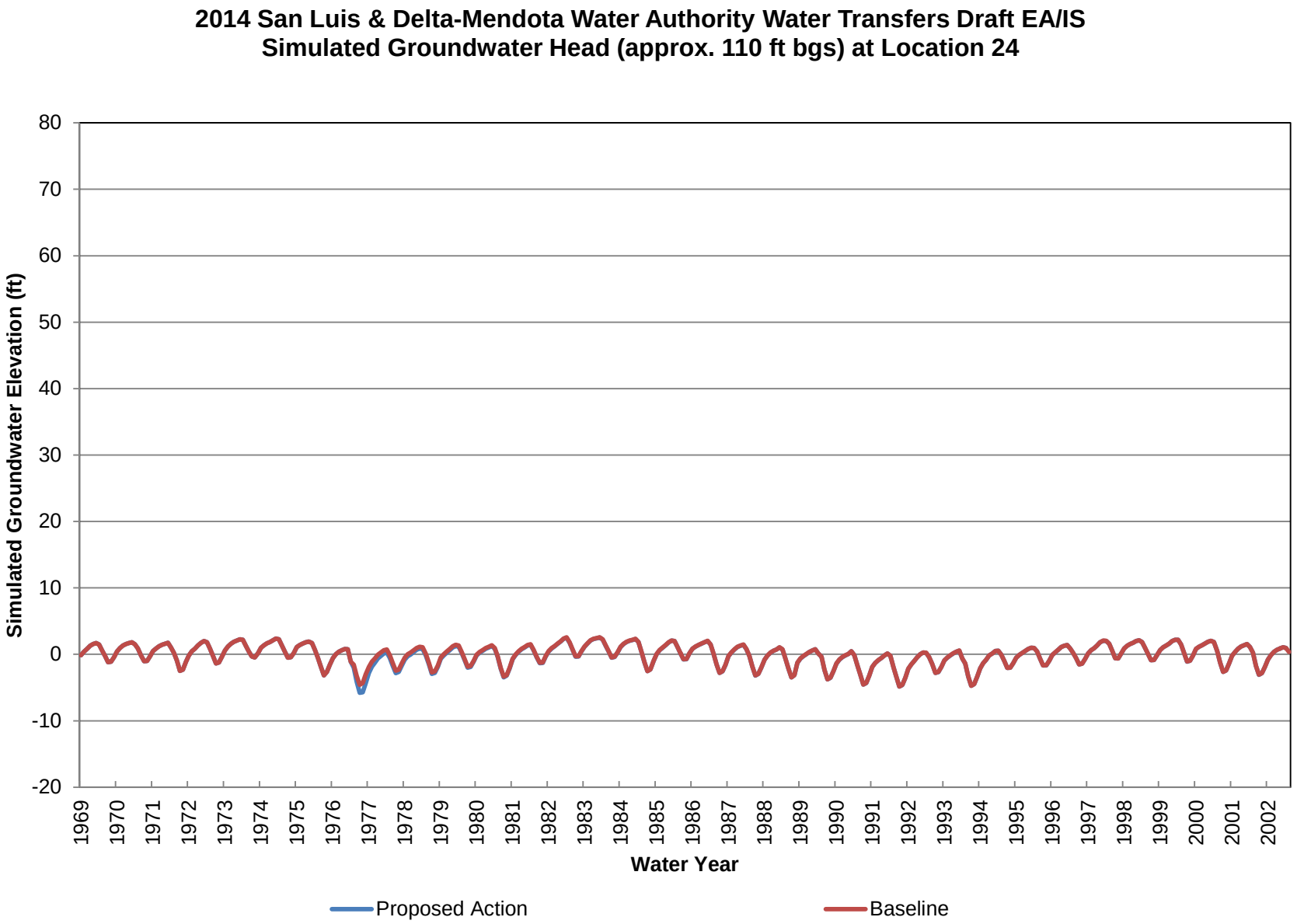


**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 23**

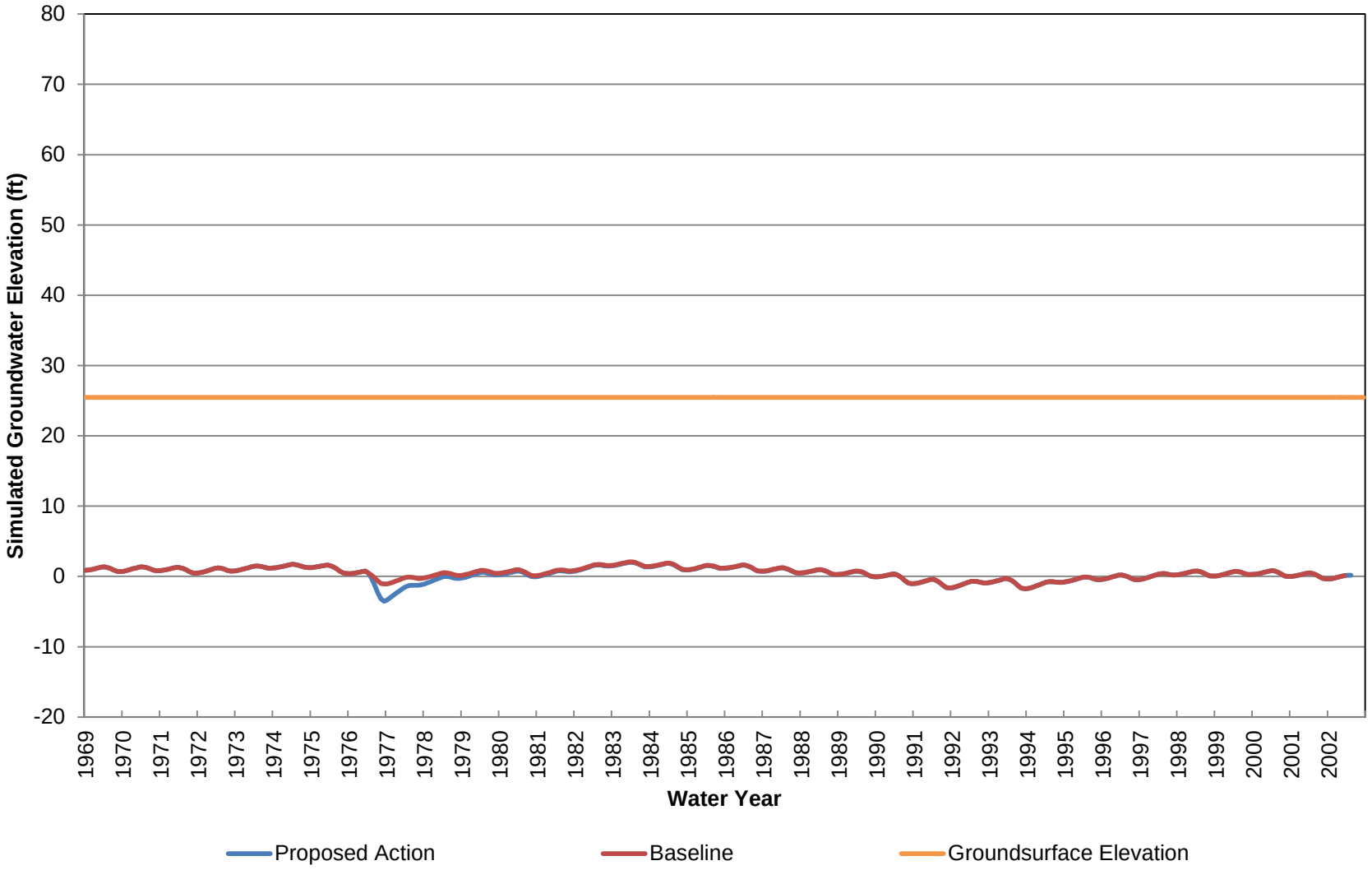


## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 24

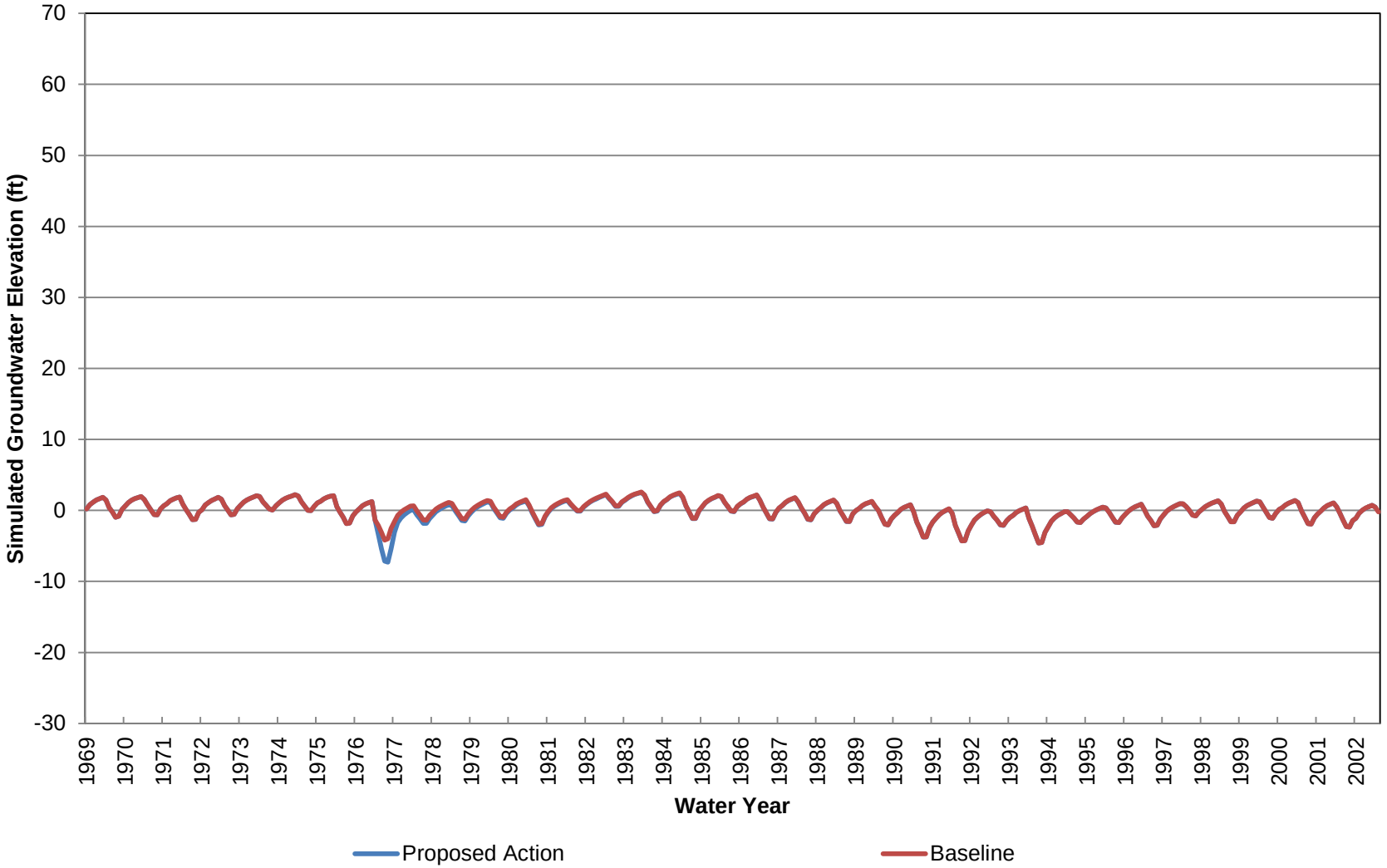



2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 24
Simulated Groundwater Elevation (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Water Year
Proposed Action
Baseline

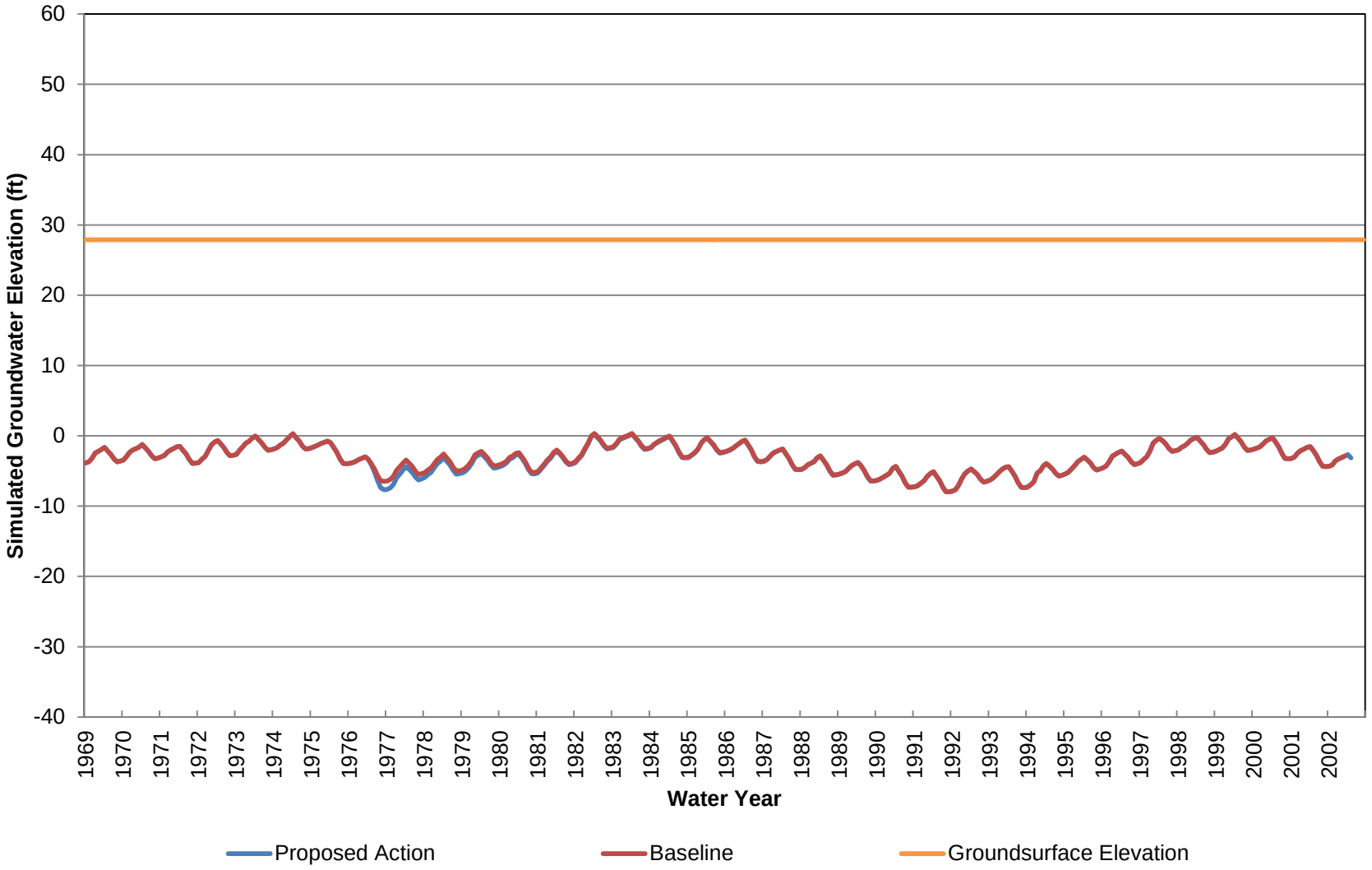
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 25



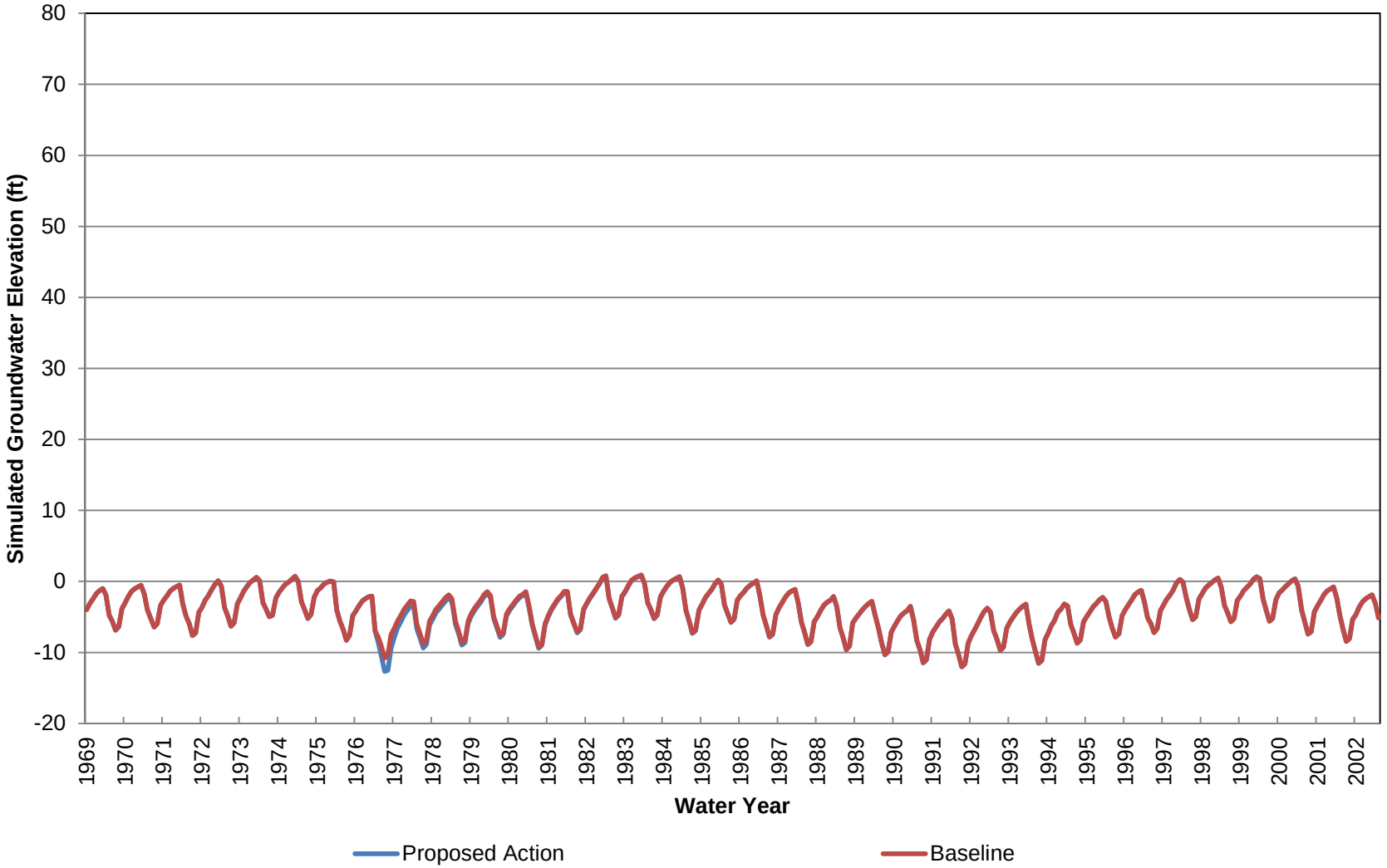
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 25



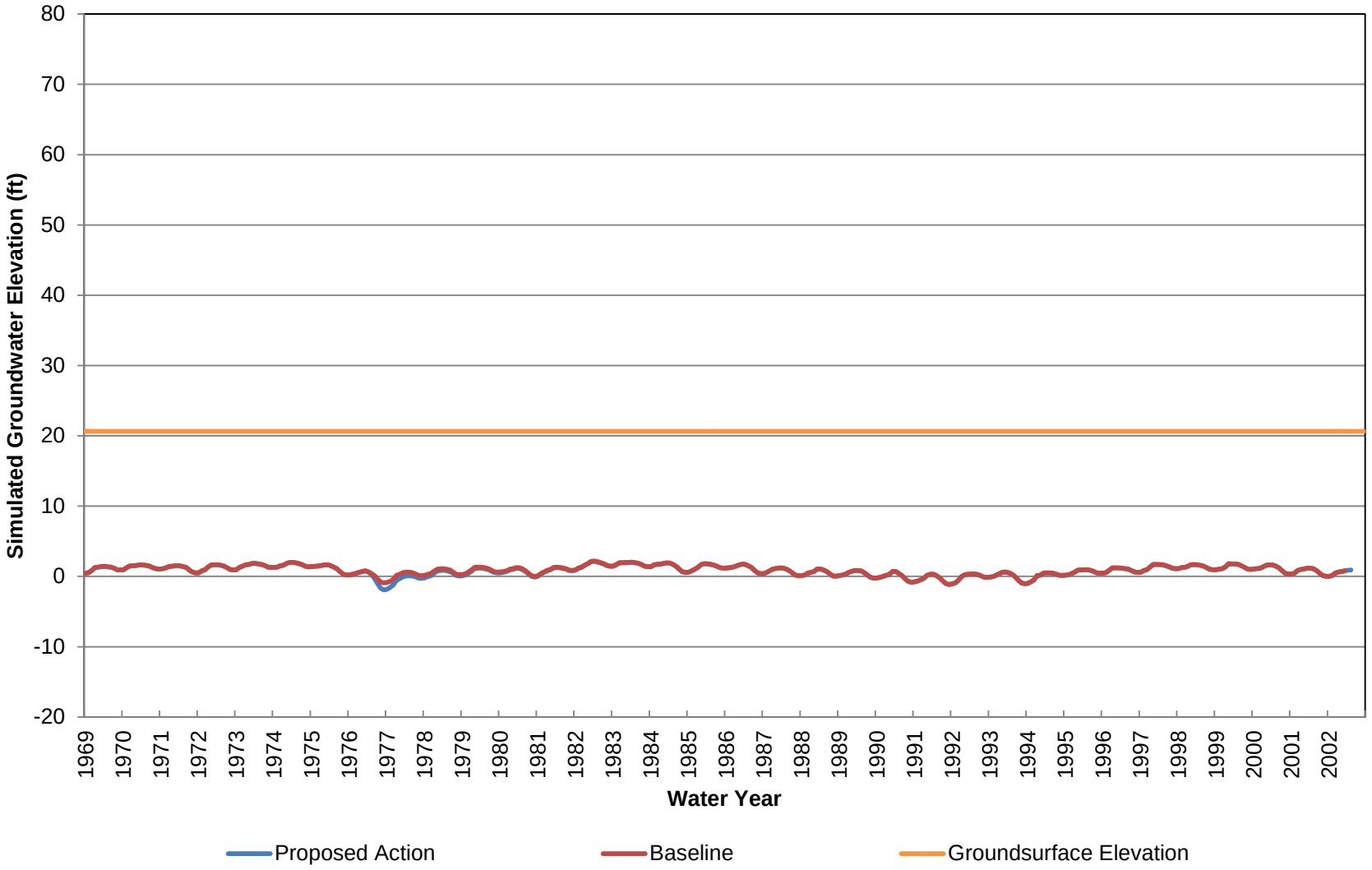
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 26



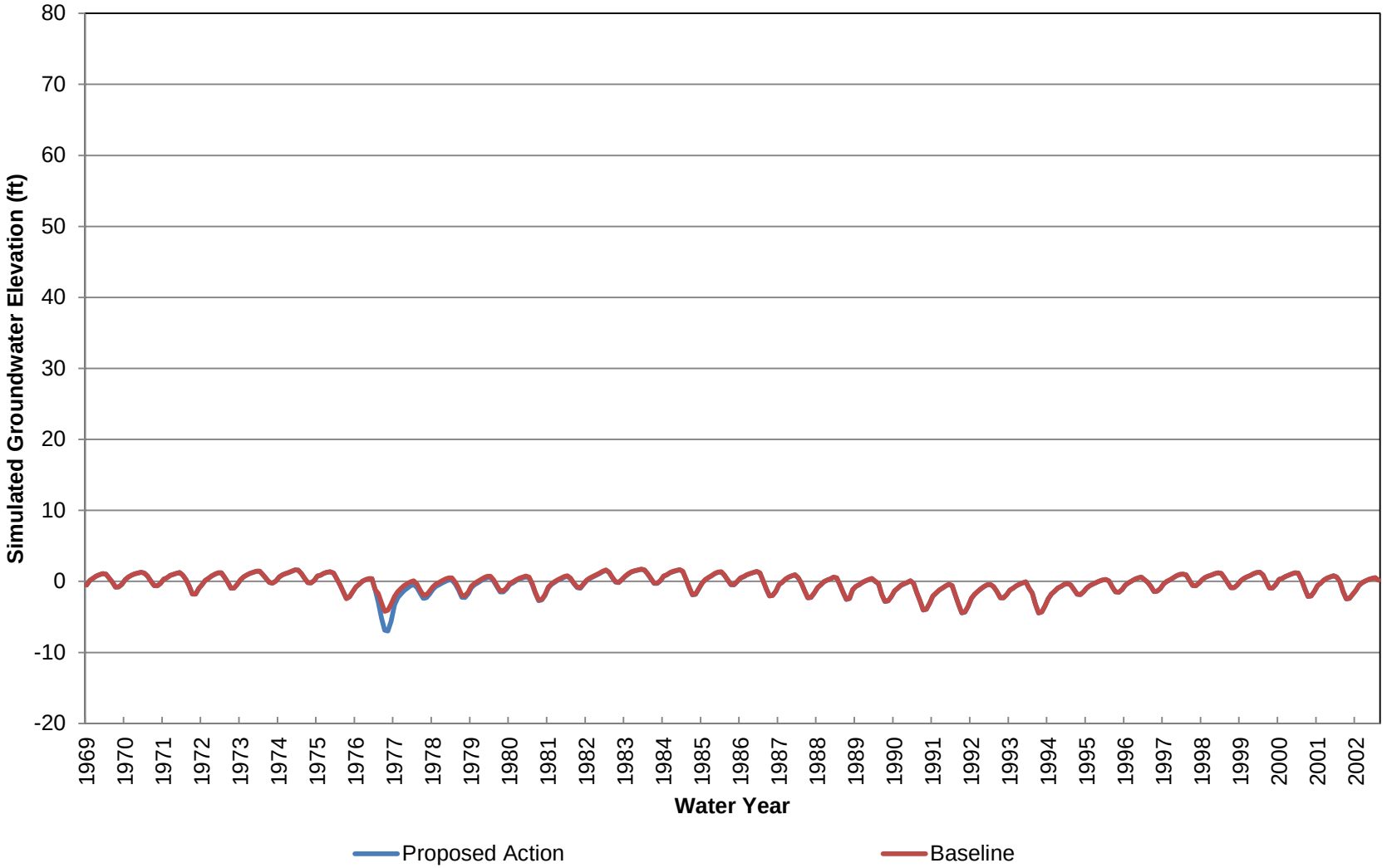
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 26



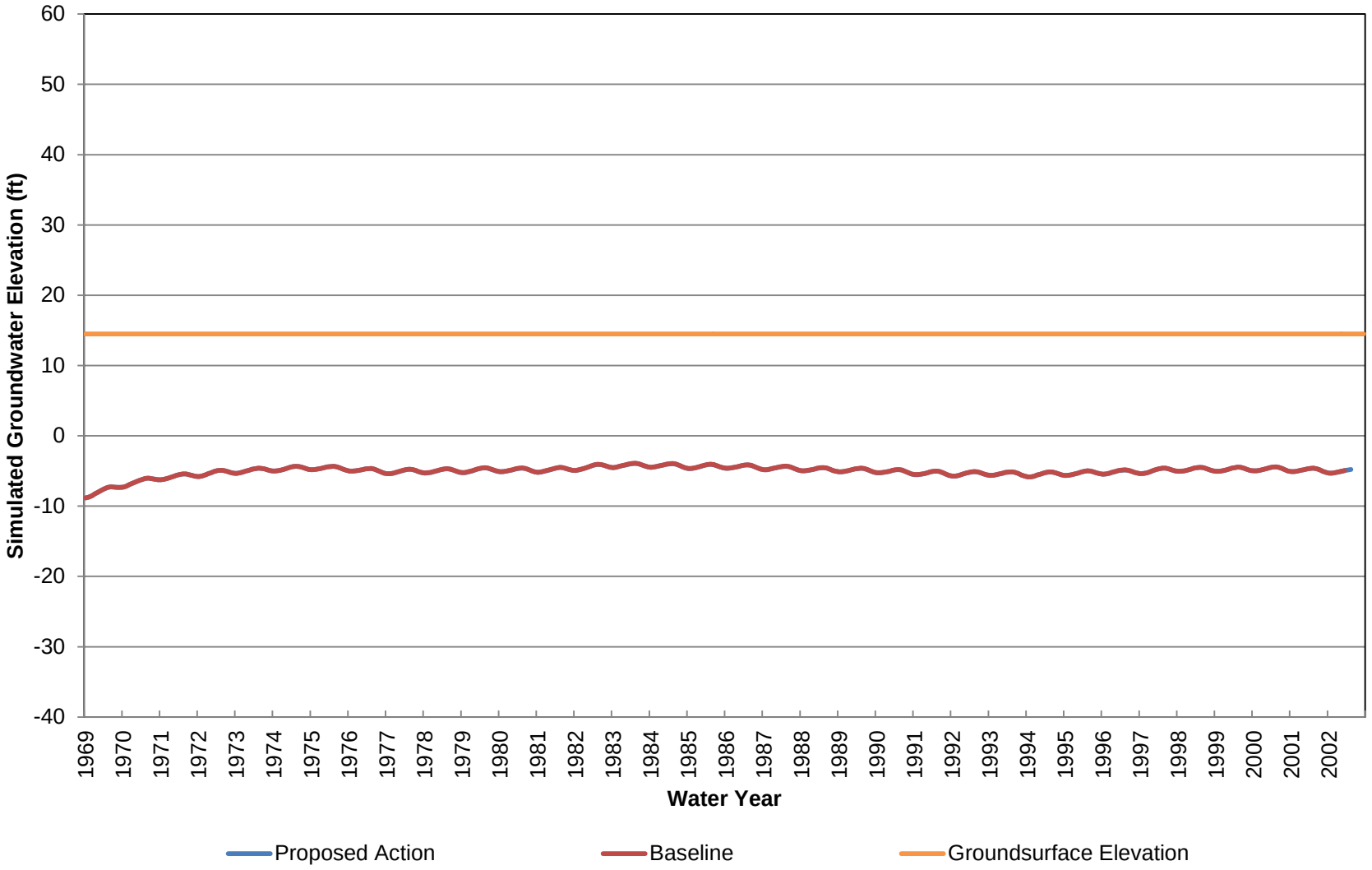
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 27



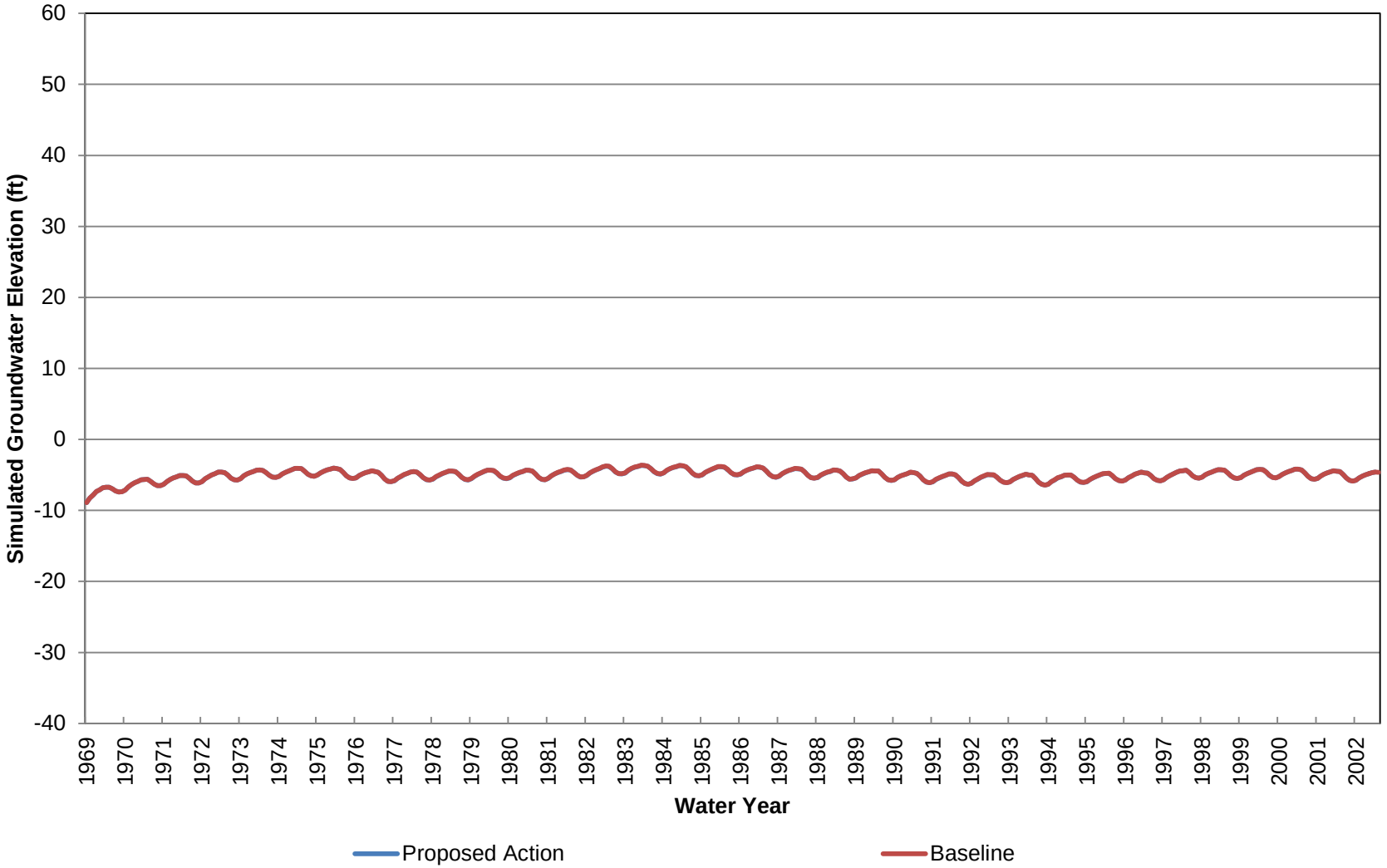
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 27**



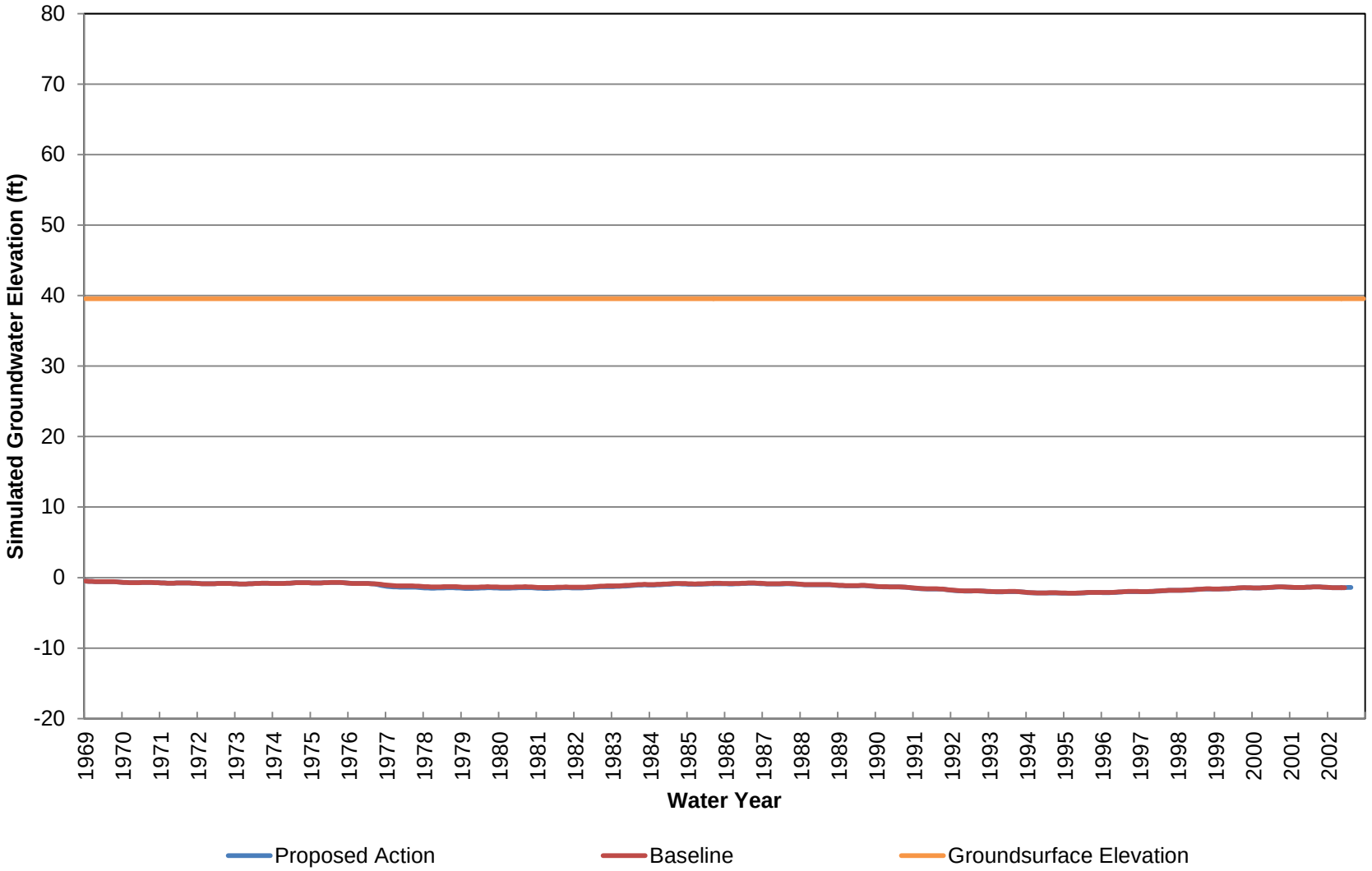
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 28



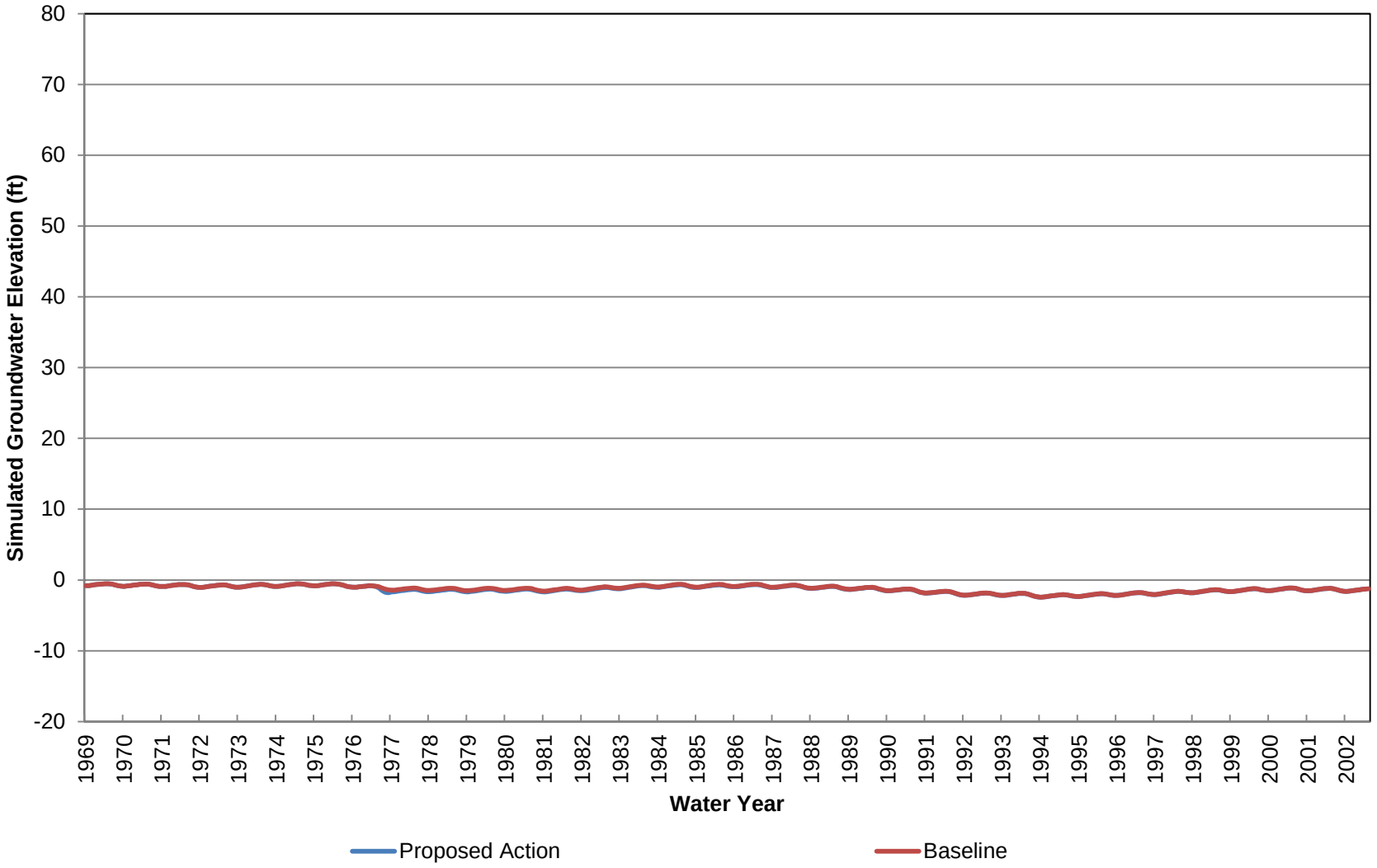
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 28



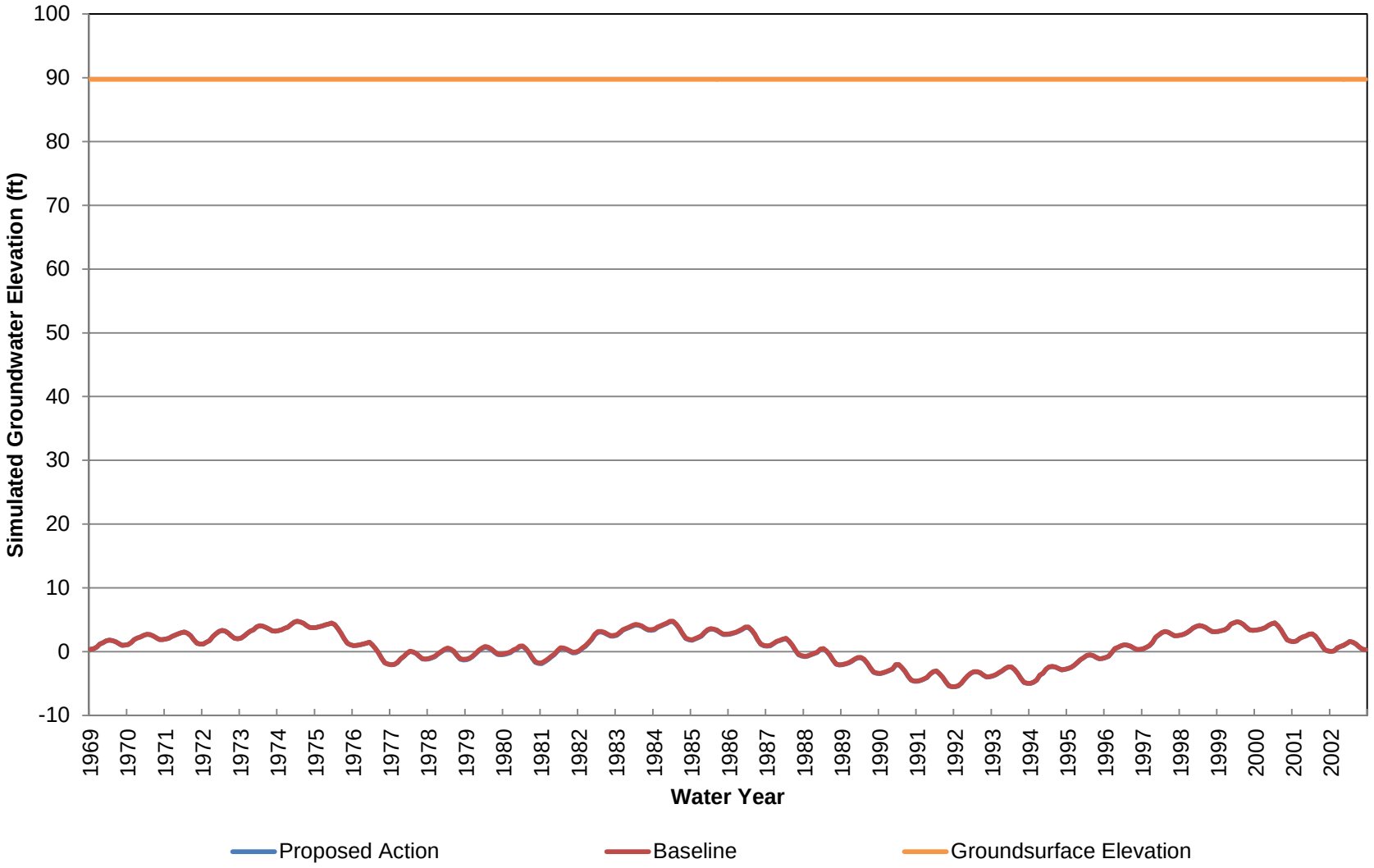
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 29



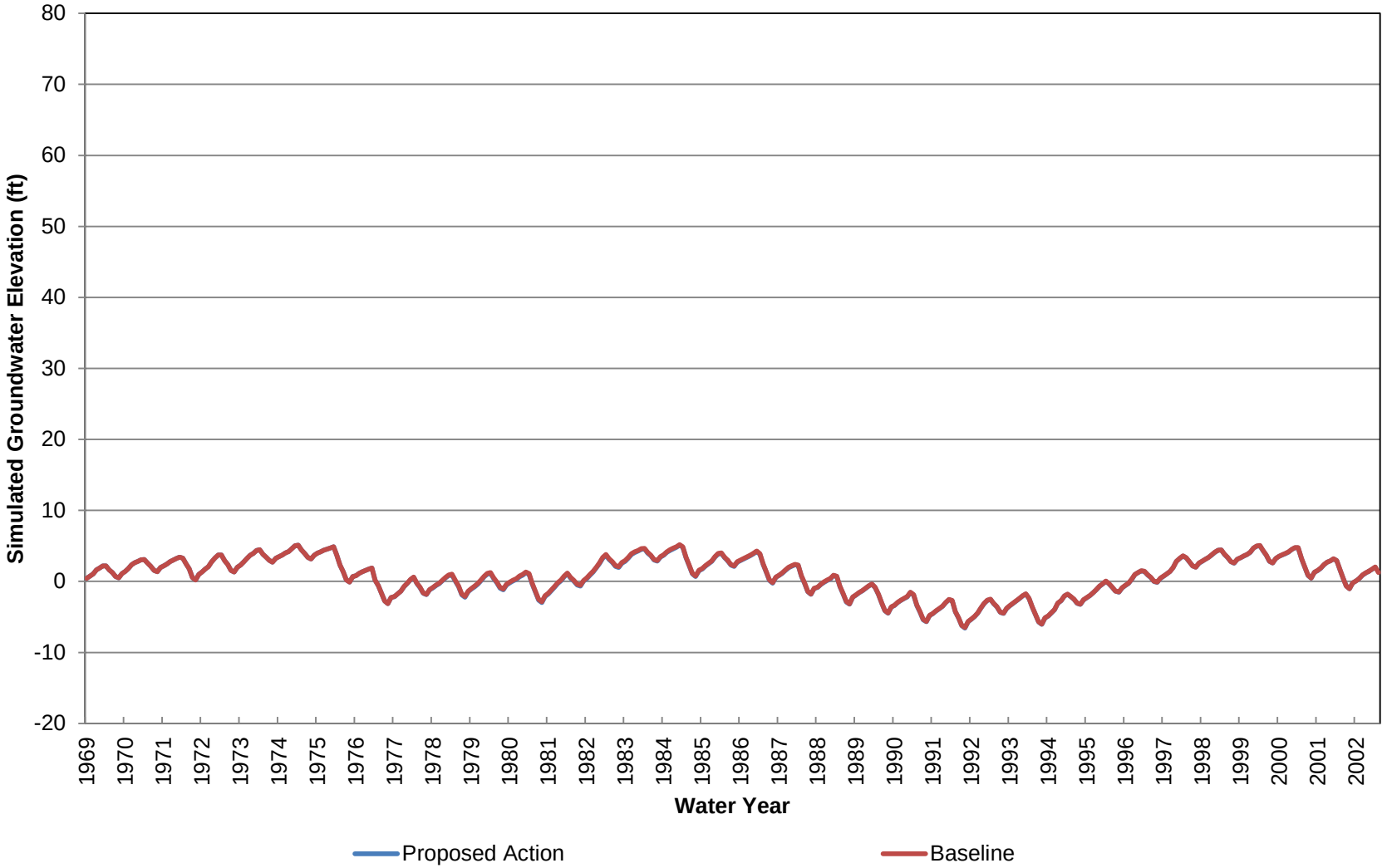
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 29



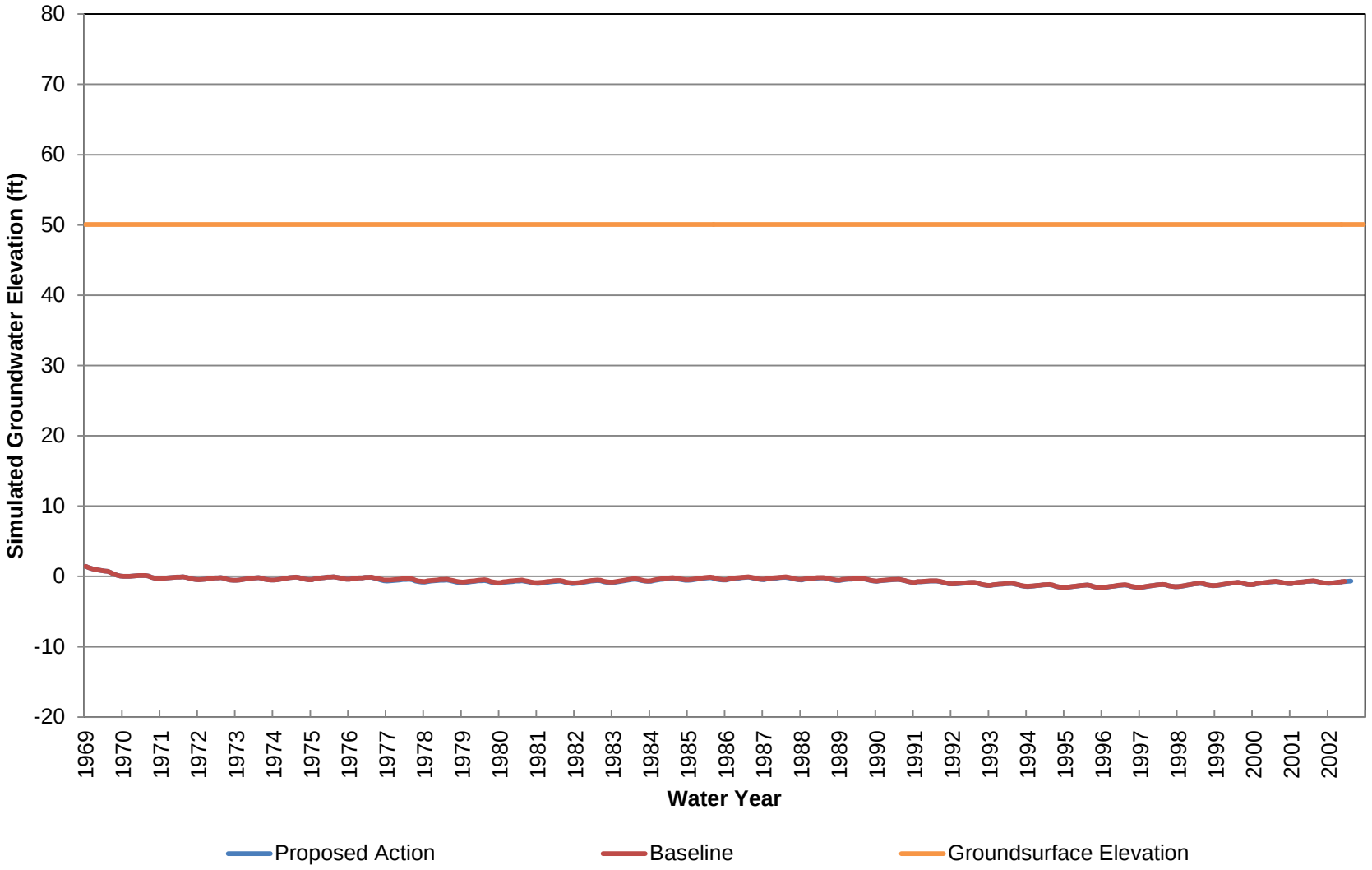
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 30



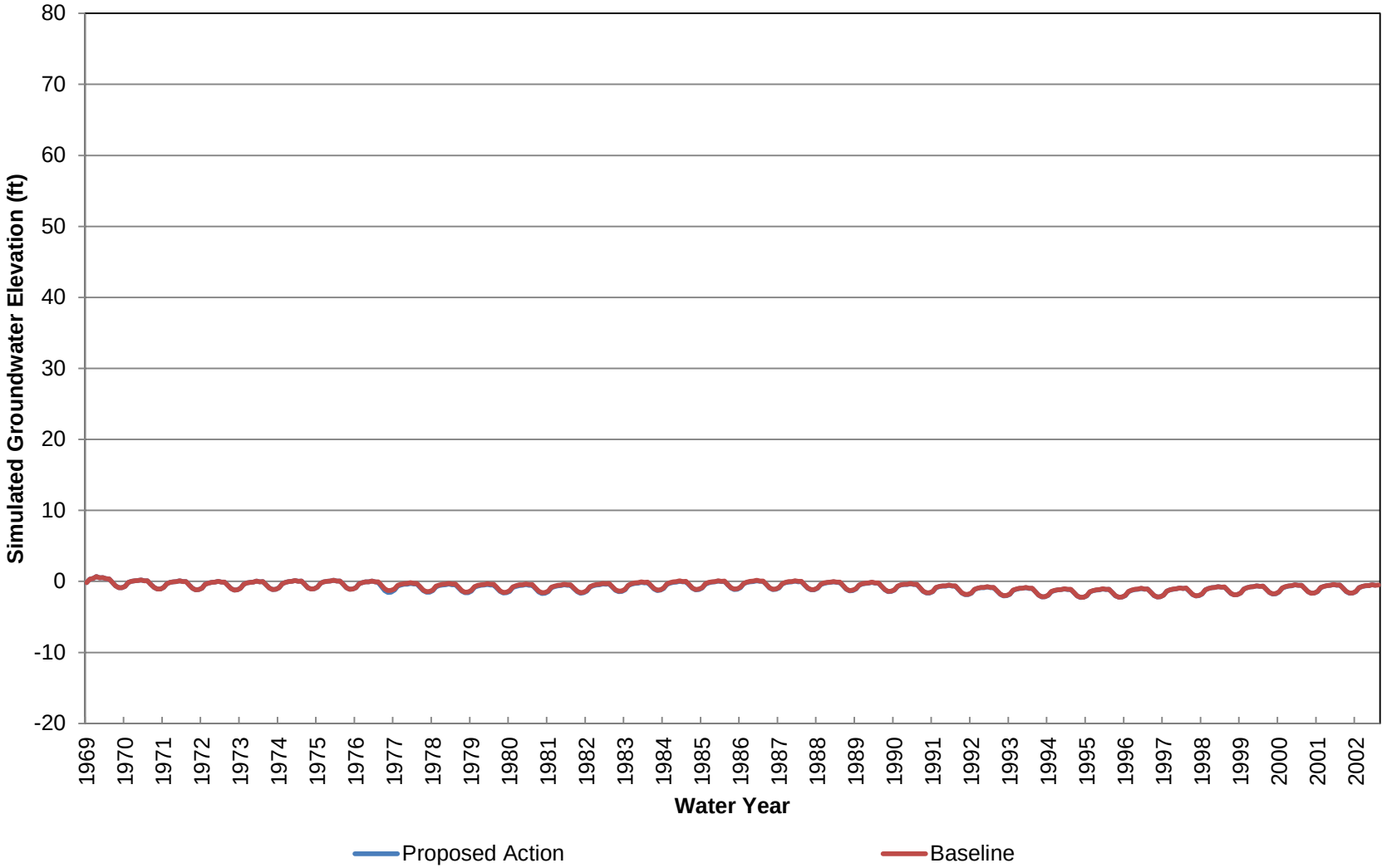
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Head (approx. 110 ft bgs) at Location 30



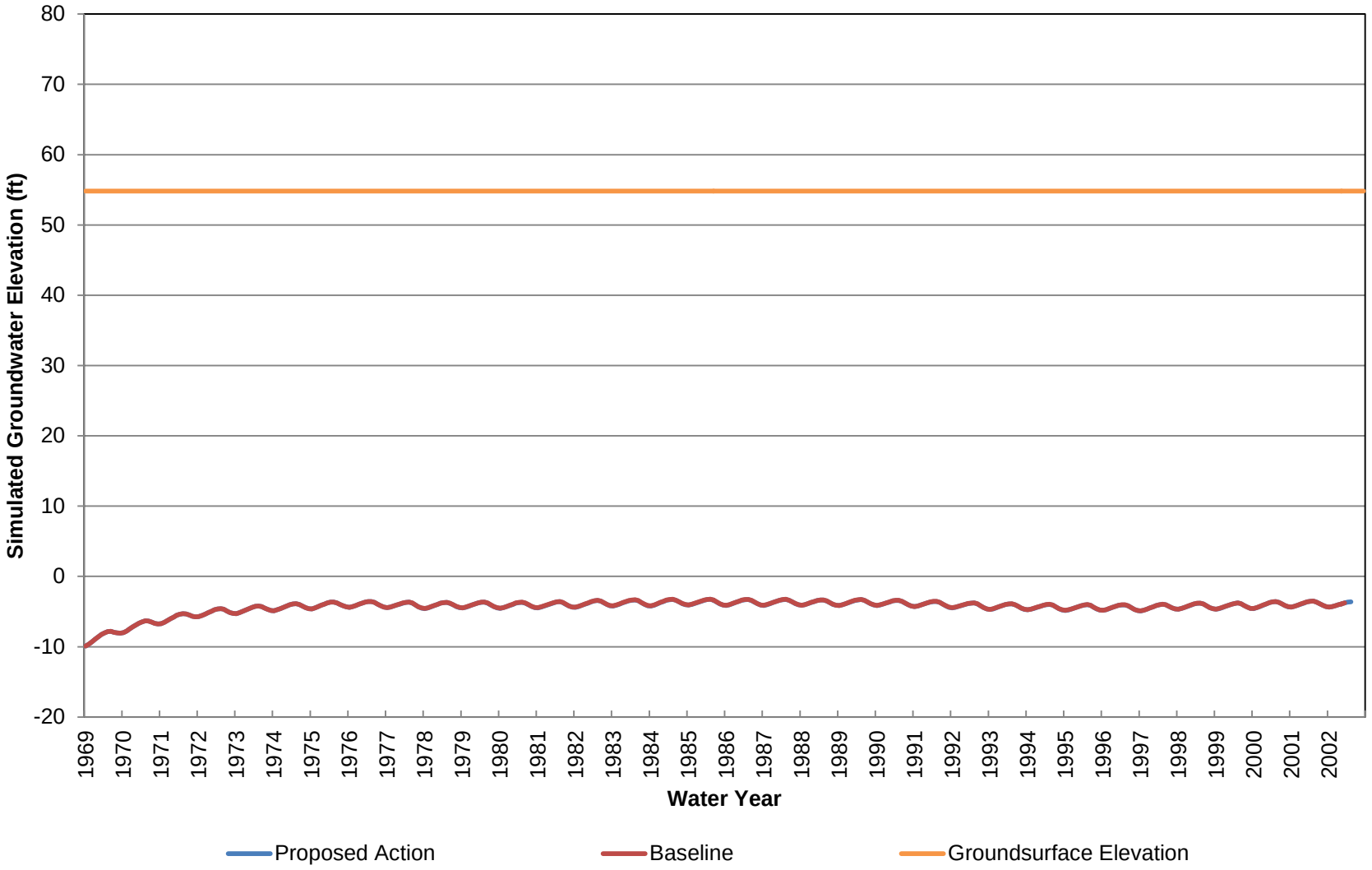
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 31



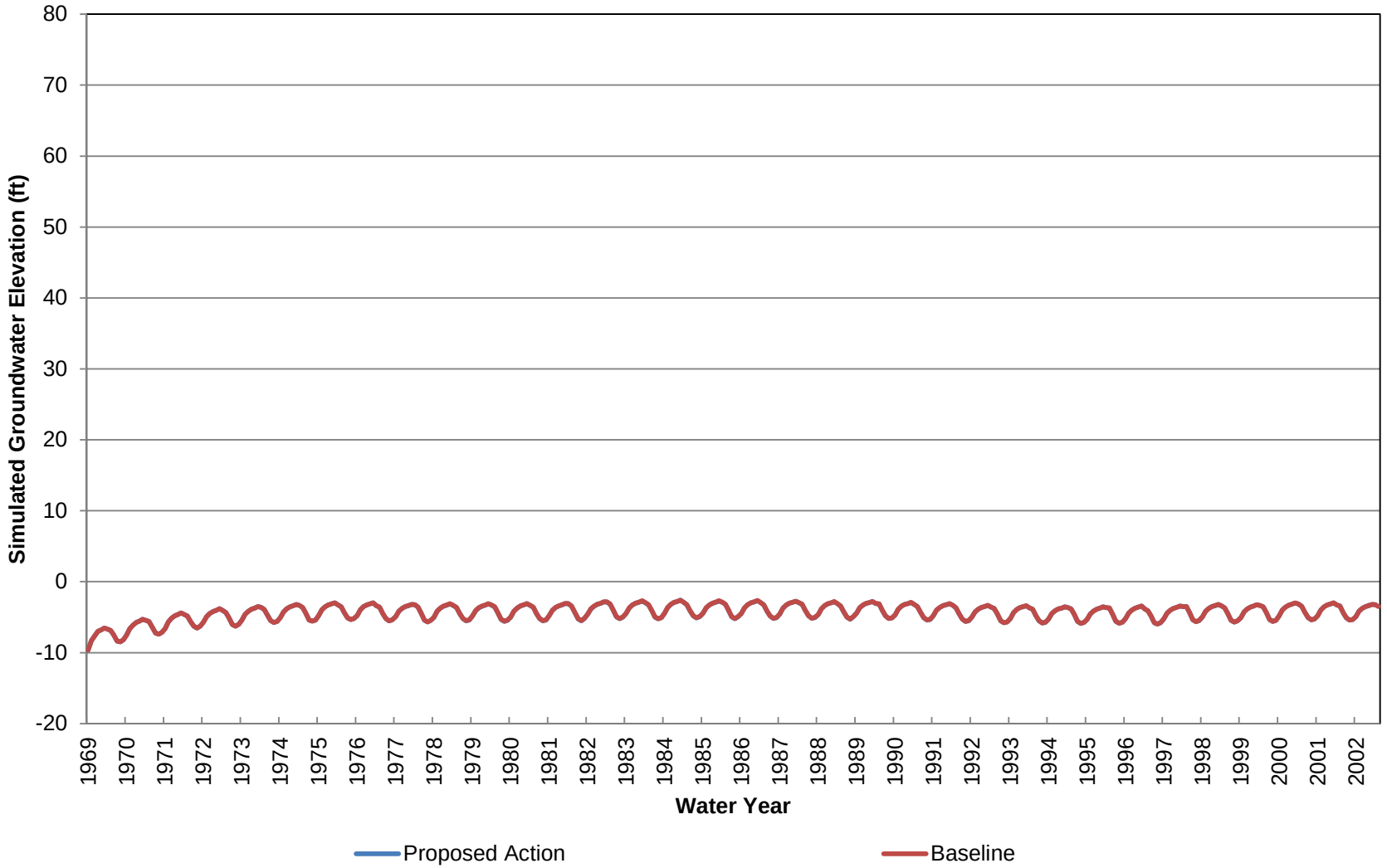
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 31**



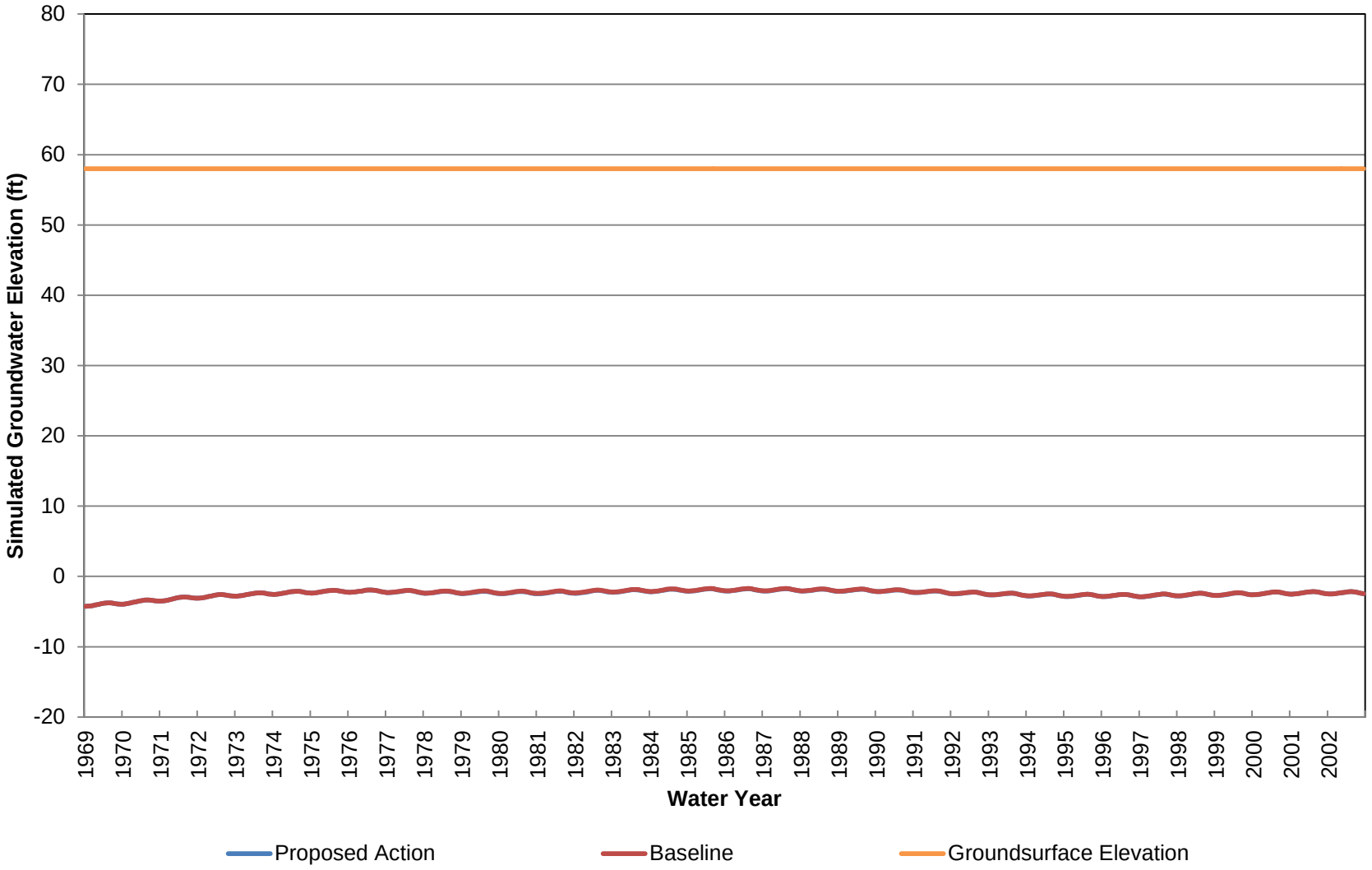
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Table Elevations at Location 32**



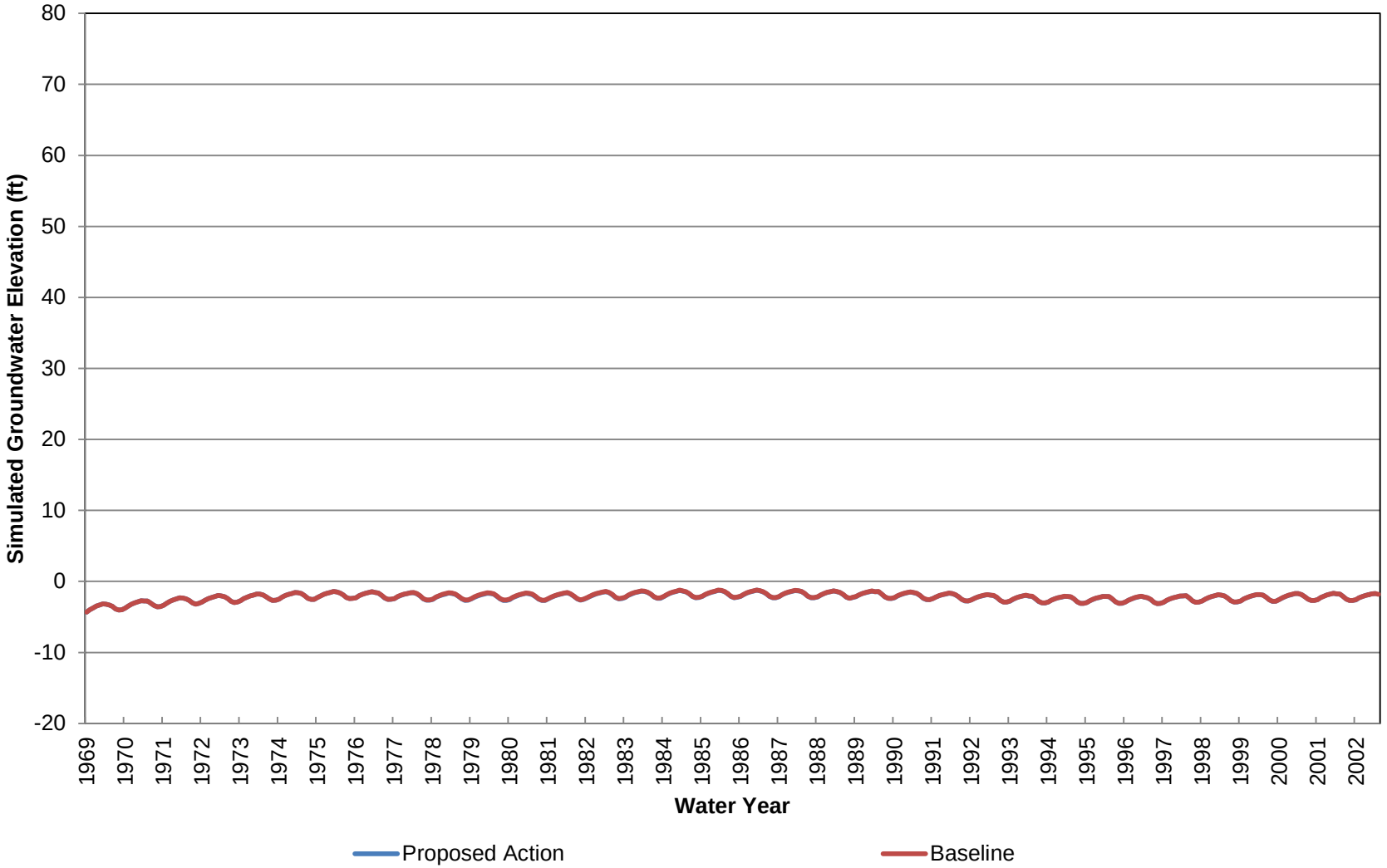
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 32**



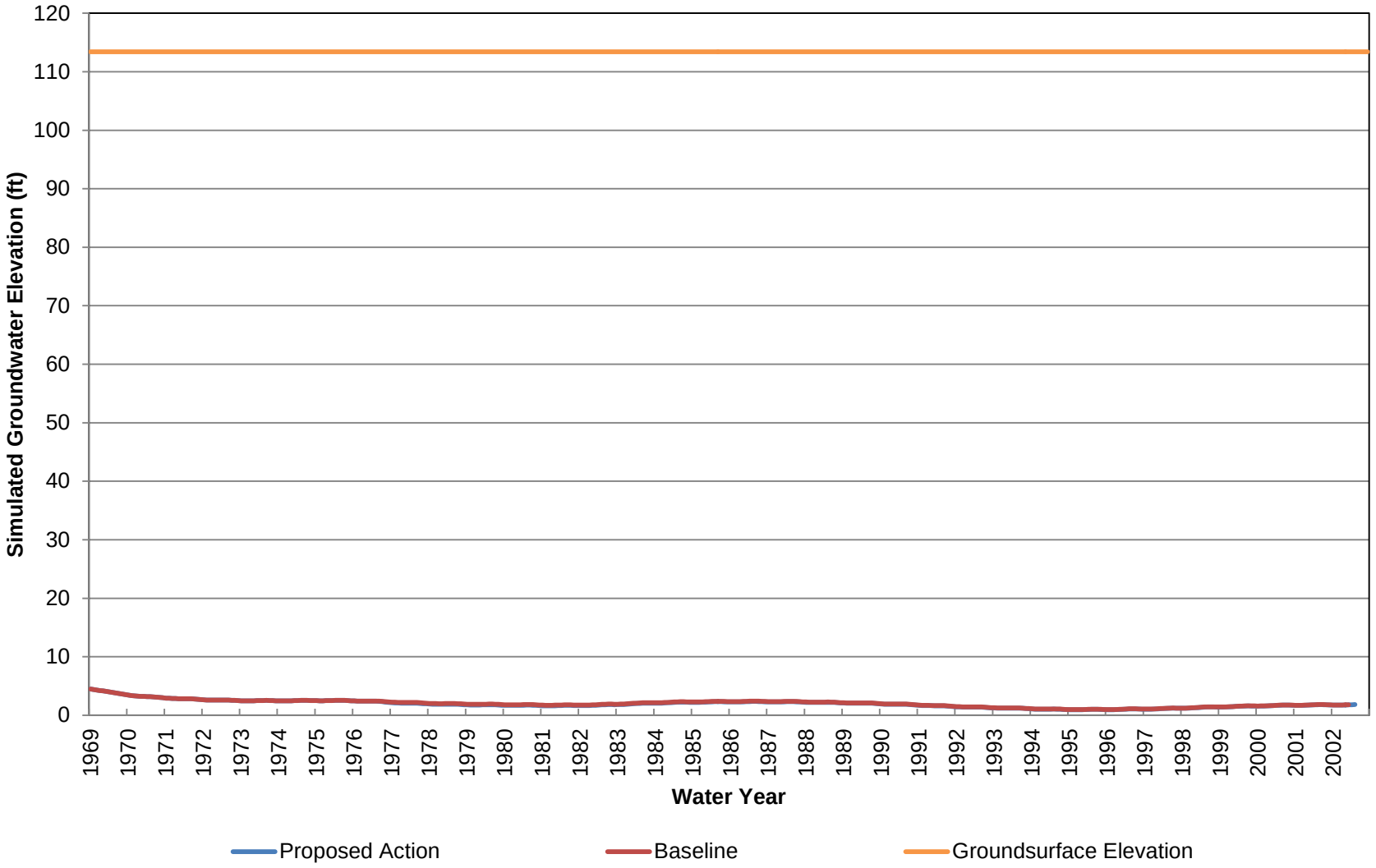
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 33



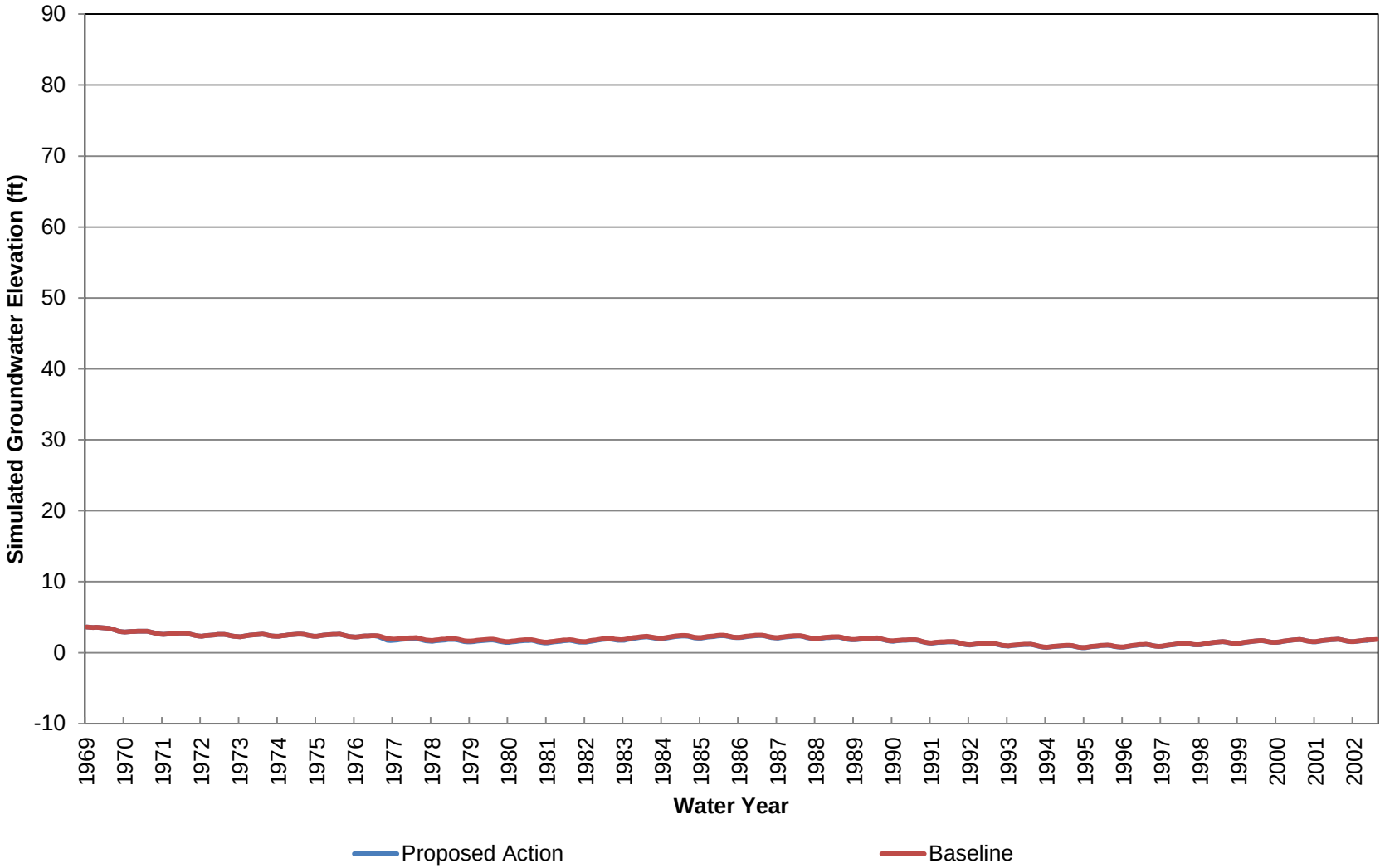
**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 33**



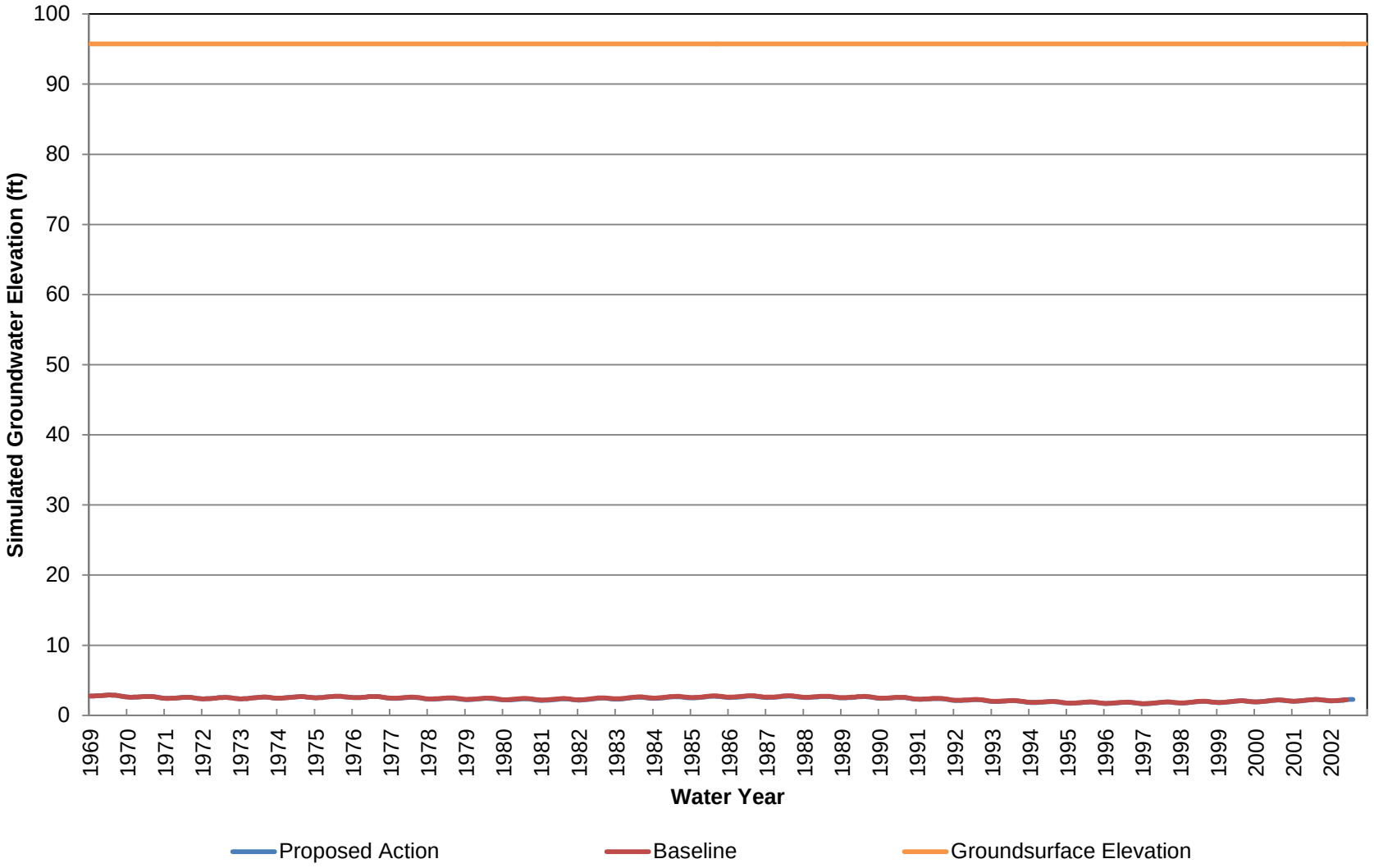
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 34

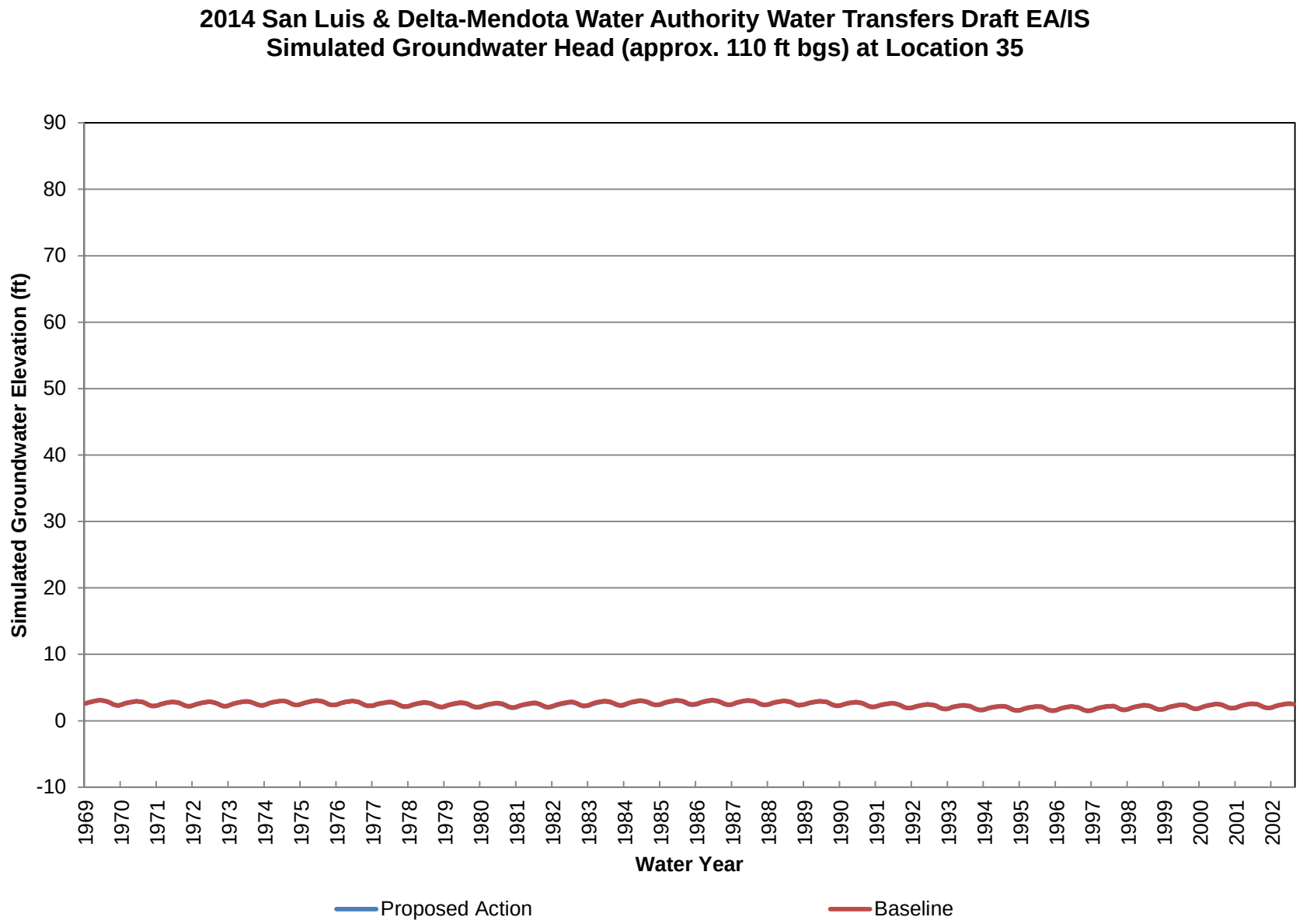


**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Head (approx. 110 ft bgs) at Location 34**

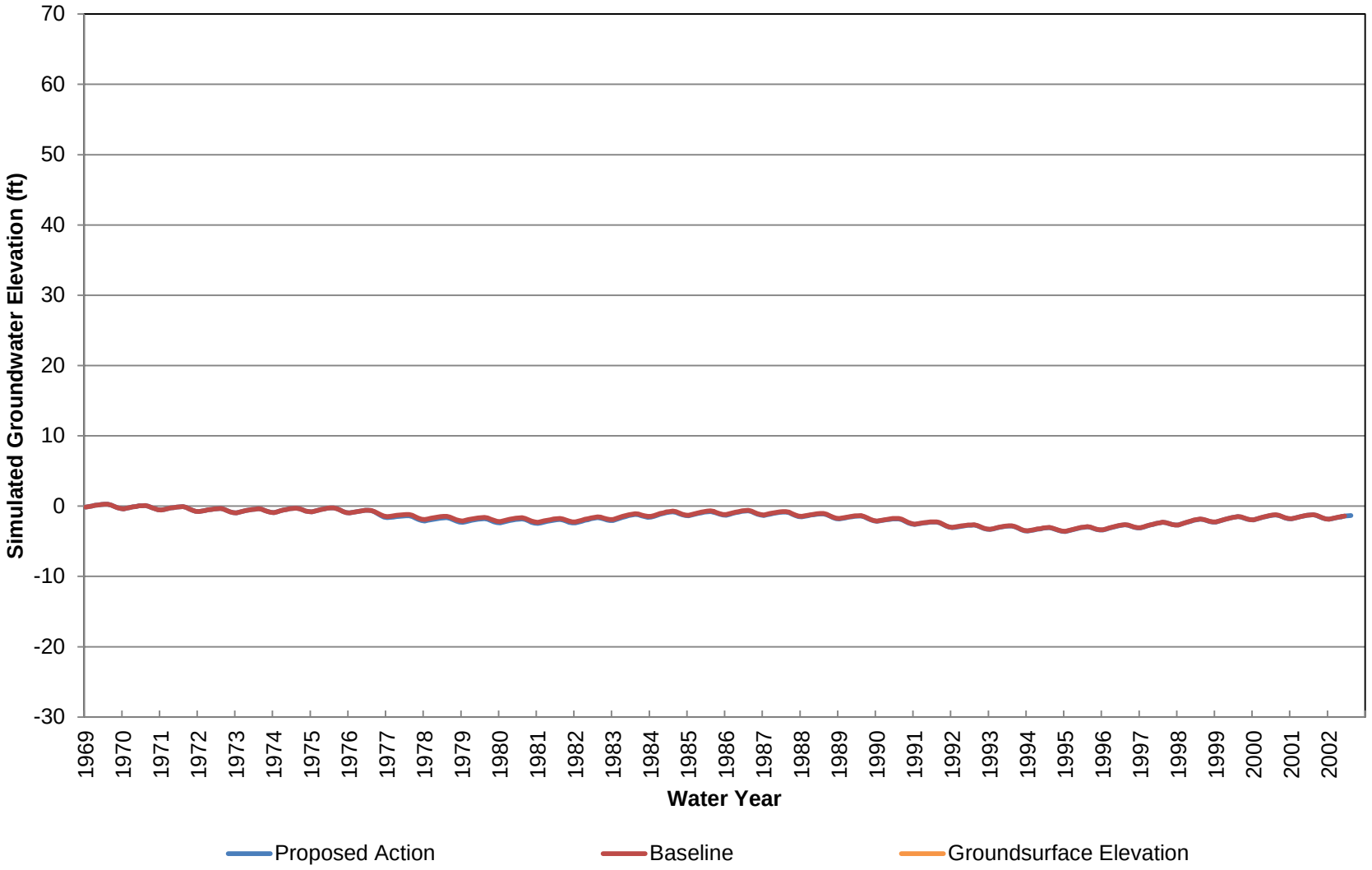


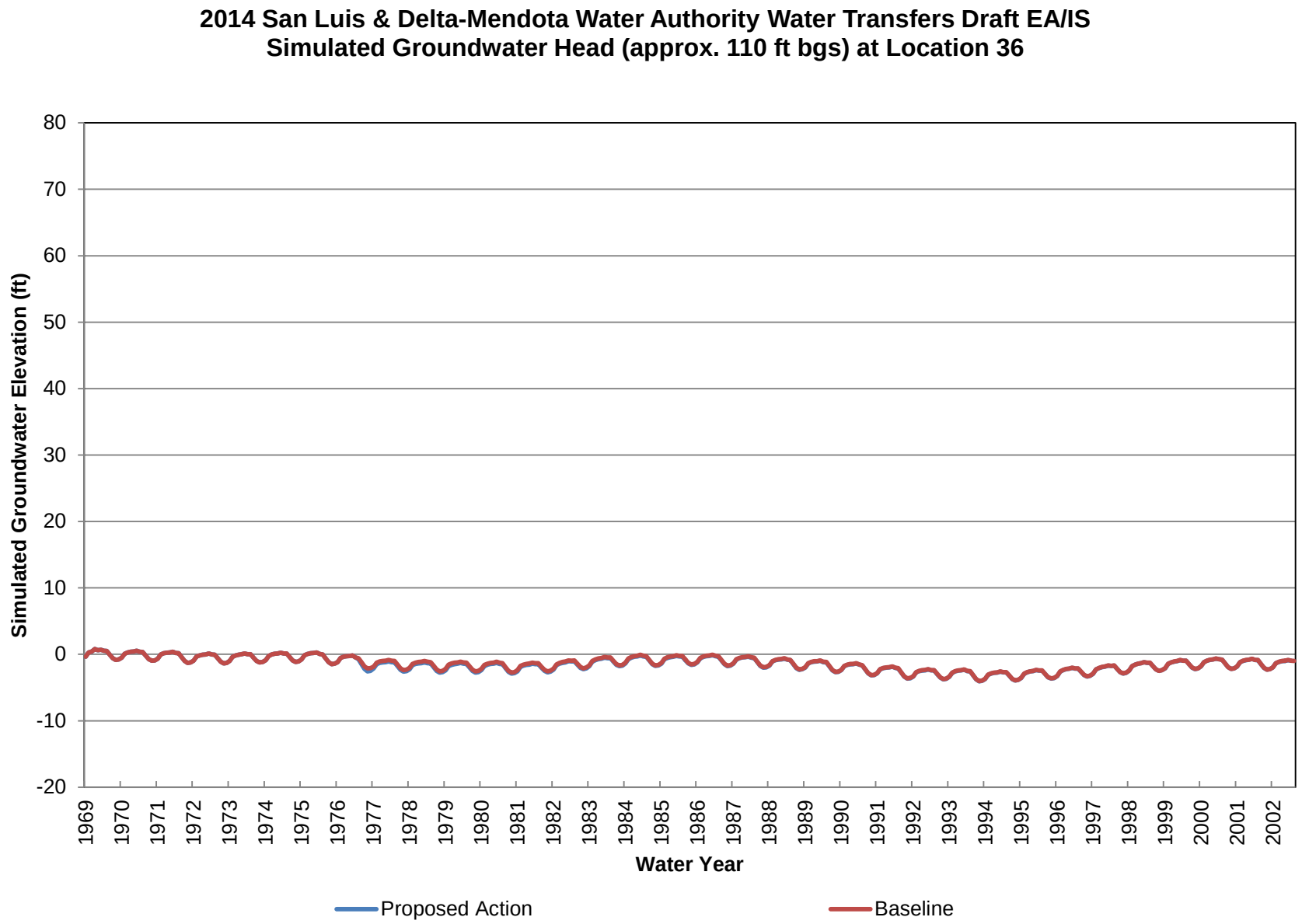
## 2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
## Simulated Groundwater Table Elevations at Location 35




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 35
Simulated Groundwater Elevation (ft)
90
80
70
60
50
40
30
20
10
0
-10
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Water Year
Proposed Action
Baseline

**2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS**
**Simulated Groundwater Table Elevations at Location 36**




2014 San Luis & Delta-Mendota Water Authority Water Transfers Draft EA/IS
Simulated Groundwater Head (approx. 110 ft bgs) at Location 36
Simulated Groundwater Elevation (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Water Year
Proposed Action
Baseline