

# RECLAMATION

*Managing Water in the West*

## Environmental Assessment

# Grassland Water District Incremental Level 4 Groundwater Acquisition Project

EA Number 14-25-MP



U.S. Department of the Interior  
Bureau of Reclamation  
Mid-Pacific Regional Office  
Sacramento, CA

September 2014

## **Mission Statements**

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

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

# Table of Contents

<b>Table of Contents .....</b>	<b>i</b>
<b>List of Acronyms and Abbreviations .....</b>	<b>ii</b>
<b>Section 1     Introduction.....</b>	<b>1</b>
1.1     Need for the Proposal.....	3
1.2     Resources Analyzed in Detail .....	3
<b>Section 2     Proposed Action and Alternatives .....</b>	<b>4</b>
Section 2.....	4
2.1     No Action Alternative.....	4
2.2     Proposed Action.....	4
2.2.1     Well Locations .....	4
2.2.2     Monitoring .....	5
<b>Section 3     Affected Environment and Environmental Consequences .....</b>	<b>6</b>
Section 3.....	7
3.1     Surface Water Resources .....	7
3.1.1     Affected Environment.....	7
3.1.2     Environmental Consequences .....	7
3.2     Groundwater and Geologic Resources .....	8
3.2.1     Affected Environment.....	8
3.2.2     Environmental Consequences .....	9
3.3     Water Quality .....	11
3.3.1     Affected Environment.....	11
3.3.2     Environmental Consequences .....	12
3.4     Biological Resources.....	14
3.4.1     Affected Environment.....	14
3.4.2     Environmental Consequences .....	19
<b>Section 4     Consultation and Coordination .....</b>	<b>20</b>
4.1     Public Review .....	20
4.2     Agencies Consulted .....	20
<b>Section 5     References.....</b>	<b>20</b>
<b>Appendix A .....</b>	<b>21</b>

# List of Acronyms and Abbreviations

B	Boron
CFR	Code of Federal Regulations
CVO	Central Valley Operations Office
CVP	Central Valley Project
DOI	Department of the Interior
DWR	Department of Water Resources
EA	Environmental Assessment
GGs	Giant garter snake
GWD	Grassland Water District
GRCD	Grassland Resource Conservation District
IL4	Incremental Level 4
mg/L	Milligrams per Liter
NHPA	National Historic Preservation Act
Reclamation	Bureau of Reclamation
Se	Selenium
Service	U.S. Fish and Wildlife Service
TDS	Total Dissolved Solids
USGS	U.S. Geological Survey

# Section 1 Introduction

This Environmental Assessment (EA) has been prepared by the Bureau of Reclamation (Reclamation) to examine the potential direct, indirect, and cumulative impacts to the affected environment associated with providing funding to purchase Incremental Level 4 water supplies for private wetlands in the Grassland Resource Conservation District (GRCD) (Figure 1).

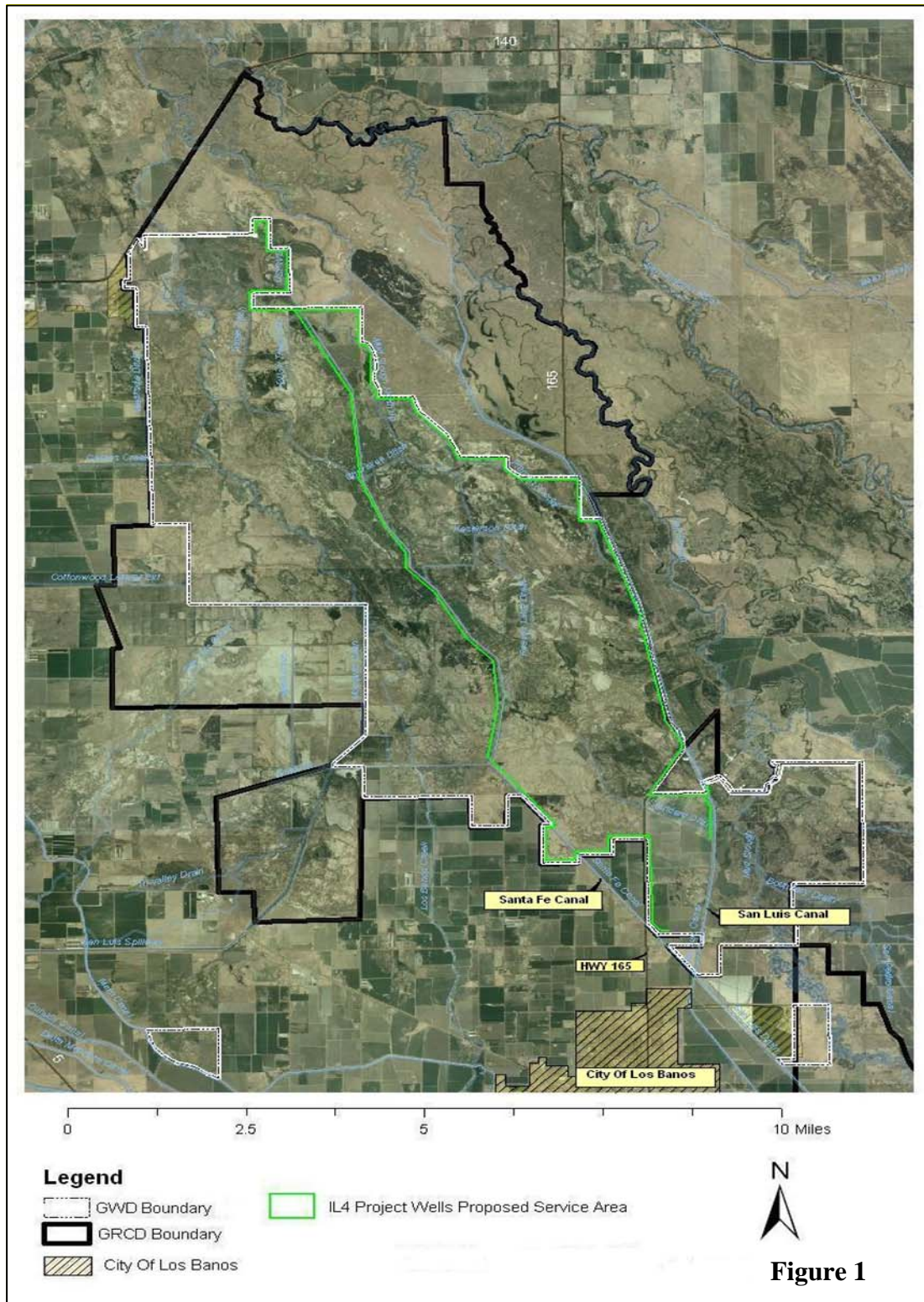
Annual refuge water allocations were established in the Report on Refuge Water Supply Investigations (3/1989) and the San Joaquin Basin Action Plan/Kesterson Mitigation Plan (12/1989), both reports incorporated into CVPIA by reference. Allocations are distinguished for two water types, Level 2 and Level 4. Level 2 Refuge Water Supplies refer to the historical annual average amount of water the refuges received between 1977 and 1984. Level 4 Refuge Water Supply is the annual amount of water needed for full development of the refuges based upon management goals developed in the 1980s. Incremental Level 4 is the difference between historic annual average water deliveries (Level 2) to refuges, and the refuge water supplies required to achieve optimum wetlands and wildlife habitat management (Level 4).

Section 3406(d)(2) requires that Reclamation provide full Level 4 supplies to all refuges starting in 2002. However, due to constraining issues including availability of water for Incremental Level 4 acquisition, funding and inadequate external conveyance capacity, Reclamation has not yet been able to meet that goal.

Each year beginning in February Reclamation's Central Valley Operation Office (CVO) issues an allocation announcement for the available water quantities to all CVP contractors for the contract year, or water year, that begins in March. The CVO water allocation announcement is revised monthly through approximately May reflecting changing hydrologic conditions. The last three years (2012-2014) have been drought years resulting in reduced CVP surface storage supplies and water availability to CVP contractors. Water year 2014 is a critically dry year and reservoir levels are low. Allocations of Level 2 water supplies for south-of-Delta refuges this year are at an all-time low of 65%. In addition, due to low CVP water allocations to agricultural contractors, Reclamation has been unable to purchase Incremental Level 4 surface water supplies for south-of-Delta refuges this year.

Millions of migratory waterfowl are beginning their fall migration through California, which lasts from September through December. The U.S. Fish and Wildlife Service (Service) has reported that this year's migratory duck population is larger than last year. Approximately 50,000 birds had arrived in the GRCD by early September 2014. Waterfowl depend on CVP refuges for water, food and habitat during their long migration and throughout the winter. Deadly bird diseases like avian botulism (particularly in the fall) and avian cholera (particularly in the spring), which do not directly threaten human health, are exacerbated during droughts. Scarce wetland habitat forces migratory water birds to crowd around the few existing water sources. The resulting overcrowding creates conditions in which these diseases can spread at an exponential rate. These conditions are beginning to take shape in areas north of the Delta where birds are now arriving in the greatest numbers. The Service has reported that tens of thousands

of birds died in recent weeks as a result of avian botulism outbreaks in wildlife refuges in northern California and southern Oregon.



## 1.1 Need for the Proposal

Reclamation is responsible for providing Level 2 and Incremental Level 4 water to 19 designated federal, state, and privately owned/managed wetlands and wildlife areas (refuges), including the Grassland Resource Conservation District (GRCD). Level 2 water supplies are primarily provided from Central Valley Project (CVP) supplies. Reclamation must acquire Incremental Level 4 water supplies through various means, including spot market purchases and groundwater development. Incremental Level 4 supplies are not provided directly from CVP yield. The proposed action is needed to provide additional Level 4 water supplies to GRCD lands to maintain existing habitat for migratory waterfowl.

## 1.2 Resources Analyzed in Detail

This EA will analyze the affected environment of the Proposed Action and No Action Alternative in order to determine the potential impacts and cumulative effects to the following environmental resources:

- Surface Water Resources
- Groundwater Resources
- Water Quality
- Biological Resources

Impacts to the following resources were considered and found to be minor or absent. Brief explanations for their elimination from further considerations are provided below:

- Indian Sacred Sites: The Proposed Action is not on federal lands, and will neither affect nor prohibit access to and ceremonial use of Indian sacred sites.
- Indian Trust Assets: There are no Indian reservations, rancherias, or allotments in the Proposed Action area. The nearest Indian Trust Asset is Public Domain Allotment approximately 39.8 miles southwest of the Proposed Action. The Proposed Action does not have the potential to affect Indian Trust Assets.
- Environmental Justice: No significant changes in agricultural communities or practices would result from the Proposed Action, other than potential changes to individual irrigation structures. These changes are not likely to have affects to any individuals or populations within the action area. Accordingly, the Proposed Action would not have disproportionately negative impacts on low-income or minority individuals or populations.
- Cultural Resources: The Proposed Action involves the acquisition of water from existing facilities with no new ground disturbance, modifications to facilities, or other potential impacts to cultural resources. Pursuant to the regulations at 36 CFR Part 800.3(a)(1), the Proposed Action has no potential to cause effects on historic properties and will result in no impacts to cultural resources. As such, Reclamation has no further obligations under Section 106 of the National Historic Preservation Act (NHPA).

# **Section 2 Proposed Action and Alternatives**

## **2.1 No Action Alternative**

The No Action Alternative would consist of Reclamation not acquiring groundwater from the four privately owned wells in the GRCD. Groundwater would not be delivered via the Santa Fe Canal and San Luis Canal to GRCD to help meet Incremental Level 4 refuge water needs.

## **2.2 Proposed Action**

Reclamation proposes to use Restoration Fund funding for the acquisition of Incremental Level 4 water supplies from four privately owned electrically powered groundwater production wells within GRCD. The groundwater acquisition effort is being proposed by Grassland Water District (GWD) as a five-month project (late September 2014 through the end of February 2015). The project will include monitoring well production, water quality, and groundwater levels. GWD would implement monitoring at each well location to confirm that water quality is suitable for refuge use. Based on the data acquired, a determination would be made to modify or curtail the groundwater pumping operations at any time during the five month project period.

The groundwater production wells would collectively produce up to 690 acre-feet of groundwater of acceptable quality per month for a total 3,450 acre-feet over a five month period, which can be conveyed and used within the GRCD. Monitoring data would be used to ensure suitable water quality in the Santa Fe Canal and the San Luis Canal, and to ensure that groundwater levels are maintained and that the project would not result in significant impacts to any resources identified in this Environmental Assessment.

The proposed action would utilize existing facilities and would not involve any ground disturbance or construction.

### **2.2.1 Well Locations**

All four of the existing groundwater production wells are located on private property in the northern portion of the GRCD, north of the City of Los Banos and east of State Route 165. Access to the wells would be by existing roads. Well #1 and Well #2 are located just north of and adjacent to the Santa Fe Canal, and are approximately 300 feet apart. Well #3 is located approximately 3,500 feet to the east of Well #1 and Well #2. All three wells are connected through a common discharge pipe that empties into the Santa Fe Canal at the location of Well #2.

Well #4 is located just south of the Standard Ditch, and discharges into the Standard Ditch approximately 1,000 feet southeast of the well. The Standard Ditch connects to the San Luis Canal. The well locations are shown on the aerial map in Figure 1. The approximate GPS coordinates of the four wells, +/- 25 feet, are:

- Well #1: 37° 06' 14.74" latitude and 120° 50' 01.76" longitude
- Well #2: 37° 06' 12.47" latitude and 120° 50' 00.03" longitude



- Well #3: 37° 06' 10.14" latitude and 120° 49' 16.83" longitude
- Well #4: 37° 07' 35.69" latitude and 120° 49' 24.53" longitude



**Location of Project Wells**

**Figure 2**

### 2.2.2 Monitoring

Project monitoring would include metering of the flows received from each groundwater well. Flows would be metered at each wellhead and at the two well discharge pipes into the Santa Fe Canal and the Standard Ditch.

To minimize any potential for surface water quality degradation associated with the utilization of groundwater in the GRCD to supplement Incremental Level 4 water supply, water quality

monitoring would consist of both surface and groundwater quality monitoring. Surface water quality monitoring would consist of both continuous and instantaneous sampling. Monitoring will include sampling from upstream locations to determine the base flow constituent concentrations, a downstream location, and at each wellhead. If threshold surface water quality objectives are exceeded at any time, corrective actions would be implemented within 24 hours, including blending groundwater with CVP surface water supplies or ceasing well pumping operations until water quality objectives are again met.

To minimize any potential for impacts on groundwater levels associated with the project, pre-production groundwater levels would be measured prior to pumping operations using an electronic water level sensor. Well drawdown would be monitored during pumping operations, and groundwater recovery would be measured after the project period has ended.

To minimize any potential impacts on land subsidence associated with cumulative groundwater pumping in the Delta-Mendota groundwater sub-basin, the GWD and GRCD will collaborate with and participate in the established land subsidence monitoring programs of the San Luis and Delta Mendota Water Authority and Central California Irrigation District. The four proposed action wells are 180 to 480 feet deep and pump groundwater from above the Corcoran Clay, which has not been associated with land subsidence. Significant land subsidence has not been documented within the GRCD.

More detailed monitoring information is located in the Project Monitoring Plan (Appendix A).

## **Section 3 Affected Environment and Environmental Consequences**

This section discusses the affected environment and environmental consequences of the Proposed Action. The overall study area includes specific analysis for each resource that may be directly or indirectly affected by groundwater pumping and use for habitat management purposes within the northern area of the GRCD.

The 58,000 acre GRCD is located in western Merced County. The northern division of the GRCD consists of approximately 38,000 acres and is located approximately 2.5 miles east of the town of Gustine and approximately 2.5 miles north of the City of Los Banos. The northern portion of the GWD is encompassed by the GRCD. The area within the GRCD that will receive the blend of CVP water and groundwater is situated east of the Santa Fe Grade and Santa Fe Canal, and west of State Route 165 and the San Luis Canal (Figure 2).

The GRCD has primarily been managed as a seasonally flooded wetland to provide for the habitat needs of migratory waterfowl and associated species. The GRCD provides habitat for a variety of bird species, including ducks, geese, shorebirds, coots, and wading birds. Black-necked stilts, sandpipers, dunlins, and dowitchers are the dominant shorebird species.

## **3.1 Surface Water Resources**

### **3.1.1 Affected Environment**

CVPIA Level 2 and Incremental Level 4 water is provided by Reclamation contract 01-WC-20-1756 signed January 19, 2001, to provide firm water supplies to refuge lands south of the Delta. The total amount of CVPIA Level 4 water allocated to GWD for delivery to the GRCD is 180,000 acre-feet per year (125,000 Level 2, and 55,000 Incremental Level 4). CVP water is delivered to the GRCD and other south-of-Delta refuges from water pumped from the Delta by the Tracy Pumping Plant and conveyed via the Delta Mendota Canal to the Mendota Pool in the San Joaquin River. A series of canals and ditches convey CVP water through the GRCD.

GWD also delivers Incremental Level 4 water supplies to the GRCD from a variety of sources. Historically, Reclamation has made annual purchases of up to 49,000 acre-feet of Incremental Level 4 water from the San Joaquin River Exchange Contractors (SJREC). Reclamation also acquires up to 10,000 acre-feet of groundwater from wells that are within or in close proximity to the GRCD as part of an ongoing pilot project. Historically, the Incremental Level 4 water is pooled among south of Delta refuges, with GWD receiving approximately 67%. Reclamation has only provided the GRCD with full Level 4 water supplies in one year, 2011.

This year, the CVP supply is inadequate to deliver full Level 2 water supplies to the GRCD, and Reclamation has been unable to purchase Incremental Level 4 supplies from the SJREC. Reclamation has allocated 65% of Level 2 supplies to GWD (81,250 acre-feet). When combined with GRCD's Incremental Level 4 water, GRCD will receive only slightly more than 90,000 acre-feet of water this year, which is approximately half of its full Level 4 water requirement of 180,000 acre-feet.

### **3.1.2 Environmental Consequences**

#### **No Action**

Under the no action alternative, Reclamation would not fund the acquisition of groundwater from the four privately owned wells within the GRCD. Groundwater would not be delivered via the Santa Fe Canal and San Luis Canal to GRCD to help meet Incremental Level 4 refuge water needs. The total available water supply for the GRCD refuge this year would remain at approximately 50% of Level 4 water needs, and the risk of avian disease outbreaks would remain extremely high.

#### **Proposed Action**

The Proposed Action would not impact surface water supplies because a net increase or decrease in CVP surface water supplies being delivered south of the Delta would not occur. The total amount of CVP surface water delivered south of the Delta would remain the same. The acquisition of groundwater under the Proposed Action would not impact surface water supplies. Surface water and pumped groundwater would be comingled for reasonable and beneficial use within the GRCD, to meet habitat needs for wildlife. Furthermore, the Proposed Action is of limited duration (5 months).

### **Cumulative Impacts**

No adverse impacts to surface water resources would result from implementation of the Proposed Action, therefore, the Proposed Action would not contribute to cumulative impacts to the resource.

## **3.2 Groundwater and Geologic Resources**

### **3.2.1 Affected Environment**

Geographically the GRCD is located in Merced County within the Delta-Mendota sub-basin of the San Joaquin Valley Groundwater Basin. Groundwater supplies are present in unconsolidated deposits extending to 800 feet or more below grade. An upper, semi-confined aquifer extends from approximately 50 to 450 feet below grade (DWR 2003). The Corcoran Clay aquitard provides a confining layer that is thick enough to separate the upper semi-confined aquifer from deeper alluvial deposits, which form the lower aquifer (DWR 2006). Wells screened above the Corcoran Clay may be in hydraulic communication with overlying surface water features, such as refuge wetlands, whereas wells screened in the lower aquifer are not likely to affect surface waters. Due to the potential for mixing waters between the two aquifer units, the Merced County Environmental Health Department prohibits the construction of wells that are open to both aquifers within the same casing (Merced County Ordinance 9.28.060).

Very little groundwater is used in the GRCD. The only well infrastructure currently used by GWD for refuge purposes includes eight groundwater wells (two in the southern division of GRCD and six in the northern division) that form Reclamation's Incremental Level 4 (IL4) Groundwater Pilot Program. These wells produce less than 10,000 acre-feet annually (GWD 2011). On the nearby state-owned Volta Wildlife Area, two groundwater wells (Volta Wells) produce less than 5,000 acre-feet annually. Historically, water pumped from these wells is divided among south-of-Delta refuges through the IL4 pool. In addition, 50% of the groundwater pumped from the Volta Wells is used to "diversify" the south-of-Delta Level 2 refuge water supply, by freeing up a portion of Level 2 refuge supplies for use by agricultural contractors. The refuges receive the other 50% of the water pumped for IL4 supplies. In the current water year, water developed by the Volta Wells is being accounted for as Incremental Level 4 water, until GWD begins receiving deliveries of its scheduled Level 2 water, at which time 50% of the water developed at the Volta Wells will be accounted for as Level 2 diversification water.

The region is heavily groundwater reliant. Within the region, groundwater accounts for about 30 percent of the annual supply used for agricultural and urban purposes. Groundwater use in the region accounts for about 18 percent of statewide groundwater use for agricultural and urban needs. Groundwater use in the region accounts for 5 percent of the State's overall supply from all sources for agricultural and urban uses (DWR 2003).

Groundwater wells commonly extend to depths of up to 800 feet. Aquifers include unconsolidated alluvium and consolidated rocks with unconfined and confined groundwater conditions. Typical well yields in the San Joaquin Valley range from 300 to 2,000 gallons per

minute with yields of 5,000 gallons per minute possible. The region's only significant basin located outside the San Joaquin Valley is Yosemite Valley. The Yosemite Valley Basin supplies water to Yosemite National Park and groundwater wells in the basin have substantial well yields (DWR 2003).

Groundwater supplies in the region are declining due to a long-term overdraft condition caused by over-pumping. However, due to reliable surface water deliveries to the refuges in the area and the neighboring SJREC, the groundwater level in the vicinity of the proposed wells remains stable and the temporary pumping of the wells for refuge water purposes is not expected to impact local groundwater resources (GWD 2011).

Land subsidence due to groundwater withdrawal is triggered by decreases in pore pressure in a confined aquifer system containing clay layers (typically montmorillonite or kaolinite clay). The decrease in pore pressure increases the effective stress on the aquifer skeleton. If this effective stress exceeds the maximum stress to which the aquifer skeleton has been subjected in the past, the clay layers can undergo permanent compaction (USGS 2009).

Elastic subsidence occurs in response to seasonal changes in pore pressure within the aquifer system. Elastic subsidence is a characteristic of any confined aquifer system and does not result in permanent compaction (USGS 2009).

### **3.2.2 Environmental Consequences**

#### **No Action**

GWD would not deliver groundwater via the Santa Fe Canal and Standard Ditch/San Luis Canal to GRCD to help meet Incremental Level 4 refuge water needs. The volume of groundwater pumping within the GRCD would remain unchanged.

#### **Proposed Action**

Groundwater would be produced from the four electrically powered privately owned wells within the GRCD for use within GRCD. Groundwater would be pumped in an amount up to 3,450 acre-feet between late September 2014 and the end of February 2015 (five months). This five month period coincides with the highest demand period for refuge water supply and would ensure that blending with surface water would be maximized. The actual amount of groundwater produced would be dependent on the productivity of the wells and other factors, such as water quality and groundwater drawdown. All groundwater produced by the production wells would be discharged into the Santa Fe Canal and the San Luis Canal (via the Standard Ditch) and mixed with surface water for dilution (if necessary). All groundwater produced during the project would be used for refuge management purposes at GRCD. Pumping would only occur if monitoring data indicates water quality and water levels are suitable for refuge use.

GWD currently utilizes a small amount of groundwater from eight groundwater wells to serve the northern and southern divisions of the GRCD. The operation of four additional wells during the project period would cause a slight increase in groundwater use in the area. Current groundwater withdrawal is less than 10,000 acre-feet annually, plus up to 5,000 acre-feet annually in the nearby Volta Wildlife Area. The total amount of groundwater that could be

pumped during the five-month project period would be up to 3,450 acre feet.

Increased use of groundwater in Merced County could potentially affect groundwater levels, surface water groundwater interactions, and rates of inelastic land subsidence. These types of potential impacts would not occur beyond the GRCD as a result of the proposed action. Although an increase in groundwater extraction would occur, the amount is minimal when compared to total groundwater use in the San Joaquin Valley hydrological region. Average groundwater usage in the region accounts for about 30 percent of the annual supply used for agricultural and urban purposes. The California Department of Water Resources estimates that total groundwater pumping from the Delta-Mendota sub-basin is 500,000 acre-feet per year. (DWR, 2003). Average pumping in the general area of GRCD, however, is minimal due to relatively stable surface water supplies. In addition, there are very few domestic residences located within the GRCD, and the majority of GRCD land is not used for irrigated agriculture. GWD estimates that annual groundwater recharge from its wetland habitat management activities is approximately 29,000 acre-feet per year, which provides a greater amount of groundwater recharge than GWD extracts through groundwater pumping (GWD 2011).

There are a handful of local landowner wells in the vicinity of GRCD, as well as the IL4 Pilot Project production wells. GWD maintains a groundwater monitoring program that includes pre- and post-irrigation season water level measurements. Monitoring data indicates that groundwater levels in the vicinity of the Proposed Action are relatively stable. Groundwater levels fluctuate somewhat throughout the year, and recharge of the basin generally occurs throughout the proposed action operational period (GWD 2011). Under the proposed action, 3,450 acre-feet would be a minimal temporary increase to the average regional groundwater use. If monitoring indicates a significant decline in groundwater levels in the relevant vicinity of the proposed wells, and that any such decline is not directly attributable to a cause other than the Proposed Action, then project pumping would be modified or terminated as necessary to avoid any significant adverse impacts.

One of the generally unrecognized limitations in groundwater availability is subsidence from groundwater withdrawal. If pumpage demands are large enough, subsidence can occur. In the San Joaquin Valley, land subsidence has resulted in damage to buildings, aqueducts, well casings, bridges, and highways and has caused flooding. These damages have cost millions of dollars (USGS 2009). Subsidence is unlikely to occur as a result of the Proposed Action. Pumping would occur from above the Corcoran Clay, and the total volume of groundwater produced is minimal when compared to regional groundwater pumping in the western San Joaquin Valley. Subsidence in the western San Joaquin Valley is typically associated with pumping from beneath the Corcoran Clay. The United States Geological Survey recently completed a thorough subsidence study that documented land subsidence to the south of the GRCD, but not within GRCD (USGS 2013). Subsidence has not been detected within GRCD, and pumping will occur above the Corcoran Clay. The project period is five months, which would allow for sufficient recharge after the project ends, to offset any minor decreases in pore pressure caused by the Proposed Action.

As part of the project Monitoring Plan and as part of GWD's ongoing groundwater management plan, GWD would collaborate with the San Luis and Delta Mendota Water

Authority and the Central California Irrigation District, which maintain local land subsidence monitoring programs.

**Table 1.** Estimated Groundwater Pumping Durations, Rates and Volumes

Well Number	Approximate Pumping Duration (days)*	Assumed Average Pumping Rate (gallons per minute)	Estimated Groundwater Volume (acre-feet)
Well #1	150 days (3600	539	357
Well #2	150 days (3600 hours)	1,077	713
Well #3	150 days (3600 hours)	1,347	892
Well #4	150 days (3600 hours)	2,244	1,486
		Total	3,448

\*Based on 5 months at 30 days/month. Total groundwater production would not exceed 3,450 acre-feet.

### Cumulative Effects

When added to past, present, and future foreseeable action, the proposed action would contribute a minor increase in groundwater production in the general vicinity for five months. Private wells in and near the project area would continue to utilize groundwater during the proposed action, however, local groundwater use would be low since the period of the proposed action is during the non-irrigation season. Pumping would not affect the lower aquifer system below the Corcoran Clay, and it is not anticipated that pumping during the Proposed Action would substantially impact the upper aquifer system.

The incremental impact of pumping up to 3,450 acre-feet under the Proposed Action when added to the pumping that occurs at the IL4 Pilot Project wells would contribute a minimal increase to groundwater pumping from above the Corcoran Clay during the five month proposed action. This cumulative impact would not be substantial because groundwater levels would be monitored for drawdown to avoid adverse impacts. Monitoring has indicated pumping of up to 10,000 acre-feet from the Pilot Project wells since 2008 has not had a negative impact on groundwater elevations (GWD 2011; GWD 2012).

The refuge groundwater production period would not occur during the irrigation season and would be unlikely to occur simultaneous with significant pumping of any local agricultural wells. The project wells would only contribute up to 23 acre-feet/day maximum for the five month period (150 days max). This additional amount of pumping would not substantially impact groundwater resources.

## 3.3 Water Quality

### 3.3.1 Affected Environment

The groundwater quality within the Delta-Mendota sub-basin varies with location and depth both within the upper aquifer above the Corcoran Clay and in the lower aquifer beneath the Corcoran



Clay. Groundwater quality in the GRCD is typically characterized by total dissolved solids (TDS), selenium (Se), and boron. Based on several years of data under the existing IL4 Pilot Program, the primary constituents of concern for refuge water supplies are TDS and selenium.

The water quality of the receiving waterway is also a relevant factor. Under the proposed action Monitoring and Mitigation Plan (Appendix A), groundwater entering GWD's conveyance system may require dilution or mixing with surface water to ensure that concentrations of TDS do not increase by more than 200 milligrams per Liter (mg/L) downstream of the groundwater discharge, and selenium concentrations do not exceed 0.0020 mg/L in the conveyance facility. Blending with better quality water supply ensures compliance with Total Maximum Daily Load regulations and refuge water quality requirements. Concentrations of all constituents are also monitored at each wellhead. Groundwater that exceeds 0.0050 mg/L of selenium at the wellhead will not be utilized, regardless of the resulting blended concentration in GWD's conveyance system.

### **3.3.2 Environmental Consequences**

#### **No Action**

Groundwater pumping would not occur at GRCD if no action were taken. Reclamation would not fund the project, and production wells would not be operated for refuge water supply purposes. Groundwater use would continue as it presently does within the GRCD.

#### **Proposed Action**

Groundwater quality data are necessary for the protection of groundwater resources because deterioration of groundwater quality may be irreversible, and treatment of contaminated groundwater can be expensive. Water quality impacts that could occur to surface water by pumping groundwater of poor quality and discharging it into the GWD conveyance system are minimal. This type of impact is unlikely to occur since the ratio of surface water moving through GWD's conveyance system would be much greater than the amount of groundwater that is pumped into the conveyance system. If necessary, surface water in the GWD conveyance system would be used to dilute the groundwater to a suitable level for further delivery to GRCD. Dilution of groundwater with surface water is a common practice.

Various water-management actions potentially have groundwater-quality effects. Therefore, water quality needs to be considered in conjunction with information about changes in water levels and water in storage in evaluating the availability and sustainability of groundwater. The Proposed Action would implement a water quality monitoring plan to ensure that water quality standards for TDS, selenium, and other constituents are not exceeded. If water quality monitoring indicates unsuitable water quality levels, pumping operations would be modified or curtailed as necessary to stay in compliance with established thresholds. The Project Monitoring Plan is included in Appendix A.

The potential for poor water quality to be extracted under the Proposed Action exists, however, the Project Monitoring Plan (Appendix A) would avoid or mitigate for unsuitable water quality to ensure that no adverse impacts occur to surface water supplies during the project.



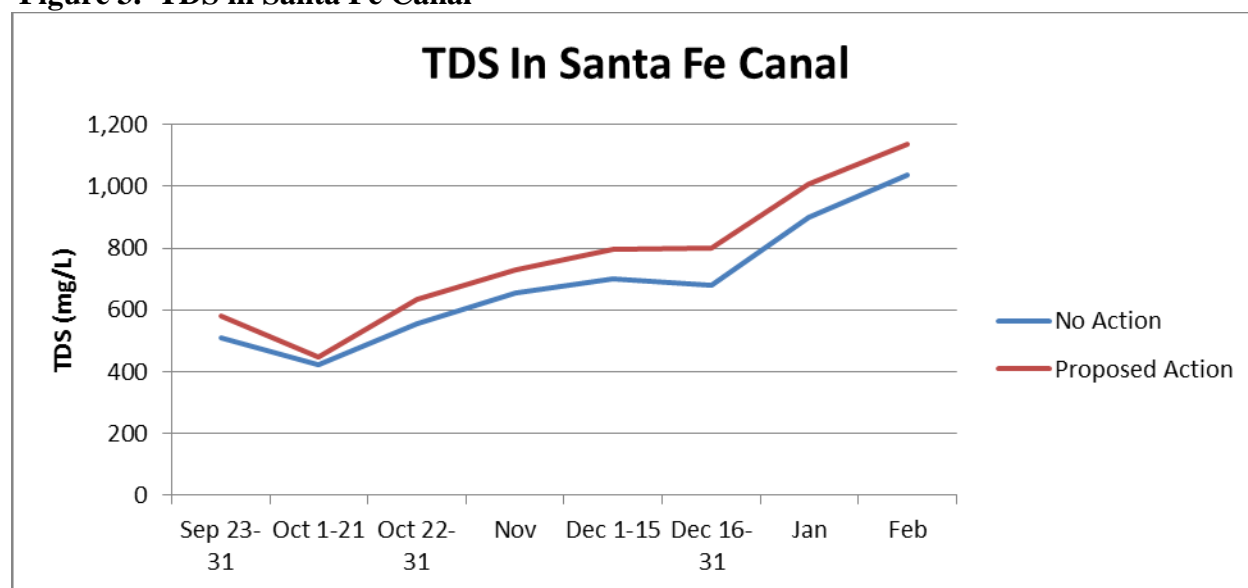
### Cumulative Impacts

Water quality analyses were conducted on samples taken from the four project wells on April 29, 2014. A summary of the analysis reports is shown in Table 2. Selenium was not detectable in two of the wells, and the other two wells were well below the Monitoring Plan's threshold for selenium. Modeling was conducted to estimate the TDS in the Santa Fe Canal and San Luis Canal during the proposed action operating period with and without the project. Under both the No Action and Proposed Action alternatives, the wells in the IL4 Pilot Project were assumed to be operating during the period of time this project is proposed to operate. The results of the modeling are shown in Figures 3 and 4. The results show that the blended TDS within the Santa Fe Canal immediately downstream of the project wells and IL4 Pilot Project wells is expected to remain below 1,200 mg/L, and the blended TDS in the San Luis Canal downstream of the Standard Ditch is expected to remain below 1,000 mg/L, which is very good quality for wetland use. Also, the increase in TDS downstream of each discharge is not expected to exceed the threshold increase for TDS of 200 mg/L in either canal. (Figures 3 and 4)

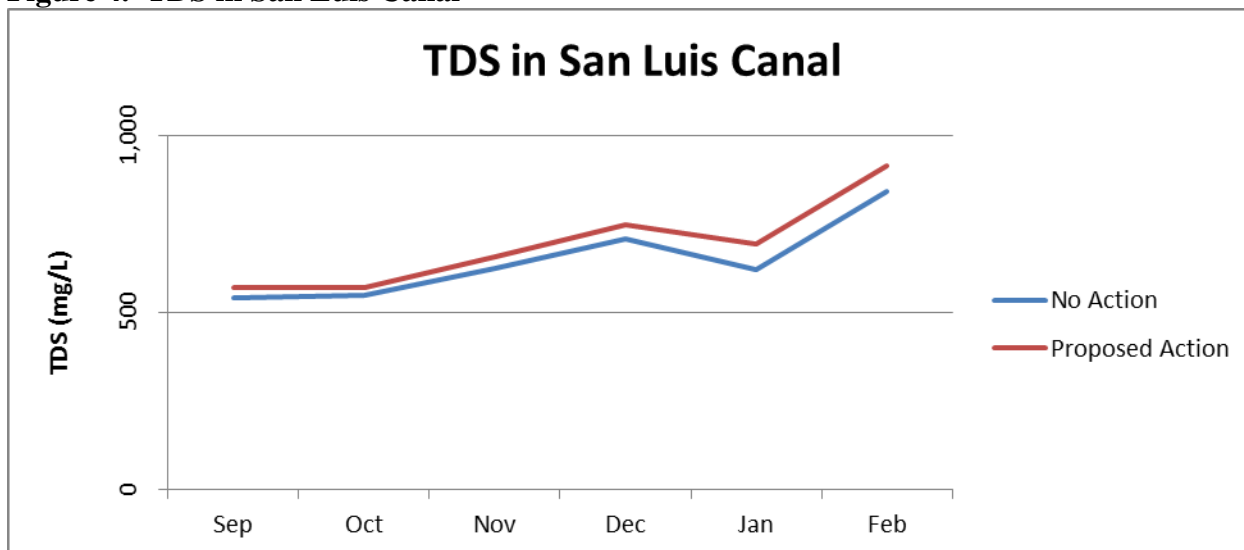
**Table 2. Groundwater Quality**

Well No.	Sample Date	EC (uS/cm)	TDS (mg/L)	Se (ug/L)	Boron (mg/L)
1	4/29/2014	2,960	2,170	<0.40	2.4
2	4/29/2014	2,760	1,980	1.19	2.4
3	4/29/2014	3,120	2,120	ND	3.5
4	4/30/2014	1,790	1,180	ND	2.4

**Figure 3. TDS in Santa Fe Canal**



**Figure 4. TDS in San Luis Canal**



Under the Proposed Action, impacts to water quality would be insignificant and continual monitoring would occur along with any follow-on actions under the Project Monitoring Plan. Therefore, the Proposed Action would not contribute to cumulative impacts to water quality.

## **3.4 Biological Resources**

### **3.4.1 Affected Environment**

#### ***Wetlands***

The wetlands of GRCD are maintained primarily by surface water and water conveyance infrastructure is in place to service each of the numerous ponds or cells. Low lift pumps are located along GWD's conveyance canals to facilitate water conveyance to the higher elevations of the GRCD. In GRCD, wetland habitats consist of seasonally flooded marshes, including moist soil impoundments, and permanent ponds and summer water. Vernal pools or seasonal wetlands occur within the GRCD.

Seasonally flooded marsh is by far the most numerous and diverse of the wetland habitat types on the state and federal refuges and private wetland areas of the San Joaquin River Basin. Seasonal wetlands are inundated fields or ponds that are managed primarily to grow seed and to produce invertebrates for migratory waterfowl, shorebirds and other wetland-dependent wildlife. These wetlands are usually flooded from October through March, and are dry for the rest of the year except for summer irrigation.

The diversity of seasonal wetlands is the product of a variety of water depths that result in an array of vegetative species that, in combination, provide habitat for the greatest number of wildlife species throughout the course of a year. Through the fall and winter, seasonally flooded marshes are used by large concentrations of waterfowl and smaller

numbers of egrets, herons, ibis, and grebes, to name a few. In addition, a full complement of raptors takes advantage of the water bird prey base. Water is removed in the spring, so large concentrations of shorebirds use the shallow depth and exposed mudflats on their northern migration. Seed-producing plants germinate and grow to maturity on the moist pond bottoms during the springs and early summer. Wetland flooding in the fall makes this food available to early migrant waterfowl and other waterfowl.

Moist soil impoundments are similar to seasonally flooded marshes, except that they are irrigated in the summer to improve production of water grass, sprangletop, and swamp timothy, the primary food species for waterfowl. Moist soil impoundments are typically irrigated during the summer to bolster plant growth and to enhance seed production. During irrigation periods, these units are often used by locally nesting colonial water birds (egrets, herons). Once flooded, these units provide an abundant food source for waterfowl. In addition, a number of wading bird species frequent them throughout the year.

Semi-permanent and permanent wetlands provide wetland habitat for year-round and summer resident species. Semi-permanent wetlands are flooded for 8 or months of the year, while permanent wetlands remain flooded throughout the year. Characterized by both emergent and submergent aquatic plants, semi-permanent and permanent wetlands provide brood and molting areas for waterfowl, secure roosting and nesting sites for wading birds and other over-water nesters, and provide feeding areas for species like cormorants and pelicans.

### ***Riparian***

There are no riparian habitats that occur in the Proposed Action area or near the water delivery areas.

### ***Developed/Disturbed***

Developed and disturbed areas include major roads, highways, and buildings and structures within more urban areas, but also facilities and access roads which are located throughout the GRCD near each well location.

### ***Wildlife***

The following list was obtained by accessing the U.S. Fish and Wildlife database at [http://www.fws.gov/sacramento/es\\_species/Lists/es\\_species\\_lists-overview.htm](http://www.fws.gov/sacramento/es_species/Lists/es_species_lists-overview.htm) (USFWS 2014).

**Table 4. Federally Listed, Proposed & Candidate Species and Migratory Birds Potentially Occurring In Proposed Action Area**

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS
<b>INVERTEBRATES</b>		
<i>Branchinecta longiantenna</i>	Longhorn fairy shrimp	Endangered
<i>Lepidurus packardii</i>	Vernal pool tadpole shrimp	Endangered
<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp	Threatened
<i>Branchinecta conservacion</i>	Conservancy fairy shrimp	Endangered
<i>Desmocerus californicus dimorphus</i>	Valley elderberry longhorn beetle	Threatened
<b>FISH</b>		
<i>Hypomesus transpacificus</i>	Delta smelt	Threatened
<i>Oncorhynchus mykiss</i>	Central Valley Steelhead	Threatened (NMFS)
<b>AMPHIBIANS</b>		
<i>Ambystoma californiense</i>	California tiger salamander, central population	Threatened
<i>Rana aurora draytonii</i>	California red-legged frog	Threatened
<b>REPTILES</b>		
<i>Gambelia (=Crotaphytus) sila</i>	Blunt-nosed leopard lizard	Endangered
<i>Thamnophis gigas</i>	Giant garter snake	Threatened
<b>MAMMALS</b>		
<i>Dipodomys nitratoide exilis</i>	Fresno kangaroo rat	Endangered
<i>Vulpes macrotis mutica</i>	San Joaquin kit fox	Endangered
<b>BIRDS</b>		
<i>Charadrius alexandrinus nivosus</i>	Western snowy plover	Threatened (Kern County)
<i>Coccyzus americanus occidentalis</i>	Western yellow-billed cuckoo	Candidate (Kern County) (critical habitat)
<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher	Endangered (Kern County) (critical habitat)

<i>Gymnogyps californianus</i>	California condor	Endangered (Kern & Tulare counties) (critical habitat)
<i>Vireo bellii pusillus</i>	Least Bell's vireo	Endangered (Kern County)
<b>PLANTS</b>		
<i>Monolopia congdonii</i> (= <i>Lembertia congdonii</i> )	San Joaquin woolly-threads	Endangered

Although there are several species identified in the list, only those species that could potentially occur in the action area are analyzed in detail.

### ***Sensitive Plants***

Major representative plant communities and habitat types present include seasonally flooded freshwater emergent wetland and alkali sink scrub. The California Natural Diversity Database records and Services species list for Merced County indicate the following rare, threatened, or endangered plant species have been sighted on or near the area in recent times:

Hispid's bird's-beak (State- and Federally-listed endangered)	<i>Cordylanthus mollis hispids</i>
Owl's clover (Endangered)	<i>Calstilleja campestris ssp. Succlenta</i>
Hoover's spurge (Threatened)	<i>Chamaesyce hooveri</i>
Colusa grass (Threatened)	<i>Neostapfia coulusana</i>
San Joaquin Valley Orcutt grass (Threatened)	<i>Orcuttia inaequalis</i>
Hairy Orcutt grass (Endangered)	<i>Orcuttia pilosa</i>
Greene's tuctoria grass) (Endangered)	<i>Greene's tuctoria</i> (=Orcutt

As this water will be used to continue wetland management practices in the Proposed Action area, impacts to sensitive plant species are not expected.

### ***Giant Garter Snake***

The giant garter snake (GGS) inhabits wetland habitats and vegetated permanent water channels in scattered subpopulations in the Central Valley from Butte County in the north to Fresno

County in the south. It is believed extirpated from the vicinity of Buena Vista and Tulare Lakes south of Fresno County. Giant garter snakes are present within the GRCD, primarily within the Volta Wildlife Area.

Giant garter snakes are always found in close proximity to permanent or semi-permanent water with vegetated perimeters. The GGS is an aquatic feeder specializing in capturing small fish and frogs in or under water. The giant garter snake spends the winter in upland retreats above the high water level. As discussed further below, the proposed action is not expected to impact this species and its habitat.

***Aleutian Canada Goose, Bald Eagle, Peregrine Falcon, and Yellow-Billed Cuckoo***

The Aleutian Canada goose, Bald Eagle, Peregrine Falcon, and Yellow-Billed Cuckoo are occasional visitors to the project area. The project would provide additional loafing, foraging, and roosting sites within the GRCD for Aleutian Canada Geese, Bald Eagles, and Peregrine Falcons. There is no suitable riparian habitat within GRCD for the Yellow-billed Cuckoo.

***Swainson's Hawk***

This species is the most migratory of all North American buteos. It breeds and summers in the arid and semiarid regions of western North America and winters on the pampas of Argentina. The breeding population in California has declined by an estimated 90 percent. In 1979, the breeding population in California was estimated at 375 pairs. This species arrives in the vicinity of the North Grasslands Wildlife Area and Los Banos Wildlife Area in late February to early March each year, and nests within an intermix of trees. Trees commonly used for nesting in this area are cottonwoods, willows, and valley oaks. The principal foods in the Central Valley are meadow mice and small birds. Use of the area by Swainson's hawk coincides with the time of year when most of the seasonal wetlands have been allowed to dry for their annual growing season. Likewise, this species migrates south prior to the seasonal wetlands being flooded for wintering wildlife populations arriving in the fall.

Based upon The California Natural Diversity Database records and observations by CDFG staff, no known Swainson's hawk nest sites occur within the GRCD Comprehensive Management Plan project area. Nest sites do occur along the San Joaquin River, which is not located in the Proposed Action area. Swainson's hawks are featured species in the GRCD management plan and would benefit from the proposed action. Grassland foraging areas and potential nest trees would not be disturbed.

***San Joaquin Kit Fox***

The San Joaquin kit fox, a State-listed threatened and Federally-listed endangered species, is a small nocturnal canid which now occurs in scattered populations from Contra Costa County south to Kern County. Historically, this species occupied extensive areas of semiarid lands in the San Joaquin Valley. Flat topography in valley bottoms with valley sink scrub, valley saltbush scrub, interior coast range saltbush scrub, nonnative grassland and alkali playa plain communities (described in Holland, 1986) are the typical habitat, but substantial populations have always inhabited the surrounding low foothills where slopes do not exceed 40 degrees (O'farrell 1983). Agricultural, industrial, and urban developments have caused rapidly increasing rates of habitat loss.

The San Joaquin kit fox is an obligate year-round burrow dweller which feeds largely upon lagomorphs and kangaroo rats (but would utilize whatever prey is locally abundant). Numerous dens are excavated and inhabited in the course of a year and individuals may cover great distances while foraging and/or dispersing.

The San Joaquin kit fox is considered here because of the potential foraging habitat (irrigated pasture and seasonally flooded grassland and alkali sink scrub). No known active or potential kit fox dens have been observed within the project area.

### **3.4.2 Environmental Consequences**

#### **No Action**

Conditions would remain the same as existing conditions if no action were taken. There would be no new impacts to wildlife, including threatened and endangered species, their critical habitat, or general habitat types.

#### **Proposed Action**

The pumping and conveyance of groundwater within GRCD would not affect aquatic species or their habitat. Habitat for Delta smelt, Chinook salmon (spring and winter run), central valley steelhead, or green sturgeon would not be affected because no construction or flow modifications are proposed on natural waterways. There would be no effect to federally listed fish species mentioned above and there would be no modification of critical habitat for the species as a result of the proposed action.

The addition of up to 3,450 acre-feet of groundwater supplies to GWD's conveyance system during the proposed period of operation will not adversely affect the species since overall water deliveries during this period will be less than normal.

Indirect impacts are not expected to occur from water quality affecting the prey base of the GGS. Groundwater from existing production wells would be pumped into the Santa Fe Canal and San Luis Canal and delivered downstream throughout the GRCD. This would occur during a period when the GGS is not active, and no effects to GGS are anticipated.

Water is expected to be of suitable quality for other aquatic species that use wetland areas within the GRCD. Water quality would be continually tested during the five-month project at the outflow of the production wells and immediately upstream and downstream of the proposed well locations. If water quality is determined to be of unsuitable quality, pumping into the GWD conveyance system would be modified or curtailed.

Overall, the Proposed Action would provide a benefit to waterfowl, shorebirds, and raptors, as the water would be used for refuge management to sustain wetland habitats. The Proposed Action may benefit GGS in that it would provide additional habitat to offset extremely dry conditions.

#### **Cumulative Impacts**

Implementation of the Proposed Action would not result in effects to biological resources, and therefore could not contribute to cumulative impacts.

# Section 4 Consultation and Coordination

## 4.1 Public Review

Reclamation intends to sign a Finding of No Significant Impact for this Project, and will make the EA available for a one week period beginning September 10, 2014. All comments will be addressed in the FONSI. Additional analysis will be prepared if substantive comments identify impacts that were not previously analyzed or considered.

## 4.2 Agencies Consulted

Reclamation coordinated with the following agencies during preparation of this EA.

- Grassland Resource Conservation District
- Grassland Water District
- U.S. Fish and Wildlife Service

# Section 5 References

California Air Resources Board. Area Designation Maps  
(<http://www.arb.ca.gov/desig/adm/adm.htm>)

California Department of Water Resources. 2003. *California's Groundwater Bulletin 118 Update 2003*.

California Department of Water Resources. 2006. *California's Groundwater Bulletin 118 Update 2006, San Joaquin Valley Groundwater Basin Delta-Mendota Subbasin*

Grassland Water District. 2011. *Grassland Water District Groundwater Management Plan*.

Grassland Water District. 2012. Incremental Level 4 Groundwater Acquisition Pilot Project 2012 Water Quality Monitoring Report.

U.S. Fish & Wildlife Service. September 8, 2014. Species List Generator, San Luis Ranch and Ignomar Quad Maps (Quads 403A and 403B).  
([http://www.fws.gov/sacramento/es\\_species/Lists/es\\_species\\_lists-overview.htm](http://www.fws.gov/sacramento/es_species/Lists/es_species_lists-overview.htm))

U.S. Geological Survey. 2009. Groundwater Resources Program. Professional paper 1766. *Groundwater Availability of the Central Valley Aquifer, California*.

U.S. Geological Survey. 2013. *Land Subsidence along the Delta-Mendota Canal in the Northern Part of the San Joaquin Valley, California, 2003–10*.  
(<http://pubs.usgs.gov/sir/2013/5142/pdf/sir2013-5142.pdf>)



# **Appendix A**

# Appendix A

## Monitoring and Mitigation Plan For the Urgent Acquisition of Groundwater for Grassland Resource Conservation District Wetlands

---

### WATER QUALITY MONITORING

In an effort to minimize significant ambient surface water quality degradation associated with the development of groundwater in the Grassland Resource Conservation District to supplement Incremental Level 4 water supply, water quality monitoring will consist of both surface and groundwater quality monitoring.

Surface water quality monitoring will consist of both continuous and instantaneous sampling. Monitoring will include sampling from upstream locations to determine the base flow constituent concentrations, a downstream location, and at each wellhead. Continuous surface water quality monitoring will be accomplished in part through the Grassland Water District's (District) Real Time Water Quality Monitoring Network, characterizing Electro-Conductivity ( $\mu\text{S}/\text{cm}$ ) (EC), temperature, pH, and flow (CFS and acre-feet), which is subject to a rigorous quality assurance program plan to ensure that the data is accurate and representative of actual conditions. Additionally, totalizing flow meters at each of the wellheads will characterize individual wellhead production in acre-feet. Data will be recorded and included in monthly reports to Reclamation in conjunction with monthly invoices from the District. Instantaneous water quality monitoring will be accomplished through grab sample analysis of the ambient surface water quality upstream and downstream of the wellhead discharge as well as the groundwater quality at the wellhead. The upstream, downstream and wellhead water will be sampled and analyzed (EC, pH, and Temperature) by the District on a weekly basis during the well operational period utilizing YSI 600XL multi-parametric SONDE water quality sensors, and recorded in a weekly log.

Grab samples will also be collected upstream of the wellhead discharge, downstream of the wellhead discharge, and at each wellhead on a monthly basis and analyzed for selenium, boron, and Total Dissolved Solids (TDS) concentrations by a Bureau of Reclamation (Reclamation) approved laboratory. The Reclamation-approved lab used to analyze selenium will provide a reporting limit (RL) of 0.4 micrograms per liter ( $\mu\text{g}/\text{L}$ ). Boron analysis requires an RL of 100  $\mu\text{g}/\text{L}$ , and TDS an RL of 10 milligrams per liter ( $\text{mg}/\text{L}$ ). As soon as practical (generally within 7 days of the District's receipt of information from the water quality testing laboratory), the District will ensure that Reclamation receives electronic copies of the complete data reports

submitted by the laboratory. All data will also be recorded and included in annual reports to Reclamation for review.

If the Monitoring Plan data indicates that the use of wells may adversely impact water quality, the mitigation measures described on the next page (and incorporated into the Proposed Action) will be implemented. If groundwater is found to contain constituent concentrations above the Central Valley Regional Water Quality Control Board's (CVRWQCB) surface water thresholds, groundwater will be blended with CVP water upon discharge into flowing conveyance channels, effectively reducing concentrations below the thresholds outlined in the Environmental Assessment (EA), or the well will not be operated for purposes of the Proposed Action until flow conditions improve and water quality objectives are again met. The mitigation measures below will ensure that the groundwater supply developed during this Proposed Action will not adversely impact water quality. If the monitoring indicates that threshold values are exceeded, mitigation measures will be implemented within 24 hours of identifying an exceedance.

#### **Water Quality Threshold and Reporting Limits – Laboratory Analysis**

<b>Analyte</b>	<b>Water Quality Goal</b>	<b>Minimum Desired RL (µg/L)</b>	<b>Method RL<sup>1</sup> (µg/L)</b>
Boron (µg/L)	Monitor	100	100
TDS (mg/L)	<200 increase over background	50.0	10,000 (10 mg/L)
Selenium (µg/L)	Not to exceed 2 ug/L in conveyance/not to exceed 5ug/L at the wellhead	N/A	0.4

#### **Water Quality Monitoring and Sampling Schedule**

Location	Sample Frequency				
	EC	FLOW	SELENIUM	BORON	TDS
Upstream	weekly	continuous	monthly	monthly	monthly
Wellhead	weekly	continuous	monthly	monthly	monthly
Downstream	weekly	continuous	monthly	monthly	monthly
Conveyance	continuous	continuous	monthly	monthly	monthly

#### **Water Quality Mitigation Measures**

The District will not accept water from any of the subject wells if any of the wells exceed the following values:

- Maximum of 5.0 µg/L for selenium

The District will cease wellhead operation until flow conditions improve if any of the following downstream water quality thresholds are exceeded:

- Maximum increase of 200 mg/L TDS upstream to downstream per well
- Maximum of 2.0 µg/L for selenium

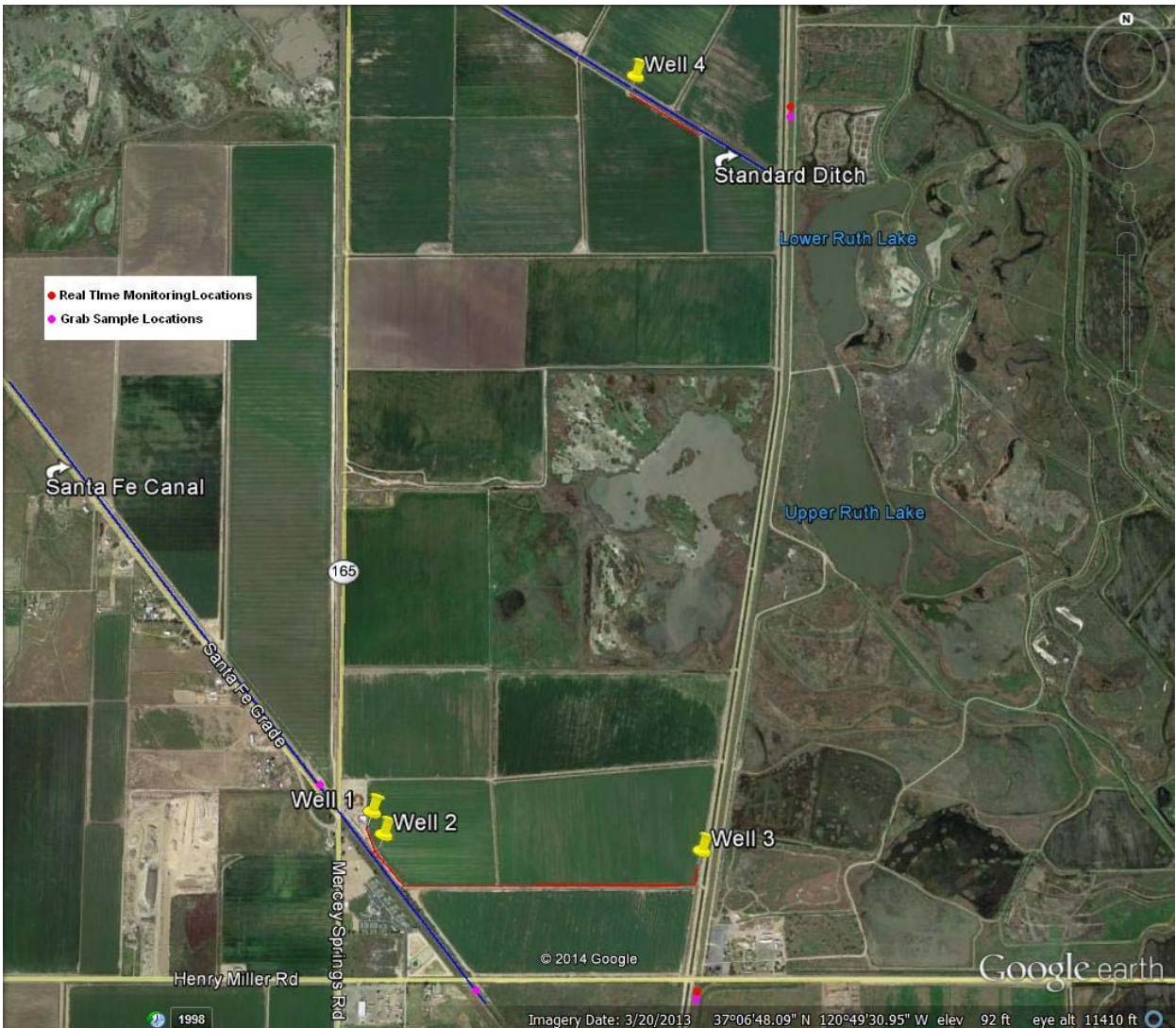
In the event that the water from any of the wells increase TDS levels in the District's conveyance downstream from a wellhead by more than 200 mg/L, the well would not be operated for Proposed Action purposes until flow conditions improve and downstream water quality objectives are again met.

The District has quantified flow conditions required to meet downstream water quality objectives for each of the wells based on individual wellhead water quality sampling data. Accordingly, the District will immediately cease pumping if inadequate flow conditions are observed prior to receiving laboratory confirmation of an exceedance.

Each well, as it is operated, will be monitored for selenium, boron, TDS, EC and flow at its discharge point (this point must represent wellhead water quality) into the District's conveyance channels. Flow will be measured by a flow meter capable of recording instantaneous flow in cubic feet per second and total flow in acre-feet.

Monitoring of downstream locations will determine the combined flow and chemistry of the operation. The sites are far enough away from the well discharges to assure proper blending for grab sample collection. All water quality data will be kept at the District's office. As soon as practical (generally within 7 days of the District's receipt of information from the water quality testing laboratory), the District will ensure that Reclamation receives electronic copies of the complete data reports submitted by the laboratory. The District will also provide a monthly water quality summary report, including volumetric data on wellhead production, within 60 days of sample collection. Water quality data and reports will also be provided to the CVRWQCB at least once per year.

The following map identifies the real time monitoring and grab sample locations for the 4 wells in the temporary urgent drought relief proposal. Wells 1, 2, and 3 are plumbed together and have only one discharge into the Santa Fe Canal in the vicinity of well 2. Well 4 discharges into the Standard Ditch, which will enter into the San Luis Canal. Three of these wells have no detectable levels of Se and well #2 has a very low detectable level of 1.19 ppb. Blending of 1, 2, and 3 is expected to reduce Se levels below the detection limit of <0.04 ppb, and below the 2 ppb RWQCB threshold. The 200 mg/L max increase will govern the operation of these wells which is monitored in real-time on the San Luis Canal (SL-1 and SL-2) and weekly on the SFC, such that if the base flow is not available the wells will be shut down until flow conditions improve.



## GROUNDWATER LEVEL MONITORING

In an effort to minimize any potential significant impact on groundwater aquifers associated with the development of groundwater as part of this Proposed Action, pre-production groundwater levels will be measured prior to pump operation using an electronic water level meter referenced to a GPS coordinate and elevation at each wellhead. Subsequently, well drawdown related to the operation of each well will be measured in the middle of the proposed pumping season, and near the end of the pumping season, typically in late winter, prior to well shutdown. Groundwater recovery will be measured at least 24 hours post-pump shutoff. Groundwater elevation data will be recorded and included in the District's annual reports to Reclamation for review. If the mid-Proposed Action groundwater elevation data indicates a significant decline in groundwater levels in the vicinity of the proposed wells, different from

the levels of decline typically seen during operation of GWD's Pilot Project wells, and if any such decline is not directly attributable to a cause other than the proposed wells, the District will modify or terminate pumping to avoid any significant adverse groundwater impacts. The District will immediately respond to any complaints received from third parties, and will take all measures necessary to avoid third party well impacts.

## LAND SUBSIDENCE MONITORING

The San Luis and Delta Mendota Water Authority is the Monitoring Agency for the Delta-Mendota sub-basin. Currently, all wells operated by GWD pump from the intermediate zone, above the Corcoran Clay. Although significant land subsidence has been measured within the Delta-Mendota sub-basin, most of it has occurred south of the District and has been associated with pumping from the lower zone, beneath the Corcoran Clay. Because of this, the District's groundwater pumping activities are not expected to contribute to land subsidence issues. The San Luis & Delta-Mendota Water Authority and Central California Irrigation District maintain land subsidence monitoring programs. The District will review the results of those monitoring programs and collaborate with those agencies to the extent practical to mitigate problems associated with land subsidence.